

Discussion Papers

469

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Relationship Banking and SMEs  
A Theoretical Analysis

Berlin, January 2005



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## IMPRESSUM

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# Relationship Banking and SMEs

## A Theoretical Analysis

by

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Suggested abbreviation of the title: Relationship banking

# **Relationship Banking and SMEs**

## **A Theoretical Analysis**

### **Abstract:**

Reliable information on small and medium sized enterprises (SMEs) is rare and costly for financial intermediaries. To compensate for this, relationship banking is often considered as the appropriate lending technique in the case of SMEs. In this paper we offer a theoretical model to analyze the pricing behavior of banks in a Bertrand competition framework with monitoring costs. We show that the lack of reliable information leads to comparably high interest rates even if a long-term relationship between borrower and bank exists. The paper offers a theoretical explanation why SME managers consider external finance as a major constraint to their business. (101 words)

**Keywords:** Relationship Banking, Financial Constraints, Small and Medium Sized Enterprises, Accounting

**JEL-classification:** D43, D 82, G21, M41

## 1. Introduction

Typically, in industrialized countries small- and medium-sized enterprises (SMEs) account for more than 90 percent of all firms, employ about two-thirds of the workforce, and contribute to nearly 50 percent of value added in non-agricultural production. In market economies SMEs are often considered to play an important role in growth promotion and poverty reduction (World Bank 1994, 2002, 2004; Beck et. al 2003; Wagenvoort 2003). Nevertheless, it seems to be a global phenomenon that SMEs are confronted with harsh credit constraints (Beck and Maksimovic 2002; European Commission 2002; Beck et. al. 2004). Recently, there is a lively discussion on the impact of the Basel II regulation and the planned implementation of international accounting standards for SMEs on lending to this kind of firms (European Commission 1995; Berger 2004; IASB 2004).

Until now the analytical framework concerning SMEs, information availability and price-setting behavior of banks has been underdeveloped. Studies on accounting of SMEs point out that there is only limited interest in financial reporting (Carsberg et. al. 1985; Gibson and Wallschutzky 1992; Gibson 1993; McMahon 1996). Enhancing reporting practice is viewed as raising material and immaterial costs without delivering clear advantages (Horowitz and Kolodny 1982; Friedlob and Plewa 1992)<sup>1</sup>. In this setting, relationship lending is considered as the most appropriate technique for collecting information on SMEs (Boot and Milbourn 2002): the firm and the bank enter in a long-term relationship that assures the firm's access to credit and gives the bank access to information about the firm (Allen and Saunders 1991; Nakamura 1992; Berger et. al. 1999; Boot 2000). One important feature of such a relation is the increase of the value of information (Schäfer 2003). Therefore one could expect that loan interest rates should decline during the relationship. Nevertheless, recent empirical literature on relationship banking offers ambiguous results: Peterson and Rajan (1994) suggest that loan interest rates decline with relationship lending<sup>2</sup>. The opposite effect is described by

Greenbaum et. al. (1989) and Sharpe (1990). They demonstrate conditions under which lenders subsidize borrowers in early periods and are reimbursed in later periods.<sup>3</sup> Based on so-called “soft” information, this lending technique is mainly generated by banks’ past experience with a given lender.

We argue that there exist linkages between the chosen lending technique and the loan interest rate. Our model is based on a Bertrand competition framework - frequently used in the credit market literature (Dell’Ariccia et. al. 1999; Jun and Vives 2004). An important advantage of this type of competition is that polypoly effects are generated in the duopoly case. Therefore differences in lending techniques are not superposed by duopoly - effects i.e. by strategic interactions of banks and firms. The lack of borrower market power is a key assumption of Bertrand competition (Gal-or 1986; Bracoud 2002). The model presented is related to previous studies where perfect competition is impeded by asymmetric information. In these settings, professional financial intermediaries like banks can make use of economies of scale in obtaining information about borrowers (Stiglitz and Weiss 1981; Diamond 1984, 1991; Ramakrishnan and Thakor 1984; Boyd and Prescott 1986)<sup>4</sup>. A major finding of our paper is that with the duration of the lending relationship, loan interest rates are not reduced. Furthermore, we argue that in markets where banks rely on relationship lending, borrowers are charged with higher interest rates compared to markets where relationship lending and credit scoring/financial statement lending coexist.

The aim of this paper is to fill at least three analytical gaps: First, we develop a theoretical model to analyze the pricing behavior of relationship banks in a Bertrand competition framework. Second, we discuss the effect of a given lending technique on lending behavior. Third, we discuss the impact of recent changes in the regulatory environment on SME lending. The key finding of the model is that there is a linkage between the lending technique used and the equilibrium loan interest rate. The remainder of the paper is organized as

follows: in Section 2, we develop a model of banking with different lending techniques. In section 3 we discuss the results of the model, while section 4 offers conclusions.

## 2. The Model

We assume a number  $(A)$  of firm borrowers, which want to realize a single investment project that requires one unit of funding and generates a random return. These borrowers are atomless and therefore have no market power. We further assume two banks; at least one of them relies on relationship lending technique. For simplification we assume that the distribution of borrowers regarding the maturity of their bank relationship is a continuous line with one borrower at every point, like pearls at a pearl necklace. The firms can have either good or bad investment opportunities, so that there are  $(q)$  good and  $(1-q)$  bad investment projects. The return of the firms  $g(z)$  is characterized by a binary random variate  $(z)$  which can adopt the values zero and one  $z \in \{0,1\}$ . If  $z$  is 1, then the project is successful and the return is non-zero; if  $z$  is zero, then the return of the firm is zero as well. It is assumed that average return  $\lambda^G g(1)$  of good projects  $(q)$  is higher than the "save" loan interest rate  $\lambda^G g(1) \geq 1+r_s$ , while for bad projects  $(1-q)$  the average return falls below this value  $\lambda^B g(1) < 1+r_s$ . As a consequence, banks do not lend to borrowers with bad projects<sup>5</sup>. On the demand side, we assume that the firm borrowers always apply for loans regardless of the project's success<sup>6</sup>. Banks are the unique providers of funds and have access to competitive capital markets where they can fund themselves at the exogenous interest rate  $p$ .

A bank has the possibility to monitor borrowers and explore if a project is good or bad. Monitoring causes costs  $(t)$  which are a function of the relationship maturity in case of the relationship lending technique, and are a constant when using financial statement lending. Therefore, if banks in the market differ with respect to the lending technique, they will have



different cost curves. The incentive for banks to monitor arises from the assumption of prohibitive costs in the case of non-monitoring. Additionally, a bank does not know the behavior of the other bank and thus tests if it can underbid its competitor by setting lower loan interest rates. It is further assumed that a bank knows the share of good projects in its portfolio with perfect foresight. Hence the expected and real shares of good projects are assumed to be equal ( $\hat{\phi} = \phi$ ). This leads to the typical Bertrand demand function, where a bank can obtain the market, if it can underbid its competitors.

$$c_i = \begin{cases} 0, & r_i > r_j \\ \frac{D(r_i)}{2}, & r_i = r_j \\ D(r_i), & r_i < r_j \end{cases} \quad \text{with } c_i \text{ for quantity of credit, } D(r_i) \text{ as total demand for credits, } i \text{ for}$$

banks  $i = 1, 2$  and  $i \neq j$ .

Consequently, if we assume that the banks in the market maximize profits and act in Bertrand competition, loan interest rates are driven down.

## 2.1 The benchmark model: a relationship lending duopoly

Consider a market with two banks that rely on a relationship lending technique. As already mentioned, this means that every bank has “soft” information about the business of a firm (e.g. reliability of the borrower, history of the firm, firm’s perspective and new markets).

Because information quality and the amount of information rises with the maturity of the relationship, monitoring costs decrease. There are two explanations for the assumption of a decline in monitoring costs during the maturity of the relationship: first, through better knowledge about e.g. the quality of intangible goods, the firm’s local market, and export opportunities, the quality of information rises and the cost of additional data collection

diminishes. Second, asset-based lending is used as a substitute when the relationship is in an infant state (Boot 2000). Since this lending technique is cost-intensive, switching to relationship lending reduces these costs.

Due to the existence of monitoring costs, the banks only have incentives to monitor their own market share of borrowers ( $x$ ) or  $(1-x)$ .

In a next step, the banks  $i, j$  identify potentially good projects with a monitoring efficiency of  $\phi_{i,j}$  and lend to firms with these investment opportunities. Due to the assumed perfect foresight, the banks charge the optimal loan interest rate  $r_{i,j}$ :

$$(1.1) \quad r_{i,j} = (f_{i,j} + t(1-x)) / \hat{\phi}_{i,j}$$

where  $\hat{\phi}$  is the expected share of successful projects based on information from previous periods. For each credit, both banks face funding costs  $p_{i,j}$ . The funding cost function of the banks is:

$$(1.2) \quad f_{i,j} = [q\phi_{i,j} + (1-q)(1-\phi_{i,j})]p_{i,j} \cdot^7$$

In a final step, the share of successful projects  $\phi_{i,j}$  becomes obvious

$$(1.3) \quad \phi_{i,j} = q\phi\lambda_{i,j}^G + (1-q)(1-\phi_{i,j})\lambda^B.$$

By definition short relationship borrowers are located at market share 0.5:

$$(1.4) \quad \frac{1}{2} = \frac{\phi_i f_j + \phi_i t - \phi_j f_i}{t(\phi_j + \phi_i)}$$

Since monitoring costs decline with the relationship duration, every bank has an advantage relative to its competitor. Therefore long relationship borrowers of bank  $i$  with low monitoring costs are short relationship borrowers of bank  $j$  with high monitoring costs.

Result 1:

Bertrand competition does not lead to marginal cost pricing<sup>8</sup>. This is caused by monitoring cost advantages of relationship banks that prevent competition except market border competition. Because of that the banks have no incentive to price-discriminate, i.e. charging loan interest rates equal to marginal costs. The banks use uniform pricing and charge all borrowers marginal costs of short relationship borrowers:

$$(1.5) \quad \pi_{i,j} = \int_{x=0}^{\frac{1}{2}} [Ar(x^*)\varphi_{i,j} - f_{i,j} - At(1-x)] dx \quad \text{with } x^* = \frac{1}{2}$$

<insert figure 1>

## 2.2 Differences in Lending techniques - the Access of SMEs to External Funds

We now turn to cases where SMEs are forced to make financial reports that can be used in financial statement lending or credit scoring. In the literature it is argued that relationship lending plays a role in these cases, too.

We assume that one ( $i$ ) of the two banks relies on relationship lending and the other ( $j$ ) on financial statement lending. As mentioned in 2.1, monitoring costs decline for the bank with relationship lending. On the contrary, the bank with financial statement lending faces the same monitoring costs for every borrower  $\bar{t}_j$ . We further assume that the average monitoring

costs of both banks are equal:  $\frac{\int_{x=0}^{\frac{1}{2}} (t_i \cdot x)}{\varphi_i} = \frac{\bar{t}_j}{\varphi_j} (1-x)$  with  $\varphi_i = \varphi_j$ . We will get comparable

results to this case if we consider a credit-scoring bank alternatively to the financial-statement-lending bank. The difference between the two techniques is simply an improved monitoring efficiency which results in higher loan interest rates:

$$\phi_{creditscoring} < \phi_{financialstatement} = \phi_{relationshiplending}$$

For banks engaging in financial statement lending, Bertrand competition implies loan interest rates equal to marginal costs:

$$(2.1) \quad r_j = \frac{f_j + \bar{t}_j}{\varphi_j}$$

The marginal cost pricing of financial-statement-lending banks results in zero profits:

$$(2.2) \quad \pi_j = A(\varphi_j r_j - f_j - \bar{t}_j) = 0$$

Since financial statement information is publicly available, market entry of another financial statement bank is likely if the financial statement bank charges loan interest rates higher than marginal costs.

Result 2:

Average loan interest rates charged by banks engaged in a market where financial statement lending is possible are lower than average interest rates in a relationship lending market.

$$(2.3) \quad r_j = r_i = \frac{f_j + \bar{t}_j}{\varphi_j} = \frac{f_i + \left( \int_{x=0}^{0.5} t_i x dx / 0,5A \right)}{\varphi_i} < \frac{f_i + \frac{1}{2}t_i}{\varphi_i}$$

As a consequence equilibrium loan interest rates are lower than marginal costs of relationship lending banks with short relationship borrowers.

Therefore this bank serves only the part of the market which is below the point where the sum of monitoring costs and funding costs equals the equilibrium loan interest rate:

$$(2.4) \quad r_i = r_j = \frac{f_i + t_i x^*}{\varphi_i} \text{ with } x^* < 0,5^9.$$

<insert figure 2>

### 2.3 Lending to large companies

In a lending market for large companies, we expect a much higher degree of publicly available information. This assumption leads to financial statement monitoring costs that are significantly lower than in a SME market:  $\bar{t}_{SME} > \bar{t}_{large}$ . Relationship lending monitoring costs are assumed to be higher and equal to the SME market:  $t_{relationshiplending} > t_{financialstatementlending}$ .

The monitoring cost function of the financial statement bank is defined as:

$$(3.1) \quad \frac{(\bar{t}_f \cdot x_j^*)}{\varphi_j} = T_f$$

The equilibrium loan interest rate is

$$(3.2) \quad r_i = r_j = \frac{f_j + \bar{t}_j}{\varphi_j} = \frac{f_i + \left( \int_{x=0}^{x^*} t_i x dx / x_i^* A \right)}{\varphi_i} \text{ with relationship banks market share}$$

$$x_i^* < \frac{1}{2}.$$

The profit of the financial statement lending bank is equal to zero, as it was shown already in 2.1:

$$(3.3) \quad \pi_2 = A\varphi r_1 - f_1 - A(t_f x_j^*) = 0$$

and the corresponding market share of the relationship-lending-bank is<sup>10</sup>:

$$(3.4) \quad x_i^* = \frac{r_j \varphi_i - f_i}{t_i}$$

Result 3:

Loan interest rates for large companies are lower than interest rates for small and medium enterprises. Therefore relationship lending serves only a small part of the market.

<insert figure 3>

### 3. Interpretation of the Results

With our model we explain the behavior of a relationship bank in different market environments. We show that in three variations of the model, relationship lending has advantages for a bank. Additionally, we show that if there is a bank which is engaged in financial statement lending, this bank is restricting the advantages of the relationship lending bank.

The central results of the model are:

- Relationship-lending banks exploit information advantages that result from their lending technique (Result 1).

- If one bank relies on financial statement lending, this bank drives down the profits of the relationship lending bank (Result 2).
- In the case of low monitoring costs for financial statement lending, the relationship lending bank serves only a small fraction of the market. Loan interest rates are directly proportional to financial statement monitoring costs. (Result 3)

Based on these general ideas, we develop three different scenarios to calculate loan interest rates. In general, we set funding costs at 2%, monitoring efficiency (except for the case of credit scoring) to 95%, and average monitoring costs at 1%. In a first scenario we simulate a market with two relationship lending banks. This is likely to reflect a market where financial data is not sufficient to do financial statement lending or credit scoring. In a second scenario we simulate a market with a relationship lending bank and a credit scoring bank. This is a setting where the financial accounting practice of SMEs enables the banks to use credit scoring. In a third scenario, we simulate a market with a highly efficient financial statement lending bank and a relationship lending bank. This is likely to be a market where financial accounting is determined by strong legal requirements.

The simulation yields interesting results (table 1). First, relationship lending leads to relatively high loan interest rates compared to other lending techniques. In a market with two relationship lending banks we obtain loan interest rates at 6.5%. Second, when assuming a lower efficiency of credit scoring (with a reduction of 15 percentage points of the monitoring efficiency to 80%) the realized loan interest rate is 5.1%. In other words, this type of market structure leads to lower interest rates than relationship lending. Third, the lowest interest rates are realized in a market with one relationship lending and one highly efficient financial statement bank. In this case the equilibrium loan interest rate is 3.8%. <insert table 1>

The simulation results stress the importance of the availability of different lending techniques to reduce borrowers' loan interest rates. In practice, especially the market of SMEs lacks high quality accounting data, which makes these firms more dependent on relationship banking than large companies. Since relationship lending leads to high loan interest rates, SMEs suffer from high costs of external funding. For large enterprises, a much higher degree of information is public and therefore available without any costs. This enables banks to apply transaction based lending (financial-statement-lending or credit-scoring) which reduces loan interest rates.



#### **4. Conclusions and Outlook**

SMEs seem to suffer from limited access to external financial resources all over the world. Banks usually are reluctant to provide credit to this type of enterprises. This behavior is due to the relatively limited publicly available information about SMEs. Legal accounting requirements for these enterprises are low, so that managers of SMEs have only small incentives to invest in detailed information practices. It is often argued that this specific lack of information can be compensated by relationship banking, which enables banks to collect detailed information about an individual firm over time. Since this information is exclusive and not available to other banks competition in the market of long relationship borrower is distorted. We show that because of this distortion there exists a close linkage between the lending technique of a bank and the interest rate offered to a firm. While relationship lending leads to relatively high interest rates the burden is much lower in the case of financial statement lending.

These results have far-reaching implications for the recent discussion on the introduction of international accounting standards in Europe. There are strong arguments for an improvement of the current design of accounting standards specifically for SMEs. First, in order to be efficient, international accounting standards should apply to all types of enterprises. Second, additional information gained through this process would lead to an improvement in decision-making. Both banks and enterprises would be the beneficiaries of such a change in the institutional framework. Third, the introduction of international accounting standards would have a self-containing, positive impact on competition within the banking sector.

Given the large interest on the interdependence of banking and SME finance further research is necessary. Since our model is limited to the supply side, adding borrower demand would be a natural extension of the model. In such an extended framework interest rate effects are expected to be supplemented by reduced demand for credit.

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**Table:**

Table 1: Simulation						
results		assumptions				
			monitoring efficiency bank i	monitoring efficiency bank j	average (marginal / share 0.5) monitoring cost bank 1	average (marginal / share 0.5) monitoring cost bank 2
SME relationship lending	6,50%	2,00%	95,00%	95,00%	1,00% (2%)	1,00% (2%)
SME credit scoring/ financial statement lending	5,10%	2,00%	95,00%	80,00%	1,00% (1%)	1,00% (2%)
LE financial statement lending	3,80%	2,00%	95,00%	95,00%	1,00% (1%)	1,00% (2%)

Source: authors' calculations.

Figures:

Figure 1

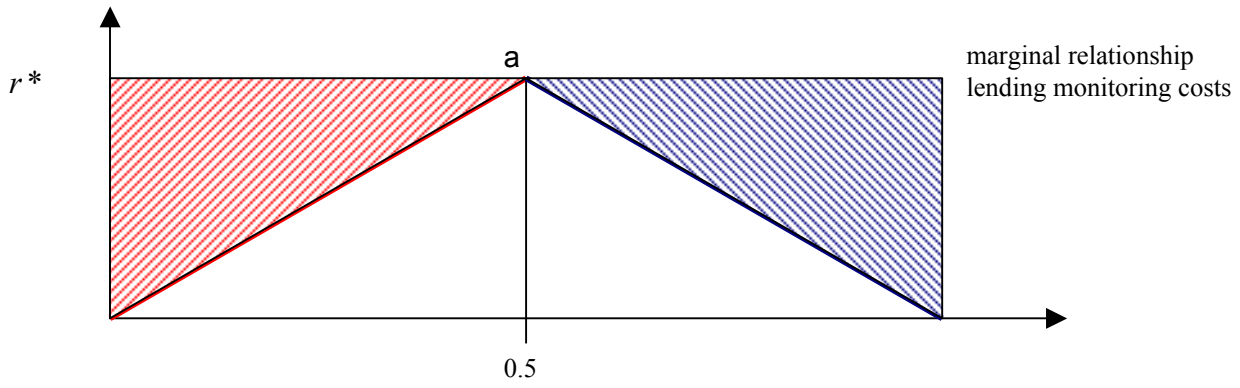
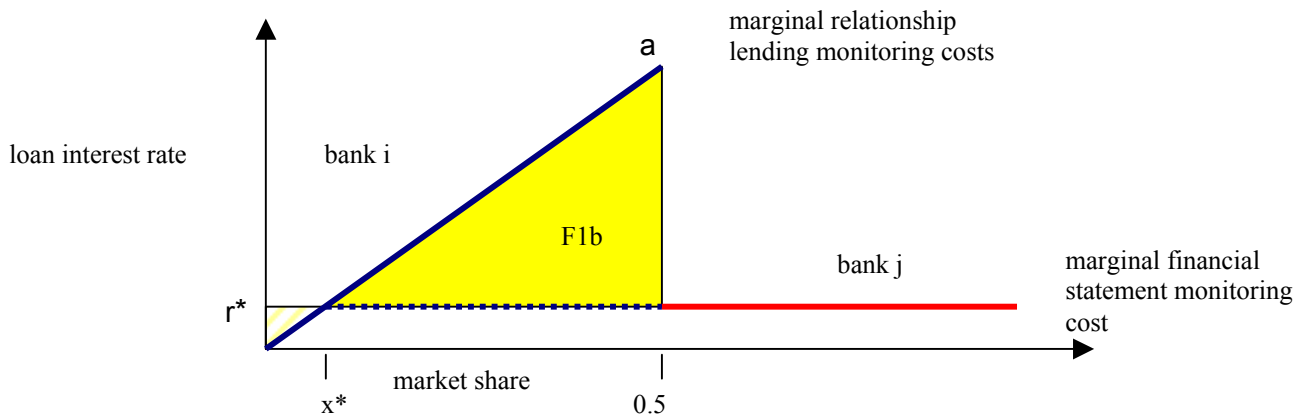
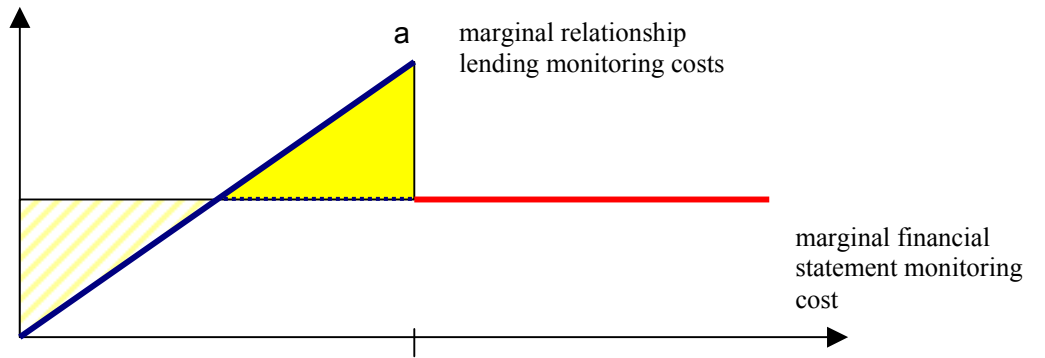


Figure 2



Appendix:

### **Lending techniques reconsidered**

In general, lending can be categorized into at least four<sup>1</sup> distinct lending techniques. These practices differ mainly by the usage and generation of information (Table A-1):

- *Financial statement lending* is based on evaluating information from the firms' financial statements. The decision to lend depends largely on the strength of the balance sheet and income statements. Since SMEs face less legal requirements than large companies to publish financial data, financial statement lending is likely to be the technique of choice in bank lending to large firms (Udell 2004).
- In the case of *asset-based lending*, credit decisions are principally based on the quality of the available collateral. This type of lending causes high monitoring costs and requires high-quality receivables and inventory available to pledge (Carey et. al. 2001, Berger and Udell 1995, 1998). Boot (2000) identifies asset-based lending as a substitute for relationship lending if the term of the relationship is short.
- *Small business credit scoring* is an adaptation of statistical techniques used in consumer lending. In addition to information about the financial statements, the creditworthiness and history of the owner is heavily weighted (Frame et. al. 2001). In practice, small business credit scoring is mostly used for micro enterprises (Saunders 2001) and is a substitute for financial statement lending with few monitoring costs but a high possibility of wrong declarations by the borrower.

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<sup>1</sup> Mostly two lending technologies are described in literature – relationship lending and transaction based lending. For our purpose we follow Berger and Udell (2002) which is a bank based view rather than the broader six technique view in Udell (2004) who includes factoring and trade credit.

- *Relationship lending* is based on the experience of a given bank with a concrete borrower and therefore on “soft” information collected over time. Therefore if financial data is limited, relationship banking is the technique of choice.

The common feature of the first three types of lending is that they are based on “hard” information; in the literature these lending techniques are called “transaction based”. In contrast to transaction-based lending, relationship lending is based on “soft” information. Banks may acquire information through the relationship by monitoring borrower performance over time under credit arrangements and/or through the provision of other services such as deposit accounts. Thus, the main difference between these two types of lending is the availability of information to competing banks. Relationship banking is based on collecting information over time and therefore produces private information that is only available to the specific bank or to a banking network. Since this information cannot be interpreted out of this specific context, the relationship-lending bank gains an advantage over its competitors.



Table A 1: lending techniques

Type of information	Efficiency	Approximation in the model	Type of information
<b>Financial statement lending</b>			
standardized financial reporting data	depends on the quality of the available data		"hard" information:
<b>Asset based lending</b>			
credit collateral	no credit loss if credit volume is in the limit of collateral value	not modeled	
<b>Credit scoring</b>			
standardized financial data of owner and firm	depends on the quality of the available data but can be only a proxy of financial insight	flat rate monitoring cost	"hard" information:
<b>Relationship lending</b>			
private information about the firm and the owner	depends on the tightness of banking relationship	decreasing monitoring costs	"soft" information:

Source: authors

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<sup>1</sup> We only review the main causes of lax financial reporting discussed in the literature. Other possible explanations for lax financial reporting are an inability of owner-managers to interpret the information, irrationality, undemanding business circumstances, a difficulty in identification of benefits, insufficient information in the reporting system, and a lack of primary information necessary to run the business in the accounting data. For further and more detailed information, see McMahon (1998).

<sup>2</sup> In concentrated relationship-lending markets, Petersen and Rajan (1994) find that loan interest rates decline less than in competitive markets because they are subsidized in favor of young relationships. This supports somewhat Greenbaum et. al. (1989) and Sharpe (1990).

<sup>3</sup> By engaging in long-term relationships, firms transmit information about the company and its projects to the bank and can therefore reduce loan interest rate and collateral requirements (Alen, Sounders and Udell (1991); Nakamura (1993)). Boot and Thakor (1994) demonstrate this relationship in a theoretical model without learning effects.

<sup>4</sup> An article similar in spirit to ours is Rajan (1992), which discusses the incentive of firms to prevent banks from extracting surplus from them.

<sup>5</sup> The save loan interest rate covers funding costs and contingency risk.

<sup>6</sup> The assumption of unknown project success holds especially for firms without sufficient financial reporting practice (e.g. non-listed firms like most SMEs). For firms with a high degree of financial reporting (e.g. listed firms) we can generally assume limited liability of managers. That is why these firms do apply for loans even if they know they have bad projects. They only care about the good state where they can earn positive profits even if the probability to improve profits is low.

<sup>7</sup> It is assumed that the bank knows which share of projects will be successful, but does not know the probabilities of success of a single investment project. The bank does not lend to

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projects which are identified as bad (the bank lends to  $q\phi_i$  identified good and  $(1-q)(1-\phi)_i$  wrongly identified bad creditors)

<sup>8</sup> The Bertrand type competition does not lead to extreme outcomes because of non-homogeneity of monitoring costs. However, if the Bertrand-competing banks prefer activity, a reduction in loan interest rate  $r^*$  would lead to a marginal profit below marginal costs. We follow Bracoud (2002) in arguing that even if banks prefer activity, it does not lead to irrational behavior in enhancing market share even if marginal profits are lower than marginal costs.

<sup>9</sup> This equilibrium is static and does not hold for a dynamic case since no new borrower is served. In a dynamic case, it is suggested that the bank subsidizes new borrowers by lending at the cost of old borrowers.

<sup>10</sup> As above this equilibrium does not hold in the dynamic case. The relationship-lending bank would leave the market.