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Asymmetric Information, Bank Lending and Implicit Contracts: Differences between Banks

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Abstract This paper studies asymmetric information on banks, relationship lending and switching costs. According to the classic theory of relationship banking asymmetric information on borrower types causes an informational lock-in by borrowers: good borrowers are tied to their banks. This paper shows that an informational lock-in effect occurs even if borrowers are identical. Asymmetric information on banks generates an informational lock-in for borrowers. A borrower is tied to the initial bank even if it charges higher loan interest. The borrower is not ready to leave the bank and take a risk that the new bank proves to be even worse.

Keywords Asymmetric information, banking, relationship lending, bank competition, switching costs
JEL classification G21

1. Introduction

Innovative articles by Sharpe (1990), Rajan (1992) and von Thadden (2004) design the theory of relationship lending that provides a theoretical explanation for actual long-term bank-firm relationships. The relationship lending theory has had a groundbreaking impact on the banking literature. Customer relationships arise between banks and firms (i.e. borrowers) because, in the process of lending, the bank that does the actual lending to a firm learns more about that borrower's characteristics than other banks. An important consequence of this asymmetric evolution of information is the potential creation of ex post, or temporary, monopoly power: the existing bank has an information advantage over potential competitors at the refinancing stage. The monopoly power allows the bank to capture some of the rents generated by its old borrowers. Due to competition, however, the rents are eroded through low introductory loan interest offers to all firms in their initial period, precisely when banks know the least about the firms. Banks lend to new borrowers at interest rates which initially generate expected losses. The relationship lending theory suggests that firms stay with the same bank because high quality firms are, in the sense, informationally captured. This is due to the difficulties firms face in conveying information about their superior performance to other banks. Adverse selection makes it difficult for one bank to attract another bank's good borrowers without also drawing the less desirable ones as well.

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This paper suggests an alternative explanation for long-term lending relationships and lock-in effects. To highlight the deviation from the classic theory of relationship lending, we assume that borrowers are identical. On the contrary, banks are different. Some banks are good at helping firms boost their returns as in Boot and Thakor (2000) and Song and Thakor (2007), but bad banks cannot offer this kind of support. The bank type is private information. In the process of lending, the firm that actually borrows from a bank learns more about that bank's characteristics than other firms. The borrower learns whether the bank is good or bad.[1] A consequence of this asymmetric evolution of information is the creation of monopoly power. Even if the firm learns to know the bank type in the process of borrowing, the monopoly power is channeled to the bank. The monopoly power allows a good bank to capture some of the rents generated by an old borrower. Because of competition, the rents are lost through low introductory interest rates offered to all firms in the initial period. The model suggests that firms stay with the same good bank because they are informationally captured. This is due to the difficulties firms face in distinguishing between good and bad banks. Adverse selection makes it difficult for a good bank's borrower to seek loan offers from other good banks without attracting offers from the less desirable banks as well. Therefore, the borrower stays with the same familiar bank even if it charges higher loan interest. The borrower will not risk taking a lower interest offer from another bank which may later prove to be a bad bank.

Consequently, both in this model and in the original relationship lending theory (e.g. Sharpe 1990, Rajan 1992, von Thadden 2004) an old borrower is informationally captured in a bank and yields profit for it, whereas a new borrower is unprofitable. In the original theory the lock-in effect is based on asymmetric information on borrower types when banks are identical. Now the lock-in effect is based on asymmetric information on bank types when borrowers are identical. The motivation of our paper is to extend the relationship lending theory by showing a new type of lock-in effect in banking, which generates the same type of interest structure as the original theory.

Empirical research supports (i) the existence of hold-up costs in banking and (ii) the interest structure of relationship lending (i.e. new borrowers pay less loan interest than old ones). Barone et al. (2011) document evidence on hold-up problem in Italy. Banks discriminate between new and old borrowers by charging lower interest rates on the former. The discount amounts to about 44 basis points and is equal to 7% of the average interest rate. Switching costs are higher for single bank firms. On average being a primary bank in the previous period increases the probability of being the main lender by about 70%. The estimated effect is larger for single-bank firms (about 80%) but is also significantly sizeable for multiple-lender enterprises (40%). These findings are supported by Ioannidou and Ongena (2010). They find that a loan granted by a new outside bank carries a loan rate that is significantly (89 basis points) lower than the rates on comparable new loans from the firm's current inside banks, and 87 basis points lower than the rates on comparable new loans that the outside bank currently

[1] Manove et al. (2001) introduced into the literature on asymmetric information credit contracts the idea that researchers could consider different banks instead of different borrowers. We will thank a referee who informed us on this.

extends to its existing customers. Ioannidou and Ongena (2010, p. 1848) go on: "We also find that when the firm switches, the outside bank is willing to decrease loan rates by another 36 basis points … The combined reduction of 122 basis points comprises almost one-tenth of the average observed loan cost of 13.4%. However, a year and a half after a switch, the new bank starts hiking up the loan rates—even if the firm's condition has not deteriorated. Rates increase slowly at first but eventually at a clip of more than 30 basis points per year." In sum, an outside bank initially decreases the loan rate but eventually raises it. These findings are consistent with the original theory of relationship lending and our alternative theory. For evidence on lock-in effects in banking, see also Schenone (2010) and Kano et al. (2011).

We study relationship lending in which a bank can improve the expected output of the borrower's project. For example, Boot and Thakor (2000) and Song and Thakor (2007) examine this type of relationship lending. Is this type of assumption realistic? Boot and Thakor (2000) give three examples on this type of help. First, a bank can provide additional financing to a liquidity-constraint firm after receiving inside information about the firm. Second, a bank can restructure the debt of a financially distressed firm by reducing its near-term repayment obligation in exchange for a higher repayment later. Third, a bank may finance many firms in the same industry. This creates specific information for the bank which can provide this information to borrowers. Scott (1986) surveys the evidence on this type of help and draws the following conclusions:

> "Many commercial banks, for example, routinely provide both financial and managerial advice to business firms … banks indicated that they made special efforts to accommodate small business borrowers by providing financial counseling, and referrals to technical and management assistance as non-fee services. As part of their cash management services, most commercial banks now offer comprehensive analysis of customer receipts and disbursements, as well as credit information, market analysis, financial management assistance and production advice." Scott (1986, p. 948–949)

Obviously, the level of this kind of help may vary between banks. Alternatively, it is possible to interpret the bank's service in a different way. In a loan contract a borrower commits to numerous covenants. The firm, for example, cannot sell its property during the loan period or replace existing key persons. The firm must meet several accounting-based ratios. The covenants may limit the growth of the firm and prevent investments in new industries. The covenants reduce the lender's risk but rigid enforcement may cause severe problems to the borrower. In reality, loan covenants are usually flexible and the borrower may receive a waiver from the lender. The lender evaluates the case and waives the right to enforce the contract if the borrower benefits from the waiver and if the decision does not add to the lender's risk. Obviously, a rational borrower expects the covenants to be flexible. Consider now two banks: Bank G and Bank B. Bank B minimizes credit losses though strict covenants and later grants no waivers even if this causes severe problems to the borrowers. Bank G also favors tight loan covenants but grants several waivers at a later date after a careful analysis. Under asymmetric information the bank type is unobservable. Hence, a borrower faces the risk that its bank proves to represent type B. Finally, the effects of unexpected external shocks vary between banks. Lo (2014) provides examples in which exposed banks reduced lending volume and increased loan spreads substantially more than other banks after a crisis. Thus, a borrower faces a risk that its bank represents a type, which has a high probability to reduce lending in the future. Gopalan et al. (2011, p. 1335) examine reasons for new bank relationships and report: "Our findings suggest that firms form new banking relationships to expand their access to credit ..." On average, firms obtain higher loan amounts when they form new banking relationships, while small firms also experience and increase in sales growth, capital expenditures and leverage. Hence, differences between lending policies drive borrowers to switch banks. This result supports our theory.

Finally, we review novel research on relationship lending. This literature is so numerous that it is possible to review only a small part of it. Since Boot (2000) and Freixas and Rochet (2008) survey prior research extensively, we focus on new research. To begin, there exist few new theoretical articles which apply relationship banking. Repullo and Suarez (2013) examine bank capital regulation using a model of relationship lending. Relationship lending and the transmission of monetary policy are investigated by Hachem (2011). Niinimäki (2014) extends the relationship lending theory to bank regulation and Niinimäki (2015) extends this theory to loan collateral. The magnitude of interesting empirical research is large. Chang et al. (2014) present evidence from China. The bank's relationship information (soft information) is statistically and economically significant in forecasting loan defaults. This information contributes the most significant improvement in default prediction, more than four times larger than the improvement arising from the firm-specific hard information. Agarwal et al. (2011) investigate home equity loans and lines-of-credit applications in U.S.A. The analysis confirms the importance of soft information and suggests that its use can be effective in reducing overall portfolio credit losses. Uchida et al. (2012) discover that more soft information tends to be accumulated when loan officer turnover is less, and when loan officer contact is frequent. These findings from Japan support the vision that the "relationship" in relationship lending is the loan officer–entrepreneur relationship, not the bank-entrepreneur relationship. Uchida (2011) explores lending decisions in Japan. Banks stress three factors: the relationship factor, the financial statement factor, and the collateral/guarantee factor. The relationship factor is crucial for small banks and under intensive competition. Cotugno et al. (2013) find that in Italy a strong bank-borrower relationship mitigates credit rationing. Distance has negative impact on credit availability. Cenni et al. (2015) report that in Italy the probability of credit rationing increases with the number of lenders and decreases with the length of the relationship with the main bank. Debt concentration with the main bank affects positively small firms. Fiordelisi et al. (2014) also utilize Italian data and discover that a closer and longer bank-borrower relationship decreases the probability of the borrower's financial distress. Geršl and Jakubík (2011) find that in Czech Republic the level of a bank's credit risk decreases with the share of relationship loans in the bank's portfolio. The research problems and results of these articles differ from our paper.

The paper is organized as follows. Section 2 introduces the economy. Section 3 investigates the operations of good and bad banks under symmetric and asymmetric information. Section 4 draws conclusions.

2. Economy

Consider a risk-neutral economy with N banks and N borrowers (=firms), where N approaches infinity. Banks and firms maximize their expected returns. The economy has two periods: period 1 and period 2. Banks can raise unlimited quantity of deposits by paying (gross) interest r on them. Here r is the risk-free interest rate of the economy.

Firms and projects A firm can undertake an investment project in each period. A project lasts for a period and requires a unit of investment input. If a project is successful, it produces Y units. If unsuccessful, the output is zero. With bank counseling a project succeeds with certainty. Without counseling it succeeds with probability p. A firm invests effort e in a project at the start of a period with certainty. The firm has no wealth of its own and it borrows a unit of capital from one bank for a period.

Banks Banks raise deposits, grant loans and may counsel borrowers. Banks have other returns which make them risk free. To shorten the study, we do not model these returns. We focus entirely on loans. Two bank types exist: good and bad. A good bank has the capacity to counsel borrowers and thus raise the probability of project success from p to 1. This type of relationship lending in which banks counsel borrowers and thereby boost the probability of project success is similar to Boot and Thakor (2000). As in Boot and Thakor (2000) we assume that the counseling capacity entails cost C to a bank in each period. More precisely, good banks may, for example, hire managers for two periods to counsel borrowers. Since good banks have already purchased the counseling capacity, they bear these sunk costs with certainty. Since the counseling process raises the probability of project success from p to 1, a good bank can increase loan repayments through counseling. Hence, good banks are always motivated to counsel borrowers. A bad bank cannot counsel borrowers and their projects succeed with probability p. The bank type is fixed: a bank is either good in each period or bad in each period. The bank type is private information and unobservable to outsiders. However, during the loan period the borrower learns the type of the bank but is unable to communicate this fact to other borrowers (this information becomes private to the two parties in the relationship—the bank and the borrower). The bank type causes a risk to a borrower. If the bank proves to be good, the borrower's project succeeds with certainty. If bad, the project succeeds with probability $p < 1$. Even if the bank type is unobservable to outsiders the shares of good and bad banks are commonly known. The share of good banks in the economy is λ and the share of bad banks is $1-\lambda$. Banks compete for borrowers and are able to charge different loan interest rates from (i) new borrowers, (ii) old borrowers of other banks and (iii) their own old borrowers (which they already know from period 1). A borrower is free to switch banks after period 1. We make the following assumptions.

Assumption 1. *With counseling, a project is profitable to a firm:*

$$\pi_G(r+C) = Y - r - C - e > 0$$

Assumption 2. *Without counseling, a project is unprofitable to a firm even if the loan interest is at the minimum level:*

$$\pi_B(r) = p(Y - r) - e < 0$$

It is easy to see that bad banks have a negative contribution to an overall wealth of the economy. A bad bank can attract borrowers only because they do not observe its type. The share of bad banks is assumed to be sufficiently low in the economy and thus firms optimally seek for loans in period 1: $\lambda \pi_G(R_1) + (1-\lambda)\pi_B(R_1) > 0$ or $[\lambda + (1-\lambda)\ p]\,(Y - R_1) - e > 0$. Here R_1 denotes the loan interest rate of period 1. We find out its exact value in Section 3. The following assumption clarifies the model.

Assumption 3. *Borrowers, who seek for a new bank, take up positions evenly in active banks.*

If each bank is active in period 1 the number of borrowers in each bank is one.

Assumption 4. *A borrower knows in period 2 the banks that were active in period 1.*

Assumption 4 is necessary for the following reason. Bad banks are more profitable in period 2 than in period 1. Their returns may be negative in period 1. In this case bad banks maximize their life-time returns by operating only in period 2. This is impossible in the model, because the share of bad banks must be $1-\lambda$ in each period. Assumption 4 forces bad banks to operate in each period. If a bank operates only in period 2, this reveals it bad type to borrowers and it cannot attract borrowers. Under assumption 4, bad banks are ready to earn negative returns in period 1 if their returns are positive in period 2 and the life-time returns are non-negative. Then each bank is active in period 1.

Assumption 5. *The cost of the counseling capacity, C, meets $C \geq \underline{C} > 0$.*

Here $\underline{C}$ is the minimum cost so that bad banks can operate in each period. That is, their life-time returns are non-negative when $C \geq \underline{C} > 0$. We detail $\underline{C}$ later.

The assumptions of Sharpe (1990): Our paper applies most of the standard assumptions of the classic relationship lending theory, e.g. Sharpe (1990). First, only short-term loan contracts for a period are possible. Banks cannot make any commitments in period 1 regarding the loan contracts of period 2. Second, a firm consumes the profit of period 1 after the period. The profit cannot be pledged as loan collateral in period 2. Third, a firm cannot borrow from many banks in a period. Fourth, the realized project output is unobservable to outsiders.[2] This assumption ensures in the classic relationship lending theory that outsiders cannot utilize the borrower's materialized project output in period 1 to update information on him. As a result, the

[2] The fact that the project output is totally unobservable to outsiders is one important case in Sharpe (1990).

inside bank of period 1 has more information on him than outsiders. The inside bank is also motivated to hide information on loan repayments so that competing banks cannot bid away its best borrowers. This assumption—the project output is unobservable to outsiders—is needed in our model, because the borrowers of good banks always succeed in their projects. A loan loss reveals that the bank represents the bad type. Hence, bad banks are motivated to hide realized project outputs and loan losses so they that can conceal their true type and attract borrowers.[3] By adopting these assumptions our paper follows the tradition of the relationship lending theory. Yet, we do not need the Sharpe's assumption that a borrower does not know his type in period 1. Now each borrower and each bank knows its type but bank type is unobservable to borrowers. The timing of the model is as follows.

1. At the start of period 1 each bank offers a short-term loan interest for period 1. In this context banks rationally anticipate the expected return from these borrowers in period 2.
2. During period 1 each borrower learns the type of its bank (be it good or bad).
3. Project outputs materialize and firms repay the loans to the banks which pay back deposits.
4. The start of period 2. Banks announce loan rate offers to the borrowers of other banks.
5. Each bank makes loan offers to its old borrowers who borrowed from the bank in period 1.
6. The firms choose their banks, borrow capital and invest the capital in the projects.
7. Projects mature at the end of period 2. Firms repay loans to banks which pay back deposits.

3. Bank operations in period 1 and period 2

Section 3 consists of the following parts. Subsection 3.1 examines a benchmark case under perfect information.[4] The rest of the section analyzes banking under asymmetric information. Subsection 3.2 outlines the operations of a good bank whereas subsection 3.3 focuses on a bad bank.

3.1 Benchmark: perfect information

Bank type is observable in each period. In period 2 bad banks cannot attract borrowers, because a loan from a good bank provides more output to a borrower. Good banks compete for borrowers. Competition pushes the loan rate down to the banks' zero profit level, $r+C$. The profit of a good bank is zero in period 2 and has no effect on the

[3] For alternative ways to hide loan losses, see Niinimaki (2012).
[4] Assumption 3 is not applicable in this subsection.

lending decision in period 1. In period 1 the scenario is the same as in period 2. Bank types are observable and bad banks cannot attract borrowers. Good banks compete for borrowers and the loan interest rate is $r+C$. The return of a good bank is again zero. Consequently, under perfect information the scenario is simple. Bad banks cannot attract borrowers. Good banks charge loan interest $r+C$ in each period and earn zero profit from every loan in each period. Now we turn to banking under asymmetric information.

3.2 Asymmetric information: a good bank

At the start of period 2 each borrower knows the type of its initial bank during period 1. First we explore the optimal strategy of a good bank in period 2. Thereafter we study it in period 1.

Period 2. A borrower knows that if he continues the same lending relationship in period 2, a project succeeds with certainty. Let R_g denote the loan interest offer of the initial good bank for period 2. Alternatively, the borrower can find a new bank for period 2. Unfortunately, the borrower cannot observe the type of the new bank. With probability λ the type is good and with probability $1-\lambda$ it is bad. Let R_o denote the loan interest offer of outside banks (good and bad) for period 2. The borrower continues the initial loan relationship also in period 2 if $Y-R_g \geq \lambda(Y-R_o)+(1-\lambda)p(Y-R_o)$. The L.H.S. displays the firm's return under the initial bank relationship. The R.H.S. indicates the firm's expected return if it switches its bank. The first (second) term on the R.H.S. denotes the case in which the new bank is good (bad). Obviously, λ and $1-\lambda$ define the prior probabilities of good and bad banks in the economy. The borrower learns the type of one bank in period 1. This implies that the borrower which learned the information is able to update its probability assessment of the chances of each of remaining $N-1$ banks being of good or bad type. When the type of the first bank is good, the updated probabilities for other banks are following. A new bank is good with probability $(\lambda N-1)/(N-1)$ and bad with probability $(1-\lambda)N/(N-1)$. Yet, since N is assumed to approach infinity in the economy, these posterior probabilities approach λ and $1-\lambda$.[5] Hence, the updated probabilities on the R.H.S. are identical to the prior probabilities. The breakeven interest offer of outside good banks meets $R_o = r+C$. Outside bad banks make the same offer, because they must mimic good outside banks to be able to attract borrowers for period 2. An outside bad bank cannot attract a borrower if its true type surfaces. From $Y-R_g \geq \lambda(Y-R_o)+(1-\lambda)p(Y-R_o)$ it is easy to solve the optimal (= maximal) interest offer of a initial good bank to its old borrower in period 2:

$$R_g = R_o + (1-\lambda)(1-p)(Y-R_o). \tag{1}$$

Here R_g exceeds the offer of outside banks, R_o. The second term on the R.H.S. shows the interest premium, which increases with the share of bad banks in the economy,

[5] We are grateful to an anonymous referee, who showed us the need to update probabilities in the second period.

$1-\lambda$, and with the probability of a project failure, $1-p$. The premium also increases with the profitability of a successful project, $Y-R_o$. Intuitively, the firm can change its bank after period 1. The change is risky, because the new bank may prove to be bad, the project may fail and the firm may lose the return from the project. Therefore, the borrower avoids outside banks and is motivated to continue the initial bank relationship. The initial bank is rational and recognizes the motivation. It can charge high loan interest in period 2 and still retain the lending relationship. Now (1) reveals the maximal loan interest so that the borrower does not switch its bank. In addition, the interest rate must be so low that the firm is ready to start the project. The interest rate has such an upper limit, $\overline{R}_g$, that $Y-\overline{R}_g-e=0$. To see this, assume the following scenario. When outside banks offer interest R_o the borrower's expected return is negative in period 2 if he switches a bank after period 1 $E(\pi_2(R_0))=\lambda(Y-R_o-e)+(1-\lambda)[p(Y-R_o)-e]<0$. This can be rewritten (given $R_o=r+C$) as follows

$$E(\pi_2(R_0))=\lambda(Y-r-C)+(1-\lambda)p(Y-r-C)-e<0. \tag{2}$$

If (2) is true a borrower is not ready to switch banks after period 1 because a new bank would be bad with a high probability. The switch is unprofitable even if outside banks charge minimum interest on loans, $R_o=r+C$. If (2) is true and if the borrower's initial bank is bad, the borrower leaves the loan market after period 1. If (2) is true and the initial bank is good, it can raise the interest rate of period 2 to the upper limit, $\overline{R}_g$, and the borrower continues the initial bank relationship. If (2) is not true, it is possible to switch banks after period 1 and the initial good bank charges interest R_g, which is sufficiently low to prevent the switch. We can express the good bank's optimal loan interest in period 2 as follows $R_g^*=\min(\overline{R}_g,R_g)$. An old borrower yields a positive return to a bank in period 2

$$\Pi_{2g}=R_g^*-r-C>0. \tag{3}$$

Period 1. Good banks compete for new borrowers and anticipate correctly the rent from lending relationships in period 2. Competition pushes the loan interest of period 1, R_1, down to such a level that the bank return is zero during the whole lending relationship

$$R_1-r-C+\delta\Pi_{2g}=0. \tag{4}$$

Here $\delta=1/r$ is a discount factor and R_1 is so low that the bank return from a new borrower is negative in period 1, $R_1<r+C$.[6] Good banks make low introductory loan offers to establish valuable lending relationships. A conclusion follows.

Proposition 1. *The hold-up problem is present. Old borrowers are tied to good banks in period 2 and these banks can charge high interest from old borrowers. Old borrowers are profitable for good banks. Competition for new borrowers makes the bank return from new entrants negative. The expected bank return during the whole lending relationship is zero.*

[6] The discount factor is not necessary in the model. It is possible that $\delta=1$.

3.3 Asymmetric information: a bad bank

A firm is unwilling to borrow from bad banks, because a loan from a good bank is more profitable. To attract a borrower, a bad bank mimics good banks and hides its true type. We study first period 2 and then period 1.

Period 2. The borrower of period 1 learns the bank type during the period and is not ready to continue the lending relationship in period 2, because the expected return from a project with a bad bank is negative for the borrower. Two alternatives result.

(i) If $E(\pi_2(R_0)) < 0$ in (2) the borrower exits from the loan market after period 1. He abandons the initial bank, which is bad. He will not switch a bank, because a new bank is bad with a high probability. Since all borrowers of bad banks exit from the loan market, no borrower searches for a new bank in period 2. A bad bank cannot attract a new borrower in period 2. Hence, bad banks have no borrowers in period 2 although they offer loans.

(ii) If $E(\pi_2(R_0)) > 0$ in (2) each firm whose initial bank was bad finds a new bank for period 2. The new bank may prove to be good or bad. Hence, a bad bank, which losses its initial borrower after period 1, can attract a new borrower in period 2. The bad bank's expected return from a loan unit to a new borrower in period 2 is $\Pi_{2b} = pR_0 - r$ units. Here $R_0 = r + C$ is the same loan interest as above when outside good banks aim to attract initial borrowers from other banks in period 2. Bad banks must offer the same loan interest.

Period 1. A bad bank offers the same loan interest, $R_1 = r + C - \delta\Pi_{2g}$, as good banks. The expected return of the bad bank from a loan unit, $\Pi_{1b} = pR_1 - r$, can be restated as

$$\Pi_{1b} = pC - (1-p)r - \delta p\Pi_{2g}. \tag{5}$$

The expected life-time return of a bad bank adds up to

$$\Pi_{12} = \begin{cases} \Pi_{1b} + \delta(1-\lambda)\Pi_{2b} & \text{if} \quad E(\pi_2(R_o)) \geq 0 \\ \Pi_{1b} & \text{if} \quad E(\pi_2(R_o)) < 0. \end{cases} \tag{6}$$

Consider scenario $\Pi_{12} = \Pi_{1b} + \delta(1-\lambda)\Pi_{2b}$. The borrowers of period 1 leave bad banks after the period. Banks aim to attract new borrowers for period 2. The total number of switching borrowers who leave their initial bad banks after period 1 and search for a new bank is $(1-\lambda)N$. These switching borrowers take their positions evenly in N banks (Assumption 3). As a result, few good banks obtain a new borrower in period 2 and have two borrowers in period 2. The rest of the good banks do not obtain a new borrower in period 2 and have then only one borrower. Recall that a good bank always retains its initial lending relationship during the second period. Few bad banks obtain a new borrower in period 2 and have one borrower in this period. The rest of the bad banks have no borrowers in period 2. Recall that a bad bank always loses its initial lending relationship after period 1. As a result, the expected number of borrowers in a bad bank is $1-\lambda$ during period 2. Consider now scenario $\Pi_{12} = \Pi_{1b}$. Since all borrowers of bad banks exit from the loan market after period 1, no borrower searches for a new bank in period 2. A bad bank cannot attract new borrowers in period 2 although it offers loans. Hence, bad banks have borrowers only in period 1.

It is easy to observe that the return in period 2 exceeds the return of period 1, $\Pi_{2b} > \Pi_{1b}$. A bad bank is more willing to operate in period 2. Whether $\Pi_{12} = \Pi_{1b}$ or $\Pi_{12} = \Pi_{1b} + \delta(1-\lambda)\Pi_{2b}$ in (6), Π_{12} increases with C and Π_{12} is negative when $C = 0$ and positive when C is sufficient. There exists $\underline{C}$ so that Π_{12} is zero. Therefore, when $C \geq \underline{C}$, bad banks can operate in each period and earn non-negative life-time returns. It is possible that a bad bank is willing to operate only in period 2 if $\Pi_{2b} > 0 > \Pi_{1b}$. This is impossible, because borrowers recognize the banks that operate only in period 2 (Assumption 4). The choice to operate only in period 2 reveals the bad type. Assumption 5 ensures that the characteristics of the economy are such that everyone acts “correctly” in the model. That is, bad banks are willing to participate in loan markets in each period, because their life-time returns are non-negative.

It is now possible to sum the findings in an environment that meets the assumptions. Bad banks offer the same loan interest rates as good banks. The lending relationships of bad banks are short-term (one period). When a borrower learns that his bank is bad, he abandons it. A short-term lending relationship may be profitable to a bad bank even if it is unprofitable to a good bank, because the operation costs are lower for bad banks. They avoid cost C. In period 2, for example, outside banks attract borrowers from the initial banks by offering loan interest $R_0 = r + C$. This loan interest generates zero return to outside good banks but positive expected return, $pR_0 - r$, to outside bad banks if C is sufficient. In period 1, outside banks offer $R_1 = r + C - \delta\Pi_{2g}$ to new borrowers. The interest rate is so low that good banks bear losses in period 1, but the expected return of a bad bank, $pR_1 - r$, is positive if C is sufficient. Given the assumptions of the model, $C \geq \underline{C}$, bad banks can operate and earn non-negative life-time returns. The non-negative return of a bad bank is based on asymmetric information, which makes it possible for them to attract borrowers. Each lending relationship with a bad bank is a mistake from the borrower’s point of view. A conclusion follows.

Proposition 2. *A bad bank operates in each period and it has short-term lending relationships. Three alternative scenarios are possible. Firstly, a bad bank may earn positive return in each period, because it has a lighter cost structure than good banks. Secondly, a bad bank makes a negative return in the first period but the return is positive in the later period. The life-time return is non-negative. Thirdly, a bad bank may earn positive (or zero) return in the first period and it has no borrowers in the later period.*

The first two scenarios are possible when $E(\pi_2(R_0)) > 0$. The last scenario occurs when $E(\pi_2(R_0)) < 0$. Bad banks lose initial borrowers after period 1 and these borrowers do not search for a new bank in period 2. The borrowers of good banks continue their initial bank relationships with good banks even if these charge high loan interest $\overline{R}_g$ in period 2. Outside banks cannot attract borrowers from the initial lenders. Hence, bad banks have no borrowers in period 2 although they offer loans. Appendix gives a numerical example, which clarifies Propositions 1 and 2.

4. Conclusions

The question of whether relationship lending provides the lender an information monopoly, which the lender exploits to extract rents from its lock-in borrowers, has captured the interest of many academics and practitioners. In this paper we take a novel approach on this question. The paper presents a model in which asymmetric information on bank types generates a lock-up effect even when the borrowers are identical. A borrower is tied to a good bank, because he does not want to risk accepting a lower loan interest offer from another bank which may represent the bad bank type. Hence, old borrowers yield high returns for good banks. The banks compete fiercely for new borrowers in order to establish valuable lending relationships. As a result, new borrowers are unprofitable for the good banks whereas old borrowers yield profit. The expected life-time return from a lending relationship is zero to a good bank. A bad bank attempts to hide its true type in order to be able to attract borrowers. These banks have only short-term lending relationships. When a borrower learns that his bank is bad, he switches banks. Yet, a bad bank may be more profitable than a good bank owing to its light cost structure.

The model is based on incomplete contracts between banks and borrowers. Banks cannot commit to detailed policies during the loan period. As a result, the bank's actual policy during the loan period may generate losses to the borrower. The contribution of a bad bank to the overall wealth of the economy is negative. When the share of bad banks in the economy is sufficient, the expected project output is negative. If bank regulators can create a method to acquire information on true lending strategies of banks and make this information public, asymmetric information on lending strategies mitigates and borrowers learn to avoid bad banks. That is, regulators ought to improve the transparency of banks.

The classic theory of relationship lending (e.g. Sharpe 1990, Rajan 1992, von Thadden 2004) examines banks which have asymmetric information on borrowers. Our study is based on assumption that identical borrowers have asymmetric information on banks' type. Is our assumption realistic? Banks are usually more transparent than small firms. Yet, it is natural to assume that the bank's ability to boost borrower's output is unobservable to outsiders. It is also natural to assume that outsiders cannot observe the bank's policy regarding loan covenants. Thus, there is asymmetric information on some aspects of banks. In the future it would be interesting to study a case in which there is asymmetric information on both banks' type and borrowers' type.

We simplify the model by assuming that borrowers cannot contact each other and communicate on bank types. In reality communication may be possible but it is not credible. It is impossible to prove the bank's ability to boost the project output later to other borrowers. It is also difficult to prove the bank's policy regarding loan covenants to outsiders. An unsuccessful borrower may blame his bank afterwards even when the quality of the bank service has been good.

In banking sector switching costs are also important from a macroeconomic point of view. They may decrease price elasticity in credit markets so that the transmission of policy rate changes to retail interest rate dynamics may exhibit some form of sluggishness because banks may not find it profitable to adjust their loan offers frequently.

In addition, strong lending relationships can reduce the negative effects of a crisis on the availability of firms to access credit.

As to the empirical implications of the model, empirical evidence on switching costs, lock-in effects and loan interest rates supports our findings. Yet, the origin of the switching costs differs in our model from the classic theory of relationship banking (e.g. Sharpe 1990, Rajan 1992, von Thadden, 2004). In our model asymmetric information on banks' type creates switching costs whereas in the classic theory of relationship lending asymmetric information on borrowers' type generates switching costs. Therefore, in the empirical research it is necessary to find out the true origin for switching costs.

It is possible to reinterpret the model. Initial and later periods may represent "good times" and "bad times" within an economic cycle.[7] Santos and Winton (2008, p. 316) find evidence that "… during recessions banks raise their rates more for bank-dependent borrowers than for those with access to public bond markets. Further analysis suggests that much of this is due to informational hold-up effects rather than to greater risk of bank-dependent borrowers versus those with bond market access." The results are supported by the findings of Mattes et al. (2013, p. 177): "We find that information monopolies exist in periods of economic contraction: only weak banks raise their spreads above the level that is justified by the credit risk for borrowers with a high cost of switching lenders." Furthermore, Asea and Blomberg (1998) report evidence that banks change their lending standards (e.g. loan spread)—from tightness to laxity—systematically over the business cycle. Bernanke et al. (1996) survey abundant empirical evidence on banks' tight lending policy during recessions. This evidence provides some support for our model. It is difficult for a bank-dependent borrower to switch banks during recessions. A rational bank knows this and charges high interest on these borrowers during recessions. A long lending relationship with the initial bank ensures that a borrower receives a loan (e.g. Cotugno et al. 2013, Cenni et al. 2015).

The paper offers a strongly simplified model which presents the basic concept. The model includes a few assumptions. Although most of the assumptions are the same as in the classic theory of relationship banking (e.g. Sharpe 1990, Boot and Thakor 2000), it would be worthwhile to design a more sophisticated model in the future and drop the assumptions step by step.

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[7] We are grateful to an anonymous referee who suggested this option to reinterpret the model to us.

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Appendix

The Appendix provides a numerical example, which shows that the considered restrictions are not mutually inconsistent (i.e. it shows that we are not considering empty set of solutions). We have three cases, which are based on the cases of Proposition 2. In each case a good bank earns negative returns in period 1, positive returns in period 2 and the life-time returns are zero.

Case I. This case represents the first case of Proposition 2, in which a bad bank earns positive returns in each period. Consider the following economy: $Y = 3$, $r = 1$, $p = 0.97$, $\lambda = 0.9$, $C = 0.04$, $e = 1.95$. Assumption 1 is met because $\pi_G(r+C) = 0.01 > 0$. Assumption 2 is also satisfied because $\pi_B(r) = -0.01$. In period 2 outside banks offer interest $R_0 = r + C = 1.04$ to the old borrowers of other banks. From (2) we observe that the borrowers of bad banks can switch banks after period 1 because $E(\pi_2(R_0)) = 0.00412 > 0$. Now (1) implies that the initial good bank of period 1 can retain its old borrowers by charging interest $R_g = 1.04588$ that exceeds the costs of the loan, 1.04. From (3) in which $R_g^* = R_g$ we observe that an old borrower yields a positive profit to its initial bank in period 2, $\Pi_{2g} = R_g - r - C = 0.00588$. The loan interest of period 1 can be solved from (4): it is $R_1 = r + C - \Pi_{2g} = 1 + 0.04 - 0.00588 = 1.03412$ and does not cover the costs of the loan, 1.04. Hence, a lending relationship is unprofitable to a good bank in period 1 and profitable in period 2. Now we focus on bad banks. In period 2 a loan provides expected return $\Pi_{2b} = pR_0 - r = 0.97 \times 1.04 - 1 = 0.0088$ to a bad bank. From (5) we obtain the expected return from a loan in period 1, $\Pi_{1b} = 0.0030964$. Thus, loans are profitable to bad banks in each period.

Let us turn to borrowers. In period 2 a borrower, who retains his original lending relationship with a good bank earns $Y - R_g - e = 3 - 1.04588 - 1.95 = 0.00412$, and is ready to participate in the loan markets. The L.H.S. of (2) is positive, 0.00412. Hence, the borrowers, who had a bad bank in period 1, switch banks after period 1 and have a positive expected return in period 2. Now we know that each borrower participates in the loan markets in period 2. In period 1 a borrower is ready to seek for a loan if $[\lambda + p(1-\lambda)](Y - R_1) - e > 0$. In this economy we have $[0.9 + 0.97 \times 0.1](3 - 1.03412) - 1.95 \approx 0.01 > 0$. Borrowers seek for loans in period 1. Hence, borrowers and banks participate in the loan markets in each period.

Case II. This case represents the second case of Proposition 2. A bad bank earns negative expected return in period 1 and positive expected return in period 2. The expected life-time return is positive. Consider a change in the economy of Case I. Now we have $C = 0.0365$. Assumption 1 is satisfied because $\pi_G(r+C) = 0.0135 > 0$. Assumption 2 is also met since $\pi_B(r) = -0.01$. In period 2 banks offer interest $R_0 = r + C = 1.0365$ to the old borrowers of other banks. From (2) we observe that the borrowers of bad banks can switch banks after period 1 because $E(\pi_2(R_0)) = 0.0076095 > 0$. We learn from (1) that the initial good bank of period 1 can retain its old borrowers in period 2 by charging interest $R_g = 1.0423905$ that exceeds the costs of the loan, 1.0365. From (3) in which $R_g^* = R_g$ we observe that an old borrower yields a positive profit to its initial good bank in period 2, $\Pi_{2g} = R_g - r - C = 0.0058905$. The interest of period 1 can be solved from (4): it is $R_1 = r + C - \Pi_{2g} = 1 + 0.0365 - 0.0058905 = 1.0306095$ and does not cover the costs of the loan, 1.0365. A lending relationship is unprofitable to a good bank in period 1 and profitable in period 2. Next we turn to bad banks. In period 2 a loan provides expected profit $\Pi_{2b} = pR_0 - r = 0.97 \times 1.0365 - 1 = 0.005405$. From (5) we obtain the expected return from a loan in period 1, $\Pi_{1b} = -0.000308785$. The expected life-time profit of the bad bank can be seen from (6), $\Pi_{12} = -0.000308785 + (1-0.9) \times 0.005405 \approx 0.00023$. Here $1-0.9$ reveals that a bad bank receives a new borrower in period 2 with probability 10 percent. Bad banks earn negative expected return in period 1 and positive expected return in period 2.

Let us turn to borrowers. In period 2 a borrower, who retains his original lending relationship with a good bank, earns $Y - R_g - e = 3 - 1.0423905 - 1.95 = 0.0076095$, and is ready to participate in the loan markets. The R.H.S. of (2) is positive,0.0076095. Hence, the borrowers, who had a bad bank in period 1, switch banks after period 1 and earn a positive expected return in period 2. We have shown that each borrower participates in the loan markets in period 2. In period 1 a borrower is ready to seek for a loan if $[\lambda + p(1-\lambda)](Y - R_1) - e > 0$. In the current numeric example this implies $[0.9 + 0.97 \times 0.1](3 - 1.0306095) - 1.95 \approx 0.013 > 0$. Borrowers seek for loans in period 1. Hence, borrowers and banks participate in the loan markets in each period.

Case III. We present the last case of Proposition 2. The borrowers of bad banks leave loan markets after period 1. Hence, bad banks have no borrowers in period 2 but these banks are profitable in period 1. To show this we change the economy of Case I a bit. Now we have $e = 1.955$. Assumption 1 is met because $\pi_G(r + C) = 0.005 > 0$. Assumption 2 is also satisfied because $\pi_B(r) = -0.015$. In period 2 banks offer interest $R_0 = r + C = 1.04$ to the old borrowers of other banks. From (2) we observe that the borrowers of bad banks leave loan markets after period 1 because $E(\pi_2(R_0)) = -0.00088 < 0$. From (1) we see that the initial good bank of period 1 can retain its old lending relationships by charging interest $R_g = 1.04588$. Yet, this interest rate exceeds the maximal interest $\overline{R}_g = Y - e = 1.045$. Given $R_g^* = \min(\overline{R}_g, R_g)$, a good bank offers interest 1.045 to its old borrowers in period 2. This interest rate exceeds the costs of the loan, 1.04. From (3) (in which $R_g^* = 1.045$) we observe that an old borrower yields a positive return to its initial bank in period 2, $\Pi_{2g} = 1.045 - 1 - 0.04 = 0.005$. The loan interest of period 1 can be solved from (4): it is $R_1 = r + C - \Pi_{2g} = 1.035$ and it does not cover the costs of the loan, 1.04. A lending relationship is unprofitable to a good bank in period 1 and profitable in period 2. Consider now bad banks. They do not have borrowers in period 2. Now (5) shows the bad bank's expected return from a loan in period 1, $\Pi_{1b} = 0.00395$. Hence, bad banks make profits in period 1 and have no borrowers in period 2. The borrowers of good banks undertake projects in period 2 and earn zero profit. In period 1 a borrower seeks for a loan if $[\lambda + p(1-\lambda)](Y - R_1) - e > 0$. In this economy we have $[0.9 + 0.97 \times 0.1](3 - 1.035) - 1.955 \approx 0.004 > 0$. Borrowers seek for loans in period 1.