

Lending technologies, loan pricing and customer profitability in SME lending

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Abstract This paper provides empirical evidence of the indirect effects of lending technologies on loan pricing and customer profitability in bank–firm relationships. I define the incremental information gathered by the bank’s corporate analysis department as a relationship lending technology, whereas the other loans are contracted using transactions lending technology. Using the unique data of Finnish privately held firms, I find that loan pricing is positively associated with customer profitability in firms that are monitored using transactions lending technology. However, in firms that are monitored using relationship lending technology the profitability of the relationship is generated from sources other than loan pricing. In addition, when the level of information asymmetry related to chosen lending technology is mitigated by the analysis of the bank’s corporate analysis department, the role of quantified soft information in bank–firm relationships is emphasized more in loan contracting than hard information is. These findings improve our understanding of the overall package of banking services under asymmetric information and the role of soft information in bank–firm relationships.

Keywords Lending technologies, asymmetric information, bank–firm relationships, hard and soft information, loan pricing, customer profitability

JEL classification G21, D82, L14

1 Introduction

Prior research is consistent on the positive association between the level of information asymmetry between firms and banks with regard to corporate loan prices. The theoretical literature on the subject argues that banks accumulate private information to gain monopolistic power to deter their competitors (Petersen and Rajan 1994; Berger and Udell 1995). This private information leads to reduced information asymmetry between firms and banks and thus enables banks to set competitive pricing strategies (Sharpe 1990; Bharath, Dahiya, Saunders and Srinivasan 2007; Cerqueiro, Degryse and Ongena 2011).

In the Finnish privately owned firms context information uncertainty is relatively high and the loan market is dominated by a few banks (Niskanen and Niskanen 2006). The Finnish environment offers the unique possibility to study lending technologies, because all firms in Finland are required to prepare financial statements. These financial statements form the basis for the pricing of the corporate loans granted by banks (Danos, Holt and Imhoff 1989). The banks, however, select a subset of loan applications for more rigorous analysis than others reflecting relationship lending technology. In this analysis the bank expands its information beyond what is customary, in other words, what is found in the financial statements. This additional information is considered necessary when there is information about the firm that is unknown and considered important. Discovering this information can have an effect on loan pricing and customer profitability. Measuring the indirect effect of this information is the objective of this paper.

The seminal paper by Berger and Udell (2006) on lending technologies in SME lending opened up avenues for detailed studies, for example, the choice of lending technology (Uchida, Udell and Yamori 2006) and bank ownership types (Beck, Demirgüç-Kunt and Peria 2011). This paper augments this stream of literature by examining the association between corporate loan pricing and customer profitability within different lending technologies. The definition of lending technology is based on Berger and Udell's (2006) classification reflecting a unique combination of primary information sources. The main lending technologies in corporate loan markets are financial statement lending as a transactions technology, which is primarily based on hard information taken from a firm's financial statements; and relationship lending, which is primarily based on soft information gained from the bank–firm relationship (Uchida et al. 2006).

Prior literature on the information factors influencing corporate bank–firm relationships has mainly focused on loan pricing (Greenbaum, Kanatas and Venezia 1989; Bosch 2006), the availability of funding (Berger and Udell 2002; Cole 1998), relationship aspects (Boot 2000; Degryse and van Cayseele 2000; Elsas 2005), credit risk assessment (Godbillon-Camus and Godlewski 2005; Grunert, Norden and Weber 2004) and collateral requirements (Godlewski and Weill 2011). Recent literature has analyzed the types of information using the dichotomies of soft and hard (Petersen 2004; Grunert and Norden 2011) and financial and non-financial information (Grunert et al. 2005). Wittenberg-Moerman (2009) found evidence that information asymmetry is associated with interest rates. However, there are few studies that take a comprehensive view of loan pricing and customer profitability – within the differential lending technologies – from a bank's perspective.

Banks play an important role in small and medium-size firms' finance, and therefore it is important to understand the impact of lending technology on loan pricing and customer profitability. The theory in this field is developing and empirical evidence is still scarce due to a lack of proprietary data.

This paper focuses on relatively small privately owned firms because these firms obtain most of their external funding from banks (Niskanen and Niskanen 2006). Bank–firm relationships are therefore expected to be especially important for small and medium-sized privately held firms (Berger and Udell, 1998). Privately held firms are more informationally opaque compared to public firms (Bosch 2006). This analysis is based on 1,945 firm-year observations obtained from the database of one major bank in Finland. The sample consists of both the bank–firm relationship and the financial statement information of small and medium-sized privately held firms from the financial periods of 2001 to 2005. The unique data in this paper allows a sophisticated proxy of lending technology that can be measured in the privately held firm context.

The research design is based on the structural equation model by means of partial least squares (PLS) that allows me to examine the simultaneous moderating effect of lending technology on loan pricing and customer profitability. The simultaneous analysis of the factors affecting loan pricing and customer profitability has not been studied before, thus the structural equation is a more suitable method for such an analysis than traditional regression analysis. This is due to the fact that it ameliorates the reliability of the models regarding moderation and mediation (Hopwood 2007). Additionally, this method allows a flexible analysis of the interdependencies of the constructs of interest, which is both informative and useful.

This paper contributes to financial intermediation in several ways. The contribution of my paper is to introduce the information role of lending technologies on privately held firm loan contracting, and, in particular, to analyze their simultaneous effect on loan pricing and customer profitability. Furthermore, this paper contributes to prior literature by positioning the relationships between lending technology, corporate loan pricing and customer profitability in a more comprehensive model.

This paper provides empirical evidence on the indirect effect of lending technology in bank–firm relationships. The results support the view that the chosen lending technology moderates the association between loan pricing and customer profitability. The moderation effect of a lending technology reflecting differential levels of information asymmetry seems to fit well with the empirical examination of the conceptual framework suggested by Berger and Udell (2006). The results show that loan pricing affects customer profitability in firms that are segmented in financial statement lending technologies, and that value in the bank–firm relationship among relationship lending firms is generated from sources other than loan pricing. The findings in this paper are consistent with the notions in Torre et al. (2010), which highlights the overall package of services that bank provides to SMEs.

There is a need for further research based on the conceptual framework devised by Berger and Udell (2006) on relationship lending and financial statement lending technologies. The findings suggest that lending technologies should be taken into account in loan decisions if we are to

understand the information role of these factors. These results enhance our understanding of privately held SMEs, which are major facilitators of growth and innovation in the economy.

The rest of the paper is organized as follows. Section 2 reviews related literature and develops the hypotheses. Section 3 describes the sample and the variables of the paper. Section 4 provides the research method and model specification. Section 5 presents the empirical results. Finally, Section 6 discusses the findings and makes conclusions.

2 Related literature and hypotheses

2.1 Loan pricing and customer profitability

Prior literature suggests that value-based differentiation is needed in business relationships. Naturally, banks would be more interested on spending time and effort on more valuable firms to increase their internal profitability. In particular, marketing literature acknowledges that relationships represent a source of competitive advantage beginning with Porter (1985) and Jackson (1985), and many studies thereafter.

Loan pricing is a key element in corporate bank–firm relationships. However, it is just one element in managing overall customer profitability. The value of a relationship is built on loan pricing as well as other banking services offered to a firm (Torre et al. 2010). Due to the discretion used in loan granting process a lower loan price could lead to higher customer profitability by cross-selling other fee-based banking services. The reason for a lower loan price could be due to the competition on the loan markets or other reasons in the pricing of the total package. Loan pricing may be viewed as way to get customership that would open up opportunities for cross-selling. However, from a risk management perspective, the Basel II Accord emphasizes the requirement for the risk-based pricing of corporate loans (Basel Committee on Banking Supervision 2006).

The determinants of loan price have been widely studied (Bharath et al. 2007; Merton 1974). However, loan pricing and the drivers of customer profitability in relation to corporate customers is largely unexplored, therefore the direction of the hypothesis is difficult to assess. At least in the long run the basic intuition in banking is that an increase in loan pricing would lead to a corresponding increase in customer profitability. This leads to the first hypothesis at the aggregate level:

H1: There is a positive association between loan pricing and customer profitability.

Due to the heterogeneity of the firms there could be several segments of customers. For a group of firms loan pricing may have a positive impact on customer profitability and for another group it could be negative. Thus, lending technology is analyzed as a potential moderator of the association between loan pricing and customer profitability.

2.2 Information asymmetry and the lending technologies

From an efficient contracting perspective it would be desirable to find ways to reduce information asymmetry between a firm and a bank (Watts and Zimmermann 1986). The literature of information asymmetries in bank–firm relationships builds on the theoretical work initiated by Diamond (1984), Greenbaum, Kanatas and Venezia (1989), Sharpe (1990) and Rajan (1992) that analyzed financial intermediation and bank financing.

Bosch (2006) examined both private and public firms to explore the effect of information asymmetry on loan spreads. He found that lenders charge higher spreads when the firm lacks publicly available information. However, he found that a bank–firm relationship mitigates this information asymmetry and can help reduce the spread. He concluded that loan spreads are affected by the amount of publicly available firm information and the nature of a bank–firm relationship. The findings suggest that there is higher demand for deeper and more intensive bank–firm relationships for privately held firms than for public firms, which is necessary in order to mitigate information asymmetry.

Baas and Schrooten (2006) showed that there is a close theoretical linkage between the lending technique of a bank and the interest rate offered to a firm. Recently, Berger and Udell (2006) conceptualized SME credit availability issues and proposed that different lending technologies have important effects on credit availability. They argued that the commonly used framework in SME financing is oversimplified and unsuitable for opaque SMEs.

Berger and Udell (2006) proposed two lending technologies: transactions technologies and relationship lending. The distinction between these two lending technologies can be found in the nature of the information that is used as a basis for a lending decision. The transactions technologies utilize primarily hard information, whereas relationship lending technologies focus on soft information. Berger and Udell (2006) classified transactions technologies further into financial statement lending, small business credit scoring, asset-based lending, factoring, fixed-asset lending and leasing¹. Arguably, financial statement lending is the most common lending technology within transactions technologies (Kano, Uchida, Udell and Watabe 2006). Berger and Udell (2006) defined financial statement lending as a transactions technology based primarily on the strength of a firm's financial statements. A necessary condition for the strength of a financial statement is that it requires audited financial statements². The primary source of repayment is expected from the future cash flows of the firm.

Uchida et al. (2006) examined different lending technologies and the extent to which they are used and what determines the choice of each technology. They found that these lending technologies are often used in tandem and are highly complementary. A specific detail in their survey was that transaction technologies are based on hard information about whether the financial statements are audited or not.

Information verifiability, bank organization, bank competition and the bank–firm relationship have been examined in Kano et al. (2006). Specifically, Kano et al. (2006) compared financial

¹ They also list trade credit as an important source of financing. However, they stated that trade credit could be classified either a transactions based or a relationship based technology. Therefore, trade credit is excluded in the empirical tests.

² In Finland all sample firms were audited during the empirical period 2001-2005.

statement lending and relationship lending technologies in Japanese SMEs. They pointed out that information verifiability was a distinctive trait of the lending technologies.

Berger and Udell (2006) proposed that there are groups of firms that are classified as firms using relationship lending technology. This lending technology is merely based on the soft information of the bank–firm relationship. Soft information is difficult and costly to capture in a form that could be used for relationship management purposes. Many banks have their own corporate analysis department for deepening the analysis of a group of firms. As a result, a bank builds up its information advantage regarding a firm’s soft information by lowering information asymmetry between itself and the firm.

In this paper the firms are segmented based on whether or not they have been analyzed by the corporate analysis department³. The firms that have been analyzed enjoy a lower level of information asymmetry and are classified as belonging to firms analyzed by relationship lending technology. The rest of the firms are classified as belonging to firms analyzed by financial statement lending technologies. This leads to the second hypothesis:

H2: Lending technology moderates the association between loan pricing and customer profitability.

It is expected that the chosen lending technology significantly affects the association between loan pricing and customer profitability, and that firms classified into relationship lending technology do not demonstrate an association between loan pricing and customer profitability in contrast to Hypothesis 1.

The expectations of this paper are consistent with the basic idea in relationship banking that a small number of firms provide the majority of customer profitability (Bharath et al. 2007). Furthermore, the concentration of borrowing at one bank would increase the loan prices for a group of firms. From a bank’s perspective this can be seen as a well-developed relationship in which a firm is locked into a relationship suffering from high external financing costs. In this kind of setting these firms may have high switching costs or other important reasons for the continuity of a lending relationship. The benefits of intensive bank–firm relationships remain with the bank and the benefits are not shared with its group of firms. In a more balanced setting the bank may share the benefits of a well-developed relationship with firms and encourage the relationship in the long run.

3 Sample and variables

3.1 Sample

First, I collected firm-specific information from the bank’s database. These variables contain basic information on the firm’s industry, risk classification and firm-specific information about the bank–firm relationship. Second, I combined the relationship information with the corresponding

³ In a similar sense Berger, Espinosa-Vega, Frame and Miller (2005) measured information asymmetry based on whether banks employ credit scoring technology to determine loan maturity and how they employ it.

financial statement information. The financial statement information contains profit and loss statement and balance sheet figures. Based on the financial statement information, key financial ratios were calculated. The data has been cross-checked to ensure its reasonableness. There are advantages in using the data from only one bank, for example, there are uniform definitions of the variables and continuity in the data processing.

The sample consists of small and medium-sized privately held firms domiciled in Finland. The original loan database incorporates 2,524 firm-year observations from the financial period December 2001 to December 2005. All the firms' reporting periods end in December, and firm-specific relationship information is captured at the end of December. Connecting these two sources of information allows the identification of their characteristics, such as the loan amount, return on equity and other key ratios. All firms are required to have a bank's internal rating and either a short or long-term loan price. These internal ratings collect information about firm quality and credit risk in broad terms, and they are automatically determined by firm-specific information. A lower credit quality as reflected in ratings is likely associated with a higher loan price.

Consistent with prior literature, the sample includes only non-financial firms as financial firms would have special characteristics in their financial reporting, and therefore they are excluded. After merging the relationship data with financial statement data, the final sample is reduced to 1,945 firm-year observations. The reason for the missing observations is the absence of the bank's internal rating (216 observations) and the absence of a loan from the subject bank (363 observations). These variables are needed for the analysis and missing observations are not likely to affect the main results. The method in this paper requires a full set of observations (Ringle, Wende and Will 2005). The final sample has no missing values for any of the variables.

3.2 Variables

3.2.1 Loan pricing, customer profitability and asymmetric information

The key indicator variable of interest is loan price. I define loan price as an indicator variable for the construct of *Loan pricing*. Originally, the loan price is determined separately for short-term and long-term loans. I calculated the loan price as the average price weighted by a proportion of the long-term and short-term loan. The price is presented as a percentage unit over the underlying basic interest⁴. Due to the notion that the amount of a long-term loan is usually larger than that of a short-term loan this definition of loan price emphasizes the effect of interest rate on long-term loans. However, including the weighted proportion of the short-term interest rate reflects and completes the overall pricing of a firm's loans. Performance pricing⁵ and revolving credits are excluded from the loan data due to their special characteristics.

⁴ The underlying cost of capital within the sample period was relatively low; decreasing from 4.09% in 2001 to 2.33% in 2005 based on the 1-year Euribor (European Central Bank 2010).

⁵ Performance pricing means that the interest rate is dependent on the firm's performance.

Another indicator variable for loan pricing is the bank's internal ratings⁶. These ratings are used to account for the information content of the bank's firm-specific credit risk. These ratings capture information about financial position and credit risk and they are determined by firm-specific information. A lower credit quality, as reflected in ratings, is likely to be associated with a higher loan price. In the analyses the internal ratings are coded so that the first rating group gets value 1, and the second value 2, and so on until the firms with the lowest internal rating get the biggest value. In this sense, when the coded value of the internal rating increases the loan price is expected to increase relative to it.

The indicator variable for *Customer profitability* is the logarithm of realized profitability in Euros in the following year end (t+1). This variable is presented from the bank's perspective and is based on the bank's internal calculation of firm-specific realized customer profitability after a one-year period. It is worth mentioning that realized profitability is computational and, for example, in corporate loans the profits are realized in total after the loan has been fully paid back. This bank uses the realized customer profitability for decision-making, and therefore it is reasonable to use this variable as the basis for assessing customer profitability.

Lending technology is a dichotomous variable that takes the value of one when the bank's corporate analysis department has specified the firm's initial internal rating and the value zero when the internal rating is solely generated from financial information in a specified form.

The initial internal rating is assessed for all firms and only a group of firms has been further assessed by the corporate analysis department. The corporate analysis department is able to scrutinize in detail the firm specific characteristics based on in-depth customer relationship information. According to the terms of Berger and Udell (2006)⁷, the firms analyzed by the corporate analysis department are segmented to the relationship lending technologies and the other firms are segmented to the financial statement lending technologies. Information asymmetry is related to lending technology and it is expected to be lower for those firms that have been assessed by the corporate analysis department. However, due to the requirements of confidentiality in the business processes of the bank the selection method for the firms scrutinized by the corporate analysis department was not available. Therefore, the selection of firms may be based on reasons other than the proposed categorization made by the lending technology and may have inferences for the interpretation of the results.

3.2.2 Relationship variables and other control variables

In the empirical tests, I estimate a PLS path model for loan pricing and customer profitability that employs several types of controls including relationship, loan- and firm-specific characteristics. All the control variables are derived from prior literature, although only statistically significant

⁶ The Basel II Framework presents an Internal Ratings Based (IRB) approach to assess the credit risk of corporate exposures (Basel Committee on Banking Supervision 2006).

⁷ The terms of the framework were initially conceptualized based on the U.S. market. The authors aimed at a conceptual framework for SME finance in developed and developing nations. Consequently, the framework, as such, may not be fully suitable to SME finance in the Finnish environment.

variables are kept in the final model, which aims to be parsimonious rather than complex. Industry affiliation is based on the classification by Statistics Finland. The main branch categories are analyzed, which consist of seven⁸ industries. The data consist of three legal forms: partnership, limited partnership and limited company. A firm's legal form has no effect on the main results and therefore they are not further reported. All publicly listed firms are excluded from the sample.

Length: Logarithm of the length of the bank–firm relationship in years. Using the length of a relationship as an indicator for relationship intensity has been questioned in many studies, although it is widely used in prior literature (Ongena and Smith 2000; 2001). Elsas (2005) found that the length of a bank–firm relationship is not associated with a close relationship. Increasing the length of a relationship has been found to not favor the firm (Petersen and Rajan 1994; D'Auria, Foglia and Reedtz 1999). The median length in Elsas' (2005) paper is 15 years, while my sample has a median length of 14 years. In this respect the samples are comparable. Blackwell and Winters (1997) also find that by holding the bank's monitoring effort constant, the length of the banking relationship has no direct effect on the pricing of a loan.

Scope: The logarithm of the number of banking services other than loans to the firm. It is expected that the scope of the relationship has a stronger effect on relationship intensity than the length of the relationship (Degryse and van Cayseele 2000). Although the continuity of a customer relationship is important to a bank, the variety of services other than loans has been highlighted in prior literature as also being important (Elsas 2005).

Depth: The logarithm of the ratio of loans from bank to total debt. A negative effect on loan pricing can be expected to be seen with regard to firm size and the depth of the bank–firm relationship, which suggests that enhanced information access and more concentrated customer behavior decreases the pricing of a loan. This expectation is consistent with the literature studying multiple relationships, where the existence of multiple lenders increases the loan price (Petersen and Rajan 1994; Elysiyani and Goldberg 2004).

Firm profitability: This variable is the firm's return on equity (percentage). It controls for a firm's ability to generate profits to pay back its loans. Firms with low profitability are expected to have higher loan prices.

Firm size: This variable is computed as the logarithm of total assets. The firm size variable is probably the most important control variable, because larger firms are able to obtain better loan terms given their reputation and the fact that they usually have more tangible assets. Thus, there is usually less information asymmetry between them.

Loan size: This variable is important in the bank–firm relationship. In the analyses I use the logarithm of long-term loan size as a control for the firm's risk exposure⁹. Smaller loans are expected to be priced with lower margins in comparison to larger ones.

3.3 Descriptive statistics

⁸ Minor branch categories are combined due to a lack of observations.

⁹ I acknowledge that there may also be different expectations regarding the effect of loan size on loan pricing. In the global context, the market for small and large loans differs in many ways due to, for example, liquidity and competition. I assume that the market for loans in my sample is substantially homogenous and that loan size mainly controls the firm's risk exposure.

Table 1 presents the descriptive statistics of the firm-specific information. It shows that the loan price (margin) ranges from 0 to 4 %. The mean value of the loan price is 1.462 % and the standard deviation is 0.591. The actual range in the bank's internal rating is from 1 to 11, but in this sample I do not have firms in the two highest rating groups, and therefore the range in the sample is from 3 to 11. Customer profitability has a mean value of 0.005 and a maximum value of 0.090. This means that there is a small group of firms that have a relatively high value with regard to their realized customer profitability.

Table 1 Descriptive statistics. The table reports descriptive statistics for the sample. Loan price is the margin above the basic interest (%); Rating is the bank's internal rating; Customer profitability is the realized profitability in thousands of Euros in the following year (t+1); Length is in years; Scope is the number of services other than loan; Depth is the ratio of bank loans from the subject bank to the firm's total assets; Firm profitability is the firm's return on equity; Firm size is total assets in thousands of Euros; Loan size is the bank loan amount in thousands of Euros; The actual range of internal ratings is from 1 to 11.

Variable	Mean	Minimum	Maximum	SD
Loan price	1.462	0.000	4.000	0.591
Rating	7.359	3.000	11.000	1.215
Customer profitability	0.005	0.000	0.090	0.008
Length	15.267	1.000	66.000	8.760
Scope	15.549	1.000	103.000	9.079
Depth	0.396	0.001	1.000	0.249
Firm profitability	0.180	-9.091	7.153	1.037
Firm size	1.865	0.040	98.567	5.387
Loan size	1.807	0.016	79.454	4.335
Number of observations	1 945			

The range of the relationship length is from 1 to 66 years. The range of scope is from 1 to 103 for the number of other services than loans. The mean values and standard deviations of these relationship variables are within a range of similar magnitude.

Loan size and the depth of a relationship reflect the concentration of the bank–firm relationship. Loan size has a mean value of 1,807 and a standard deviation of 4,335. The depth of the relationship has a mean value of 0.396 and a standard deviation of 0.249. Total assets have a mean value of 1,865 and a standard deviation of 5,387.

4 Research method and model specification

I employ variance based path modeling by using SmartPLS 2.0 (Ringle et al. 2005) software. The core characteristics of the variance based approach include the explicit estimation of latent variable scores and the possibilities that the research model will have a high complexity (Chin 1998;

Fornell and Larcker 1981). Ideally this method is based on the prediction analysis of a specific model, in which the aim of the research is more on prediction accuracy than parameter accuracy. Variance based estimation is also called PLS (Partial Least Squares) path modeling. PLS path modeling does not require distributional assumptions, like regression analysis or a covariance-based approach¹⁰.

One advantage of PLS path modeling is that single-item measures can be estimated, whereas covariance-based models require at least two indicators. PLS methodology also has less stringent requirements for data including robustness with different scale types and the allowance of interrelated observations. The distribution of variables in accounting research tends to be somewhat non-normal including skewness or kurtosis. Therefore a variance-based method may be more suitable for accounting research (Chin 1998; Reinartz, Haenlain and Henseler 2009).

This paper examines relationships among multiple variables and focuses on prediction and theory development rather than the empirical confirmation of parameter estimates on loan pricing and customer profitability. Therefore, a variance-based approach is chosen for this paper¹¹.

In reflective measurement models causality develops from construct to measure. Indicators are expected to be correlated and measurement error is accounted for at the item level. In a sense, the relationship between a construct and a measure based on a reflective indicator model is probabilistic (Hair et al. 2009).

In this paper the measurement of indicators is reflective due to the prediction orientation of the research problem. This means that the constructs of the paper result in indicators with an item level error. Specifically, loan pricing is reflected in loan prices and internal ratings. However, the other constructs are measured with a single-item indicator, which means no difference between the reflective and formative measurement. It should be noted that constructs in the same model can be measured by both the reflective and formative ways and that the final decision is made by the researcher¹².

Due to the objective nature of the indicators, single-item measures are preferred to multiple-item measures. Bergkvist and Rossiter (2007) compared the validity of single-item versus multiple-item measures of the same constructs and concluded that for decision-making purposes the single-item measures of the constructs are equally as valid as multiple-item measures. Many survey studies use multiple-item measures to capture the content of a latent construct. Arguments for multiple-item measures are found when assessing internal consistency, in which unidimensionality can be established and reliability measures can be calculated. However, if the indicator of the construct is concrete there is no specific need for multiple-item measures. In fact, using multiple-item measures with an objective indicator may lead to validity problems (Bergkvist

¹⁰ Tenenhaus, Esposito Vinzi, Chatelin and Lauro (2005) present a more theory-oriented article on PLS path modeling.

¹¹ Reinartz, Haenlain and Henseler (2009) compared the efficacy of covariance-based and variance-based SEM and showed evidence that justifies the use of PLS especially in research questions related to prediction and theory development instead of the empirical confirmation of theoretically indicated relationships.

¹² See further discussion in Hair et al. (2009).

and Rossiter 2007). The main decision criteria when choosing between single and multiple-item measures has to be based on the research problem and the related indicators¹³.

Data in this paper is concrete¹⁴ and in this sense more objective than, for example, survey data. I acknowledge that the figures from financial statements and relationship information are the outcomes of information production processes, but they are not influenced, for example, by the phrasing of the questions as has been the case in survey studies. Therefore, I use mainly single-item measures in this paper. However, loan pricing is measured with a multiple-item measure where the construct of loan pricing is reflected in the loan price granted a firm and the firm's rating. Unreported results show that the loan price is significantly correlated with internal rating. These indicators have a positive correlation that means the better a firm's internal rating the lower its loan price is. Unreported results also show that this relation is consistently found in every rating group. By including these two indicators of loan pricing instead of two single-item measures the explanatory power of the model increases, but the main results remain qualitatively similar.

Figure 1 presents the model specification of the structural equation. The model consists of unobservable constructs (latent variables indicated in Figure 1) and observable indicator variables. The focal constructs are loan pricing and customer profitability. In the model the elements of the bank–firm relationship intensity are broken down into the length, scope and depth of a relationship. The control constructs in the main analysis are the firm's profitability, firm size and loan size. For reflective measurement the model includes multiple-item and single-item measures.

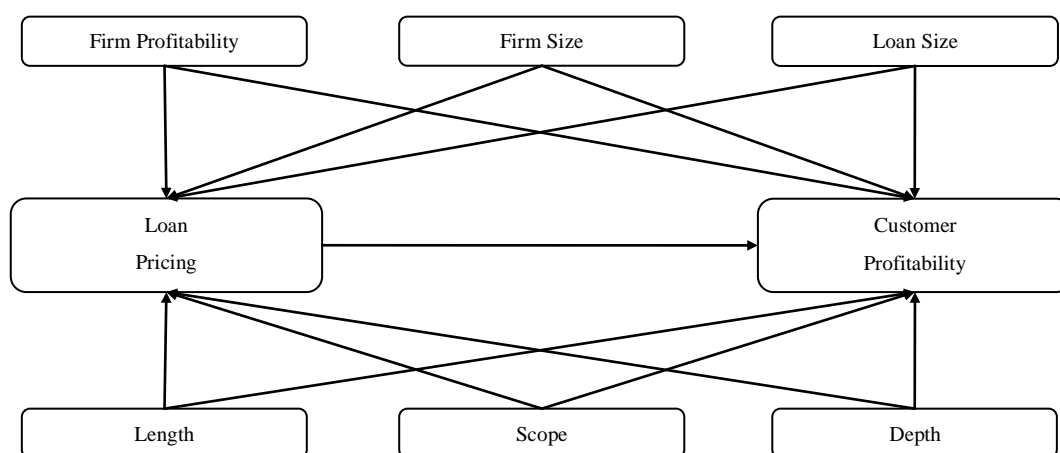


Figure 1 Model specification. The figure presents the latent variables of the model for hard information (Firm profitability, Firm size and Loan size), soft information (Length, Scope and Depth), and the focal constructs (Loan pricing and Customer profitability).

The factor loadings for the loan pricing are for the loan price 0.772 and for the internal rating 0.776. T-values using 500 bootstrapping samples are 28.443 and 30.999, respectively. The internal consistency reliability shows a composite reliability of 0.750 for loan pricing indicating accepted

¹³ The ongoing debate on this issue is seen in Sarstedt and Wilczynski (2009).

¹⁴ The term concrete is used in Bergkvist and Rossiter (2007) and is used here as they use it.

levels (Nunnally 1978). The AVE for loan pricing (0.599) is therefore above the conventional guideline of 0.500 for adequate convergent validity (Nunnally 1978). The square root AVE for loan pricing is 0.774 and the latent variable correlations are in the range between -0.389 to 0.478. The square root AVE for loan pricing is higher than the correlations among the latent variables, indicating that more variance is shared between the loan pricing indicators than any other block of different indicators. The highest negative correlation is between firm size and loan pricing (-0.389). The highest positive correlation is between firm size and customer profitability (0.478). Also the correlation between relationship scope and value (0.423) is relatively high.

The examination of the structural model was conducted to assess the relation between the constructs and a bootstrapping procedure was used to evaluate the parameter estimates and their significance. The results of the bootstrapping and the model's explanatory power (R^2) are presented in Table 2. The path coefficients on loan pricing are statistically significant, except for the element of the relationship length. All the path coefficients on customer profitability are statistically significant. The R^2 of loan pricing is 19.3 % and the customer profitability is 42.7%. The R^2 -results are described as moderate by Chin (1998). In summary, the model seems to fit with the empirical data.

Table 2 Assessment of the structural model. The table reports the T-values and the significance of the bootstrapping procedure. The focal constructs are Loan pricing (latent variables consisting of loan price and internal rating) and Customer profitability (the logarithm of realized profitability in the following year). Length is the logarithm in years, Scope is the logarithm of the number of services other than a loan, Depth is the ratio of the bank loans from the subject bank to the firm's total assets, Firm profitability is the firm's return on equity, Firm size is the logarithm of total assets, Loan size is the logarithm of loan size.

	Loan pricing		Customer profitability	
	T-value	Sign.	T-value	Sign.
Loan pricing			5.582	***
Length	0.880		2.714	***
Scope	3.928	***	15.052	***
Depth	7.225	***	12.048	***
Firm profitability	4.258	***	5.389	***
Firm size	18.280	***	19.151	***
Loan size	4.693	***	5.168	***
T-statistics of bootstrapping procedure. ***, ** and * denote significance at the 1%, 5% and 10% respectively.				
R^2 of Loan pricing	0.193			
R^2 of Customer profitability	0.427			

In summary, the assessment of the measurement and structural model shows an acceptable fit with the empirical data and there is equilibrium between comprehensiveness and parsimony in the model. The main analysis of the paper follows in the next chapter.

5 Empirical results

It is supposed that a loan pricing decision precedes the realization of customer profitability and therefore the direction of the effect is from loan pricing to customer profitability. However, there are many approaches for assessing value in bank–firm relationships and especially in marketing research, the definition of customer profitability is analyzed in detail, whereas the focus in this paper is simplified into a financial measure.

Hypothesis 1 examines the association between loan pricing and customer profitability. It stated that there is a positive association between loan pricing and customer profitability. The results in Table 3 show that the coefficient of loan pricing on customer profitability is 0.118, which is statistically significant. This finding supports hypothesis 1 by indicating that there is a positive association between loan pricing and customer profitability at the aggregate level.

Table 3 PLS results on loan pricing and customer profitability. The table reports the results of the total effects at the aggregate level. The focal constructs are Loan pricing (latent variables consisting of loan price and internal rating) and Customer profitability (the logarithm of realized profitability in the following year). Length is the logarithm in years, Scope is the logarithm of the number of services other than loans, Depth is the ratio of bank loans from the subject bank to the firm’s total assets, Firm profitability is the firm’s return on equity, Firm size is the logarithm of total assets, Loan size is the logarithm of loan size.

	Loan pricing	Sign.	Customer profitability	Sign.
Loan pricing			0.118	***
Length	-0.019		0.046	
Scope	0.087	***	0.286	***
Depth	-0.156	***	0.274	***
Firm profitability	0.092	***	0.078	***
Firm size	-0.437	***	0.498	***
Loan size	0.099	***	0.105	***
R ² of Loan pricing		0.193		
R ² of Customer profitability		0.427		

Path coefficients are the total effects. T-values are calculated using the bootstrapping procedure. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively.

The further testing of hypothesis 2 involves the moderation effect of the lending technology. The main rationale behind such a measure is the amount of useful information for loan contracting. Banks accumulate information on a firm to mitigate the problems of asymmetric information. However, the information is costly and banks should also focus on key firms to increase their customer profitability. Hypothesis 2 stated that asymmetric information moderates the relationship between loan pricing and customer profitability.

First, a priori segmentation is employed by using lending technology as a grouping variable. The sample is split into two segments: the first segment of firms based on relationship lending

technology represents the lower level of information asymmetry. The second segment of firms based on financial statement lending technology represents the higher level of information asymmetry. The sample sizes are 221 observations for the first segment (11.4%) and 1724 observations for the second segment (88.6%). In Table 4, the explanatory power (R^2) of the models used for the relationship lending segment is higher than that of the financial statement lending segment.

Table 4 A priori segmentation. The table reports the results of a priori segmentation based on lending technology. The relationship lending segment represents the lower level of information asymmetry, while the financial statement lending segment represents the higher level. The focal constructs are Loan pricing (latent variable consisting of loan price and internal rating) and Customer profitability (logarithm of realized profitability in the following year). Length is the logarithm in years, Scope is the logarithm of the number of services other than the loans, Depth is the ratio of bank loans from the subject bank to the firm's total assets, Firm profitability is the firm's return on equity, Firm size is the logarithm of total assets, Loan size is the logarithm of the loan size.

	Relationship lending segment n = 221				Financial statement lending segment n = 1724			
	Loan pricing		Customer profitability		Loan pricing		Customer profitability	
Loan pricing			-0.032				0.140	***
			(0.575)				(6.177)	
Length	0.014		-0.061		-0.023		0.070	***
	(0.204)		(1.170)		(0.956)		(3.480)	
Scope	0.140	*	0.390	***	0.083	***	0.270	***
	(1.834)		(7.451)		(3.374)		(13.431)	
Depth	-0.224	***	0.195	***	-0.148	***	0.288	***
	(3.824)		(3.129)		(6.290)		(11.457)	
Firm profitability	0.104		0.024		0.094	***	0.080	***
	(1.398)		(0.634)		(4.022)		(5.011)	
Firm size	-0.556	***	0.404	***	-0.396	***	0.469	***
	(8.434)		(5.185)		(15.582)		(17.625)	
Loan size	0.038		0.201	***	0.108	***	0.088	***
	(0.602)		(3.634)		(4.716)		(3.867)	
R^2	0.315		0.506		0.168		0.399	

Significance using the bootstrapping procedure. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. Path coefficients for the customer profitability are the total effects. T-values in parenthesis result from bootstrapping each group.

Table 4 shows that the association between loan pricing and customer profitability is negative in the relationship lending segment (-0.032) and positive in the financial statement lending segment (0.140). However, the path coefficient for the relationship lending segment is not statistically significant. On the other hand, the firms that are segmented into the financial statement

lending technologies have a statistically significant positive association between loan pricing and customer profitability. This finding suggests that there may be other reasons for continuing a relationship with a bank than loan pricing, for example, other services provided by the bank.

The length of a relationship seems not to be highly associated with loan pricing. However, the association between relationship length and customer profitability has a negative value (-0.061) in the relationship lending segment, whereas the financial statement lending segment has a statistically significant positive value (0.070). The magnitude of the path coefficients is relatively low, but this suggests that relationship length increases customer profitability in financial statement lending technologies. Thus, the relationship lending technology shows that the length of a relationship has a relatively low negative effect on customer profitability. This finding augments prior literature on relationship length and customer profitability, and highlights the importance of consideration with regard to the ending of relationships, which is in line with the findings made by Halinen and Tähtinen (2002).

The intensity of bank–firm relationships is found to be more pronounced in the elements of relationship scope and depth. Relationship scope has a statistically significant positive association (0.083) with loan pricing in financial statement lending technology, and a stronger positive association (0.140) with relationship lending technology. Relationship depth has a statistically significant negative association (-0.148) with loan pricing in financial statement lending technology and a stronger negative association (-0.224) with relationship lending technology.

The constructs of relationship scope and depth on customer profitability are statistically significant in both segments. Relationship scope has a positive association (0.270) with customer profitability regarding financial statement lending technology and a stronger positive association (0.390) with relationship lending technology. In contrast, relationship depth has a positive association (0.288) with customer profitability regarding financial statement lending technology and a weaker positive association (0.195) regarding relationship lending technology. These findings suggest that when information asymmetry is reflected as a lending technology, it constitutes a moderation effect.

Second, the moderation effects are statistically analyzed. The detection of moderating effects through segment comparisons is calculated from differences between the path coefficients of the segments.

From the results in Table 4 the moderation effect on the association between loan pricing and customer profitability can be calculated as a subtraction of the path coefficient of relationship lending technology (-0.032) from financial statement lending technology (0.140). The difference between the segments in the relationship between loan pricing and customer profitability is then 0.172.

This demonstrates that loan pricing does not have a significant association with customer profitability for firms that are segmented into relationship lending technologies. On the other hand, loan pricing has a significant positive association with customer profitability in firms that are segmented into financial statement lending technologies. These findings indicate that loan pricing is associated with customer profitability in firms that are segmented into financial statement

lending technologies, but that the value in a bank–firm relationship in relationship lending firms is generated from sources other than loan pricing.

The assessment of the statistical significance of differences between segments is challenging in PLS path modeling and several approaches have been suggested (Hair et al. 2009). In analyses with dichotomous variables, as in lending technology, the analysis is relatively straightforward. There are at least three approaches for assessing the statistical significance of the differences: parametric, moderation and permutation approaches¹⁵.

Henseler, Ringle and Sinkovics (2009) presented an alternative approach to the PLS-based group comparison. This novel approach does not rely on assumptions about normal distribution and therefore it is more suited for partial least squares. This approach is well described in their article and it aims at the verification of how probable a difference in parameters between the two segments is likely to be. It can be calculated as follows:

$$P(b^{(1)} > b^{(2)} \mid \beta^{(1)} \leq \beta^{(2)}) = 1 - \sum_{\forall j,i} \frac{\theta(2\bar{b}^{(1)} - b_j^{(1)} - 2\bar{b}^{(2)} + b_i^{(2)})}{J^2} \quad (1)$$

In this equation, J denotes the number of bootstrap samples, $b_j^{(1)}$ and $b_i^{(2)}$ the bootstrap parameters estimates, $\bar{b}^{(1)}$ and $\bar{b}^{(2)}$ the means of the focal parameters over the bootstrap samples, and θ the unit step function, which has a value of 1 if its argument exceeds 0, otherwise 0. The superscript in parentheses marks the respective segment. The calculation of probabilities is based on the bootstrap output that is generated by SmartPLS 2.0 (Ringle et al. 2005) and the final calculations were made using an MS Excel spreadsheet. The probability of error in assessing the significance of segment differences is shown as the P-value using specified significance levels.

The main sources of customer profitability seem to emerge from other banking services and firm size in relation to the magnitude of path coefficients. The results in Table 5 show that some of the moderation effects of the lending technology on loan pricing and customer profitability are statistically significant. Therefore, the path coefficients are significantly different for the lending technologies.

¹⁵ Keil, Tan, Wei, Saarinen, Tuunainen and Wassenaar (2000) suggest a parametric approach for calculating test statistics using path coefficients and related standard errors. Keil et al. (2000) suggest using the standard errors obtained from bootstrapping as the input for a parametric test. This approach includes parametric assumptions about the distribution of the parameter standard errors. This test is used when the two distributions have the same variance. However, Chin and Dibbern (2010) studied a permutation approach with simulation tests and concluded that a parametric approach may overestimate the statistical significance. In line with Chin and Dibbern (2010) I found that all moderation effects in my setting seem to be statistically significant and therefore a parametric approach may not be suitable for assessing the statistical significance of the moderation effects.

Table 5 Moderation effects of lending technology. The table reports the moderation effects and their probability of error. The focal constructs are Loan pricing (the latent variable consisting of loan price and internal rating) and Customer profitability (the logarithm of realized profitability in the following year). Length is the logarithm in years, Scope is the logarithm of the number of services other than loans, Depth is the ratio of bank loans from the subject bank to the firm's total assets, Firm profitability is the firm's return on equity, Firm size is the logarithm of total assets, Loan size is the logarithm of the loan size.

	Loan pricing		Customer profitability	
	Moderation	P	Moderation	P
Loan pricing			0.172 (0.011)	**
Length	-0.037 (0.270)		0.131 (0.008)	***
Scope	-0.057 (0.216)		-0.120 (0.010)	***
Depth	0.076 (0.104)		0.093 (0.093)	*
Firm profitability	-0.010 (0.471)		0.056 (0.079)	*
Firm size	0.160 (0.014)	**	0.065 (0.188)	
Loan size	0.070 (0.135)		-0.113 (0.029)	**

Probability of error in parenthesis using the Henseler et al. (2009) approach. ***, ** and * denote probability of error (P) at the 1%, 5% and 10% level, respectively. The coefficients for customer profitability are the total effects.

The difference (0.172) in the association between loan pricing and customer profitability as seen in Table 5 is statistically significant (P-value 0.011). So, the path coefficient from loan pricing to customer profitability is significantly different between the relationship and financial statement lending technologies. This finding supports hypothesis 2 by presenting evidence that the lending technology moderates the association between loan pricing and customer profitability.

The association of relationship length with customer profitability is positive in financial statement lending technologies and negative in relationship lending technologies, and their difference is statistically significant. This suggests that relationship length positively affects customer profitability in the case of firms that suffer from a higher level of information asymmetry (financial statement lending technologies). Therefore, a relationship's intensity is found in the element of relationship length for firms that are segmented into the financial statement lending technologies.

The relationship scope affects customer profitability positively in both lending technologies. The statistically significant moderation effect of lending technology regarding relationship scope indicates that firms that have a lower level of information asymmetry (relationship lending technologies) generate more customer profitability through other banking services than firms segmented into a higher level of information asymmetry (financial statement lending

technologies). The pattern is similar between the lending technologies regarding the association of relationship scope with loan pricing, but not statistically significant.

On the other hand, relationship depth seems to have a consistently negative association with loan pricing and a positive one for customer profitability. In the case of loan pricing, the relationship lending technology seems to have a stronger negative association than the financial statement lending technology. The interpretation is that firms that are segmented into relationship lending technologies gain from concentrating their loans with one bank by receiving decreases in the cost of their loans. Regarding customer profitability, the financial statement lending technology seems to have a stronger positive association than relationship lending technology. This suggests that firms segmented into financial statement lending technologies receive increased customer profitability when they concentrate most of their loans at one bank. However, the moderation result on the relationship between relationship depth and loan pricing is not statistically significant.

The association of loan size is positive with loan pricing and customer profitability in both lending technologies. The results of the moderation effects show that in relationship lending technologies the effect is weaker for loan pricing and stronger for customer profitability than it is for financial statement lending technology. The association of firm size with loan pricing is negative for both lending technologies. However, the negative association of firm size on loan pricing is significantly bigger for relationship lending technologies, which suggests that these firms find compensatory benefits through the use of mitigated information asymmetry.

6 Discussion and conclusions

The extant literature on bank–firm relationships provided the theoretical foundations and empirical evidence for strengthening the examination of the association between loan pricing and customer profitability. Berger and Udell's (2006) framework for lending technologies provided major avenues for finding pertinent points of view for examining their relevant aspects. The research gap on the simultaneous examination of the moderating effect of lending technology on loan pricing and customer profitability was examined in this paper in order to gain an incremental understanding of their information role. The theory in this field of research is developing and prior empirical evidence lacks an understanding of many aspects of the interdependencies between these constructs.

This paper studies the information asymmetry between banks and firms and the nature of the information mitigating the problems of information uncertainty in loan contracts. The discussion of soft and hard information in bank–firm relationships has evolved mainly in this decade and this paper empirically examines the conceptual framework devised by Berger and Udell (2006). From the bank's perspective there are basically two potential channels of information flows in order to gain useful information about a firm's loan repayment ability. Firstly, hard information from a firm's financial statement will provide the foundation for continuous customer evaluation. Secondly the soft firm-specific information on the intensity of a relationship will provide useful information about the sustainability of the relationship. The theoretical foundations of both

Petersen and Berger as well as Udell on bank–firm relationships formed the basis for the building of the theory of this paper.

The paper focused on small and medium-sized privately held firms, because these firms acquire most of their external funding from banks (Niskanen and Niskanen 2006). With a large and unique sample of privately held firms from one of the major banks domiciled in Finland, the study was able to combine bank–firm relationship and financial statement information and address the research problem by scrutinizing the constructs in a comprehensive manner.

As there are many disputed results in bank–firm relationship literature, especially those related to the privately held firm context, a specific method was used to shed light on the association between the focal constructs and their interdependencies. The method used – structural equation modeling by means of partial least squares path modeling (PLS) – was found to be a very useful method for examining the relations and the type of effect. In addition to the prediction orientation, this method provided insights for searching for unobserved heterogeneity within a sample.

The findings were consistent with the majority of empirical findings on bank–firm relationships. The basic rationale behind the decreased information asymmetry produced by a more intensive relationship between a bank and a firm prevailed in the empirical results. However, heterogeneity within the sample suggested that further clarification was needed to understand the very different implications for groups of firms.

The findings supported the view that there is a positive association between loan pricing and customer profitability. The results showed that loan pricing did not have a significant association with customer profitability for the firms that are segmented into relationship lending technologies. On the other hand, loan pricing had a significantly stronger positive association with customer profitability for firms that are segmented into financial statement lending technologies. These findings indicated that loan pricing affects customer profitability in firms that are segmented into financial statement lending technologies, and that profitability in bank–firm relationships for firms that are segmented into relationship lending technologies is generated from sources other than loan pricing.

By allowing for the moderation effect of lending technology the results indicated that relationship intensity is found in the element of relationship length for firms that are segmented into financial statement lending technologies. The moderation effect of lending technology regarding the relationship scope indicated that firms that have a lower level of information asymmetry generate more customer profitability through other banking services than firms that have a higher level of information asymmetry.

The association of relationship scope with loan pricing is stronger in groups of low return on equity. Those observations lend support to the argument of a lock-in situation where firms with a broader scope of banking services are locked into a bank–firm relationship that allows the bank to charge higher loan margins. For firms with a high return on equity this association is weaker, which indicates that more profitable firms may have better loan availability and consequently more possibilities to compare their contract terms.

Regarding the association of relationship depth with loan pricing, the firms that were segmented into relationship lending technology had a significantly stronger negative association

than the firms segmented into financial statement lending technology. The interpretation was that firms that are segmented into relationship lending technology are remunerated by concentrating their loans with one bank and thus receive their loan at a decreased cost. The negative association of relationship depth with loan pricing is consistently stronger in groups with a low return on equity. These firms gain from concentrating their bank loans at one bank, although this also indirectly indicates their reduced ability to receive bank funding. When a firm's return on equity is high, the association of relationship depth with customer profitability is consistently stronger. So, the bank gains from concentrating on these firms.

The sample is taken from one of the major banks in Finland, and I acknowledge the notion that the bank's business culture may affect the results. However, all major banks in Finland have quite a similar strategy and business logic, so this matter should not cause bias. Also, as the other main banks in Finland have similar customer strategies, there is unlikely to be any major differences that could affect loan pricing. In addition, the enforcement of bank regulation between countries may differ, although banks should follow the requirements of the Basel Framework and Solvency Framework Directive (Basel Committee on Banking Supervision 2006). However, the fact that the sample is from one bank eliminates the possibility to have certain variables, for example, the number of banking relationships that each firm has.

In conclusion, the findings in this paper have implications for the theory development of bank–firm relationships and managerial guidance. In terms of the contribution of this paper, soft and hard information in the form of a unique combination of primary information sources can be positioned into a comprehensive model to convey the information role they have. Moreover, the model exhibits predictive relevance, making it a valuable tool for managerial guidance. The findings suggest that these constructs should be taken into account in relation to loan contracting, particularly for privately held small and medium-sized firms that acknowledge information risks and are seeking efficient contracting. In particular, the findings on information asymmetry that are reflected as lending technology fitted well with the empirical examination of the conceptual framework developed by Berger and Udell (2006). It demonstrated that it is worthwhile to pre-segment bank–firm relationships. These findings may have implications for further theory development.

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