



Information asymmetry between banks, rent extraction, and switching in mortgage lending

Endre J. Reite^{*}

Norwegian University of Science and Technology, Department of International Business, P.O. Box 1517, 6025, Aalesund, Norway

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ABSTRACT

This study explores how banks compete for a mortgage following different information about the same client. We employ inside information about a bank's clients and the information available to an outside bank making a competing offer for 13,080 individual mortgage clients in Norway from 2010 to 2018. We demonstrate that disentangling the effects of the duration of the client–bank relationship and the asymmetric information between banks bridges a gap in the existing literature. The inside bank is less sensitive to negative external information and extracts rent based on the length of the client–bank relationship.

1. Introduction

Information asymmetry in corporate client bank switching has been described as a multi-stage game, demonstrating how an external bank may offer a better rate to a client whose negative information is accessible only to its inside bank (Sharpe, 1990; von Thadden, 2004). We expand on this research by studying how much weight the inside and outside banks place on the different types of information available to them.

The novelty in our approach is our ability to test the actual use of information available to all banks like client demographic data, loan characteristics, and credit score data, and information available only to the inside bank like the duration of the client–bank relationship and internal information regarding bank products used by the client and late payments. Our study allows us to bridge theory by using the actual prices offered by two competing banks and testing how the banks employ the information available to them to determine their pricing.

Extant research offers two theories of how informational asymmetry can contribute to a price difference between existing clients and switchers. A bank can extract rent after the first favorable offer to a client making a switch (Sharpe, 1990; von Thadden, 2004; Degryse and Ongena, 2005; Ioannidou and Ongena, 2010; Ongena et al., 2021), or it can use its information advantage to offer better rates to existing clients as its knowledge about their risk increases (Boot and Thakor, 1994; Berger and Udell, 1995). Furthermore, rent extraction and pricing depend on market frictions, the duration of the client–bank relationship, and the bank's perceived risk that the client will switch (Brunetti et al., 2020). In this study, we also employ a centrality measure from Statistics Norway (Statistics Norway 2022) to capture information differences due to distance from the inside bank's closest branch (Agarwal and Hauswald, 2010) and centrality's impact on competition and perceived risk (Ongena et al., 2021).

We propose a new model where the price a bank offers is a function of client characteristics, loan characteristics, risk information available to all banks, and other client–bank relationship information available only to the inside bank. We test this hypothesis with

^{*} Corresponding author.

E-mail address: endrejr@stud.ntnu.no.

Table 1
Definition of the independent variables.

Variable	Definition
Credit risk	Information _{outside} is represented by a credit risk as a measure of the risk of a client defaulting on a loan. The credit risks obtained at the time of the competing offer without accessing Information _{inside} only known to the inside bank. A higher value signifies a higherrisk of default.
Information _{inside}	Information _{inside} is measured on an increasing scale based on the amount of negative information relevant to the internal scorecard of the bank. The scale includes late mortgage payments to the inside bank scaled by the number of late payments, by days, and outstanding amount. Positive information is given 1/10 weight and consists of the median deposit coverage ratio for the last 24 months and the average number of bank products used by the client.
Client–bank relationship	The client–bank relationship is measured by the duration of the relationship between the client and the inside bank.
Client characteristics	Client characteristics include sex (male); The regression further control for age of the client.
Loan characteristics	Loan characteristics include the loan size, loan-to-value ratio, and collateral centrality. The centrality measure is strongly correlated with proximity to the inside bank ($\rho=-0.831$) and thus encompasses proximity, employed in earlier research (Degryse and Ongena, 2005; Agarwal and Hauswald, 2010), and a measure of the general attractiveness of the housing market to both banks.

data representing each of these factors. disentangling the size of the factors at play in switching and the importance of positive and negative information and relational strength for different groups of mortgage clients.

We apply quantile regression because a bank's profit or loss from a client is non-linear across varying positive and negative information (Somers and Whittaker, 2007). Our results show how seemingly conflicting findings from previous studies on how information asymmetry contributes to price differences between existing clients and switchers can be explained by the differences in how banks use their information sources contingent upon the type of information available to them, and dependent on the weight they put on any signals from the different information sources.

2. Data and methodology

We expand on von Thadden (2004) by exploring the information available to a bank when it acquires a new client at time $t=0$. We define *available information*, Information_{outside}, as all client and credit-scoring information, except for internal information known only to the client's incumbent bank, Information_{inside}. Information_{inside} is the additional internal information acquired from the inside bank during the client–bank relationship, at the time a client receives a competing offer from an outside bank. At this time, the inside bank also has access to Information_{outside}. Additionally, we expand on Ongena et al. (2021) by exploring the link between a client's risk and the increased probability that they will switch banks when they receive a counteroffer.

Our new hypothesis combines earlier research using mortgage pricing models based on objective and discriminatory factors (Allen et al., 2014) with models where pricing is based on information asymmetry (Sharpe, 1990; von Thadden, 2004; Agarwal and Hauswald, 2010; Ioannidou and Ongena, 2010). Our approach expands on Agarwal and Hauswald (2010) by separating credit score into an external credit score, and a measure of additional internal score relevant information on the client. Furthermore, we employ data on offers from a competing bank to a client and the counteroffer from the inside bank. We hypothesize that banks use similar models to estimate their offered margin, based on the client's credit score and all the information on client and mortgage characteristics available to all banks, like loan size, loan-to-value (LTV) ratio, and the client's age and sex. We suggest that the information advantage of the inside bank results in additions to or subtractions from this price based on Information_{inside}, such that the competing offer is represented by Eq. (1) and the counteroffer is based on Eq. (2) below.

To decompose margins into loan, bank, consumer, and market effects, we estimate the following linear Eqs (1) and (2):

$$\text{Competing offer} = \beta_{\text{Outside}} \begin{bmatrix} \text{Information}_{\text{Outside}} \\ \text{Client characteristics} \\ \text{Loan characteristics} \end{bmatrix} + \varepsilon \quad (1)$$

$$\text{Counteroffer} = \beta_{\text{Inside}} \begin{bmatrix} \text{Information}_{\text{Outside}} \\ \text{Information}_{\text{Inside}} \\ \text{Client characteristics} \\ \text{Loan characteristics} \\ \text{Client – bank Relationship} \end{bmatrix} + \varepsilon \quad (2)$$

The price difference between the offers is determined by the value the inside bank gains from its Information_{inside} and the value it seeks to retain, based on the rent extracted from the length of the client–bank relationship.

We measure the weight of the different sources of information by adjusting the competing offer, and counteroffer at time t by the inside bank's average funding cost at the time of offer and estimate Eqs. (1) and (2) with the independent variables presented in Table 1.

We investigate the proportion of the price related to Information_{inside} compared to the proportion of the price explained by publicly available Information_{outside} and the weight the inside bank places on Information_{inside} and Information_{outside} in determining its

Table 2

Factors influencing the competing offer and the inside bank's counter offer when a client receives a competing offer (N=13,080).

	Model 1a	Model 1b	Model 2a	Model 2b	Model 2c	Model 2d
Const	54.706*** (0.500)	54.700*** (0.498)	84.079*** (0.499)	84.067*** (0.488)	84.077*** (0.483)	83.161*** (0.455)
Male	-1.322*** (0.463)	-1.382*** (0.462)	-1.524*** (0.458)	-1.646*** (0.450)	-1.649*** (0.446)	-1.592*** (0.418)
Loan-to-value ratio	11.149*** (0.471)	10.959*** (0.470)	14.742*** (0.470)	14.356*** (0.462)	14.284*** (0.456)	12.566*** (0.434)
Amount	-20.207*** (0.443)	-20.194*** (0.444)	-10.426*** (0.469)	-10.400*** (0.460)	-10.500*** (0.455)	-14.833*** (0.414)
Centrality	-1.158** (0.476)	-1.125** (0.474)	-1.255*** (0.473)	-1.187** (0.464)	-1.175** (0.459)	-0.860** (0.433)
Credit risk		5.870*** (0.488)		10.293*** (0.477)	-1.074 (0.742)	1.196* (0.705)
Client–bank relationship					11.946*** (0.905)	11.860*** (0.851)
Inside information						17.703*** (0.467)
Controls	X	X	X	X	X	X
N	13,080	13,080	13,080	13,080	13,080	13,080
Adj. R**2	0.178	0.185	0.161	0.193	0.210	0.302
lnL	-7.06e+04	-7.05e+04	-7.05e+04	-7.02E+04	-7.01E+04	-6.93E+04

Note: a) Standard deviations in parentheses. Significance levels are: * 10%, ** 5%, and *** 1%. b) Controls for type of bank: local, regional, national, international, and age of client c) Credit risk is based only on information available to all banks.

counteroffer. Earlier research has not empirically investigated external information, internal information, proximity to a bank branch, and the client–bank relationship in a complete model, thus failing to shed light on the different uses of information sources by the inside and outside banks. We hypothesize that introducing separable measures of the client–bank relationship, $Information_{Outside}$ and $Information_{Inside}$ can increase the understanding of information and price differences between inside and the outside bank

This study is the first to explicitly explore the marginal effect of these separate sources of information. Although negative information is significant in a small number of observations, the value of substantial negative inside information is high given the potentially large loss when a mortgage client defaults (Qi and Yang, 2009).

Our dataset consists of 13,080 mortgages from a medium-sized Norwegian bank whose clients received competing offers from other banks between 2007 and 2017. The dataset encompasses a series of instances where an existing mortgage client of the inside bank received or requested a competing offer from another bank. The summary statistics are presented in Appendix Table A1.

We establish a novel scale of information about the client, based on negative information like late mortgage payments and positive information, such as the average deposit coverage ratio and additional bank products used by the client. This scaling assumes that negative information indicates the absence of profitability from other products and the presence of credit risk indicators. In contrast, positive information is the absence of credit risk indicators and the presence of indicators of profit from deposits and other products. Our results remain robust when we use several alternate methods to establish a scale.

3. Results and discussion

When comparing Models 1a and 2a in Table 2, we find that in the absence of credit score as an independent variable, the competing and the inside bank have similar weight on loan, and client information, including the credit risk in Models 1b and 2b only slightly increases the overall explanatory power of the model. Thus, other factors are more important than credit score in determining the price in the case of clients receiving an offer from a competing bank. Comparing Model 1b with all information available to the outside bank with Model 2c, we find that the duration of the client–bank relationship significantly increases the price offered by the inside bank (11.946, [0.905]). Including negative information available only to the inside bank in Model 2d, we observe only a slight decrease in the coefficient on centrality/proximity. Centrality seems to be equally important to both the outside banks and the inside bank. In our data, Centrality display a strong negative correlation with distance to both the inside ($\rho = -0.831$) and competing bank ($\rho = -0.744$). This result indicates the need to include Centrality when comparing the informational effect of proximity as a measure of informational asymmetry and points to an alternative explanation to findings in previous research. Model 2d further explains nine percent more of the variation in price offered by the inside bank than Model 2c. The coefficient on internal information is also large and highly significant (17.703, [0.467]), indicating a significant informational asymmetry between the inside bank and the outside bank.

Table 2 shows that for the outside bank, the LTV ratio and loan amount have substantially more significant effects than credit risk. It further shows that while the credit risk is highly significant in determining the outside bank's price (5.870 [0.488]), the size and significance of the effect are much smaller for the inside bank (1.196 [0.705]). $Information_{Inside}$ is significant in determining the counteroffer and increasing it (17.703 [0.467]). However, the duration of the client–bank relationship also increases the counteroffer independent of negative information (11.860 [0.851]). These results suggest rent extraction based on the duration of the client–bank relationship. Table 2 further shows that an increase in centrality reduces the rates offered by both banks. This variable encompasses the effect of distance to the inside bank, competing bank and the collateral's general attractiveness and has a separate information value

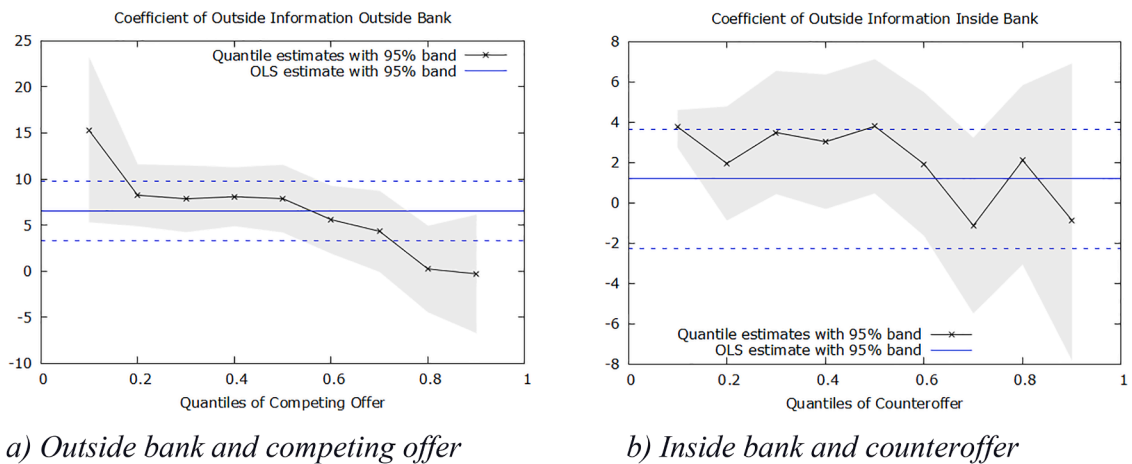


Fig. 1. Coefficient of credit risk for different price quantiles for inside and outside banks (N-13,080) in Models 2d and 1b.

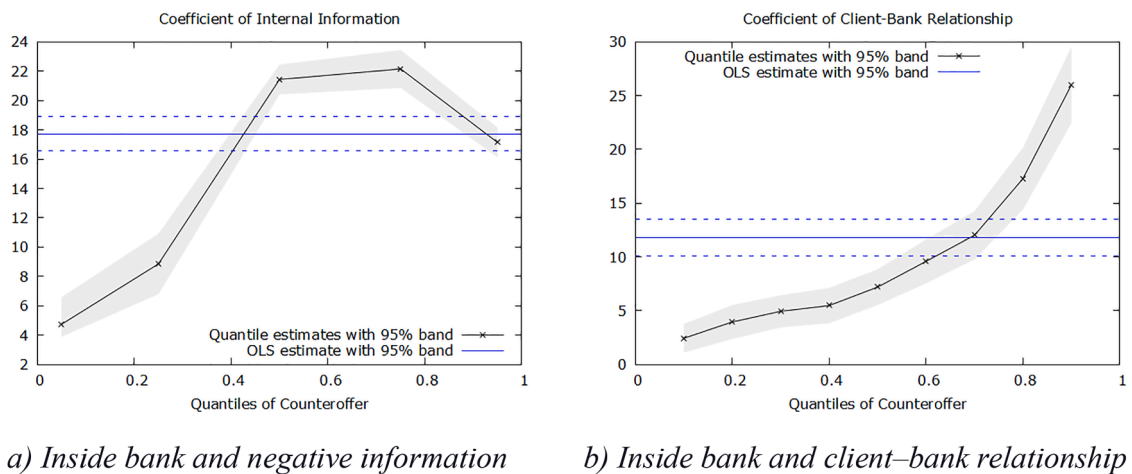


Fig. 2. Coefficient of negative information and client–bank relationship for different counteroffer quantiles (N-13,080) in Model 2d.

when other internal information is factored in. However, the variable is less important for the inside bank than inside negative information and the client–bank relationship.

Table 2 further illustrates how the difference between a competing offer and a counteroffer from an inside bank with internal information and knowledge about the client–bank relationship depends on the type of data available from these three sources. When outside information is negative, the inside bank may offer a lower price. When inside information is negative, a winner’s curse can occur, and if the information is neutral, an increase in the client–bank relationship will result in an increase in the price the client pays as the inside bank extracts rent based on factors such as switching barriers, friction or loyalty. Turning to the quantiles of selected coefficients, Fig. 1a illustrates how the marginal importance of credit risk falls as the competing offer from the outside bank increases. The inside bank, however, has lower coefficients and lower significance across quantiles. A client with higher credit risk can thus get a comparatively lower counteroffer than the competing offer.

Turning to the quantiles in Fig. 2a, we observe how the coefficient of internal information is significant but small in the lowest quartile, but larger as the counteroffer increase. In Fig. 2b, we find that a short client–bank relationship has a negligible effect on the lowest counteroffers. Contrarily, a long client–bank relationship increases the highest counteroffers, indicating that the inside bank’s pricing seeks to exploit a perceived loyalty effect or switching barrier.

4. Conclusion

We find that the different sources and uses of information can contribute to the winner’s curse linked to information asymmetry between two banks in mortgage lending. However, the proportion of information hidden from an external bank is small, and the effect of hidden information is only material in determining the price for clients with extensive, prolonged, and repeated defaults. The value of internal information is, on average, limited. Still, the absence of negative information leads to a small but significant increase in a

Table A1
Summary statistics, standardized independent variables (N=13,080).

Variable	Mean	Median	SD	Min	Max
Competing offer	52.4	43.4	58.8	-27.1	424
Counteroffer	68.0	60.3	59.0	-14.1	424
Male	-1.16e-015	0.564	1.00	-1.77	0.564
Centrality	2.03e-016	0.00168	1.00	-1.81	1.67
Credit risk	-9.63e-015	-6.02e-005	1.00	-1.57	1.91
Loan-to-value ratio	-9.53e-017	0.0461	1.00	-3.44	2.86
Amount	-4.53e-016	-0.424	1.00	-1.32	1.36
Client–bank Relationship	-3.84e-015	-0.222	1.00	-1.11	3.87
Information	-1.54e-015	-0.237	1.00	-2.30	9.34

Notes: All independent variables are scaled to a uniform standard deviation.

bank's willingness to offer a low competing price when a client faces an offer from a competing bank. Since mortgage lending has a long-tailed loss distribution, the significant effect of negative information on a small group of clients can create substantial risk for a bank.

When outside information about a client is negative, our model can explain a scenario where the inside bank offers more favorable terms to existing clients than the offer the clients receive from a competing bank. When external information is neutral or positive, the external bank provides more favorable terms because the inside bank tends to extract rent as the duration of the client–bank relationship increases. Conflicting findings in earlier research may have stemmed from differences in the information available to the inside and outside banks. The inside bank places less weight on changes in the information available to all banks and more on the inside client information. [Berger and Udell \(1995\)](#) studied businesses in 1989 during the savings and loan crisis ([Williams et al., 1991](#)) where it is plausible that the positive effect of internal information could dominate the negative outside-business-environment information. [Degryse and Ongena \(2008\)](#) and [Ioannidou and Ongena \(2010\)](#), in contrast, studied data from a period without such negative shocks in outside information. In our results, their findings are consistent with different weights on client–bank relationships and communication from outside and inside a bank.

This study is limited to mortgage pricing and switching in a highly digitalized country. The findings related to the informational effects can diverge from results in countries with processes more dependent on personal interaction between clients and banks. Future empirical research should explore environments where internal information and public information are measurable for two parties, and the development of a theoretical framework surrounding our suggested model. We further suggest including centrality, and to explore the differences in correlation between centrality and distance to both inside, and outside bank-branches in research on distance-based price discrimination in banking.

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Data Statement

The research data are confidential.

CRedit authorship contribution statement

Endre J. Reite: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft.

Declarations of Interest

The author is affiliated with the bank that provided data for the research.

Data Availability

The data that has been used is confidential.

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Appendix

Table A1

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