Information sharing in credit markets: incentives for incorrect information reporting

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Abstract

The introduction of institutions of credit information sharing - private credit bureaus and public credit registries - in the market for bank loans represent one of the possible solutions of information asymmetry problem, - the problem which the creditors tend to face. However the possibility of information sharing influences the bank's incentives in two different ways. While it disciplines the borrowers and, therefore, reduces the share of bad loans, a bank loses the competitive advantage, namely the monopolistic knowledge about the data in its clients' credit histories. Does the bank have an opportunity at its disposal to use the benefits of information sharing without losing its competitive advantage and its clientele? One way to do so is to report false data on borrowers. This paper analyses the bank's incentives for such opportunistic behavior and describes the impact of false information reporting on the characteristics of market equilibrium. The opportunity to get extra profit and to offer less expensive credit to new clients explains why banks prefer the strategy of dishonest behavior. This paper outlines the role of the informational intermediary in quality control for the data, contained in credit reports. Also, it describes the conditions under which verification of a certain share of reports provides that the parameters characterizing the equilibrium are equal to those in no information asymmetry situation.

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Contents

1 Introduction

Information about the borrowers represents an asset of a certain value for any bank. A bank's client who enjoys the advantages of bank loan for ages and who repays fully and regularly, getting new loans on more favorable conditions, would certainly agree with this statement. Those who borrow in order to repay old debts would agree too. And the creditor himself would concur with it: the efficiency of his credit policy is tightly connected with availability of this resource. Each bank would like to distinguish between reliable and risky borrowers, minimizing time and funds on data search, collection and analysis and on borrowers' actions monitoring. Each borrower would prefer to obtain the loan on favorable conditions, namely to pay the interest which does not exceed the degree of his own and his project riskiness.

This applies to the existence of an informational intermediary in the bank loans market. This intermediary accumulates data on borrowers, which is received from banks and some other sources, and then renders it to potential creditors. This method is usually faster, cheaper and more accurate for a bank than doing search and analytical work itself. It is particularly true for consumer credit market.

Why is it so important to pay attention to informational intermediation institutions while studying the market for bank loans? The case is that one of the most serious problems of this market is asymmetry of information between a lender and a borrower. The procedures of financial statement analysis, estimation of investment quality, monitoring of borrower's actions are described and discussed quite comprehensively. However they are costly and probably inefficient. Informational intermediaries' activities may be considered as an alternative, which is targeted directly on improvement of the market with information asymmetry:

1. They provide the necessary information and therefore make banks more aware about their potential clients. This helps to estimate the creditworthiness more precisely, to offer the interest rate at the level more consistent with the particular client's riskiness and to reduce the share of bad loans in bank's credit portfolio.
2. The bank's expenses for information collection and analysis usually decrease.
3. Monitoring becomes cheaper. The fact that his credit history exists and will be used by potential creditors disciplines the borrower, because all the future loans will be granted on the conditions determined by his previous behavior.
4. Informational rent, resulting from bank's exclusive knowledge on borrower's creditworthiness, tends to be diluted. This spurs competition and leads to overall interest rate

reduction, adding to borrowers the incentives to borrow and invest in less risky projects.

Formal informational intermediaries in the market of bank loans are *private credit bureaus* and *public credit registries*. Private credit bureaus' functioning is based on principles of voluntary membership and mutuality of data flows. Often they are commercial organizations. Public credit registries are usually founded by the Central Bank of a country. Information on credits over a certain threshold must be reported without fail. In contrast to private credit bureaus the services of public credit registries may be free of charge.

In practice some sort of informal "segregation of duties" takes place: private credit bureaus concentrate on personal loans, credits to small and medium enterprises, public credit registries accumulate data on large loans. However if informational intermediation is represented by one type of institutions, it usually copes with all segment of market.

Informational intermediary usually collects two types of data. *Black* (negative) information includes the data on failures to pay on time, bad loans and other breaches of credit contract. *White* (positive) information consists of different components. Usually it embraces data on loan (amount, interest rates, maturity period, guaranties) and on borrowers' own characteristics.

Quite often information provided by banks is compared to that from other sources the intermediary has access to, some statistical analysis is performed with the use of specially designed software. The partucular channel of data control is represented by borrowers, because they usually have the opportunity to check the information in their credit files. Nevertheless credit reports tend to have some mistakes, and there may be the situation when such a mistake influences the decision about credit provision. The mistakes are probably caused by some technical defects. But could other reasons be there?

The case is that the value of information about borrowers as a competitive advantage may be the reason for a creditor, who is a member of information exchange network, to behave himself opportunistically. Actually bank may prefer to provide his competitors with false information to preserve the competitive advantage. The purpose of this paper is to study the incentives for this kind of opportunistic behavior, the influence of false information reporting on the characteristics of market equilibrium, the role of the informational intermediary as a "quality controller" of the data, contained in credit reports.

This paper is organised as follows. Section 2 contains the review literature on information asymmetry problems on market of bank loans and on peculiarities of informational intermediation as a way to solve them. Section 3 offers the model, which is used to analyze bank's benefits connected with false data reporting. Section 4 describes some examples of systems of

data accuracy and reliability control, which are adopted in different countries, and demonstrates that misreporting takes place even there where these systems are highly developed. Section 5 summarizes the findings.

2 Literature

The information asymmetry in credit markets and problems connected with this phenomenon were mention by the first time in 1970 in seminal paper by Akerlof, which is devoted to adverse selection problem. He wrote about a typical creditor in Indian village - a money-lender: "with his intimate knowledge of those around him he is able, without serious risk, to finance those who would otherwise get no loan at all" (Akerlof, 1970). City banks did not grant loans to those, they did not possess information about - to peasants. This explained monopolistic power of village money-lenders and their opportunity to set the interest rates higher than those, that would be offered by banks.

As a result of information asymmetry the price of a loan - the interest rate - is not equal to an equilibrium one, which balances demand and supply. Determining interest rates banks take into account an average probability of credit repayment, because they know about good and unreliable borrowers' existence, but are not able to distinguish between these two types. Stiglitz and Weiss show, that higher interest rate makes more risky projects attractive for borrowers, that is why the bank does not agree to lend money even if borrowers offer higher prices (Stiglitz, Weiss, 1981).

Among the first papers to pay attention to information sharing as an institution, which allows to solve the problem of information asymmetry on the credit market were those by Jappelli and Pagano and Padilla and Pagano. With introduction of credit bureaus and credit registries the average interest rates tend to decrease, so does the probability of repayment failure. However there is no distinctness about the total amount of credits. Increased number of refusals to grant a loan due to high degree of risk may be compensated by increased quantity of loans offered to good, reliable borrowers (Jappelli, Pagano, 1993).

In the same time banks may have no incentives to take part in information sharing. The case is that data on their own borrowers is their competitive advantage. They agree to sacrifice this advantage only if the borrowers, understanding that after information revealing they will be offered lower interest rates, will do their best in order not to default now. On the other hand, a bank has an incentive to announce, that information will be revealed and not to do so.

Padilla and Pagano show that in situation when inter-borrower communications are absent or are costly only existence of a credit bureau may make banks not to behave opportunistically (Padilla, Pagano, 1997).

Does the already mentioned disciplinary effect, which affects the borrowers' behavior in the information sharing regime, depend on the volumes of data reported by banks? Padilla and Pagano find out that the exchange of positive information, as well as the absence of any sharing, does not allow to reach the first-best level (no information asymmetry situation). Disciplinary effect appears in case of negative information sharing: for a borrower it is worth applying more efforts to repay the loan because this will reduce the interest rate for future loans (Padilla, Pagano, 1999). Similar conclusion was drawn earlier by Vercammen (Vercammen, 1995).

If that's the case, does the bank have an incentive to report false information about the borrowers in order to enjoy the advantages of disciplinary effect and in the same time to continue informational rent extracting? This question is raised in paper by Padilla and Pagano (Padilla, Pagano, 1999), but there is no answer in this paper as well as in any other. Using the model of market of bank loans (offered in Padilla, Pagano, 1997, 1999) we will analyze an additional strategy - the strategy of dishonest behavior - in a framework offered in the latter paper.

3 The model of dishonest bank

Consider a two-period model of the market for bank loans. The contract in this market is made by two agents: by bank (creditor) and by entrepreneur (borrower) - and implies a loan for an investment project of the latter. The project requires the loan of the size 1, which must by repaid in a single period.

3.1 Agents' characteristics

There is a continuum [0,1] of risk-neutral *entrepreneurs*, who are divided into two groups: - high-ability (H) and low-ability (L) (their proportions of the total population are γ and $1-\gamma$ respectively). High-ability entrepreneurs invest in the projects which yield R^* per period in the case of success and 0 otherwise. The probability of success p depends on level of efforts applied by high-ability entrepreneur, which is chosen once for both periods of the game. The bank cannot observe this choice, so the level of efforts is non-contractible.

The projects chosen by low-ability entrepreneurs yield nothing in any case.

Initially an entrepreneur has no own capital, so he is to borrow money for his projects. All the profits are consumed in current period and cannot be transferred into the next one, therefore the loan must be used in the second period too. The liability is limited, i.e. if the project gives zero return, the loan is simply not repaid. A default in the first period does not mean that the borrower must repay it in the second one, or is not allowed to invest at all.

There are two identical *banks* - A and B - in this economy, the cost of capital for both creditors equals to $\overline{R}$. Banks have symmetrical information about potential borrowers in the first period. They cannot distinguish between high- and low-ability entrepreneurs but they know the average expected probability of success for each type: p and 0 respectively. They are also aware of the proportions of two types in the population. Granting a loan in the first period, bank receives the information about the type of his client. Therefore by the second period banks obtain the competitive advantage connected with the information about their clients.

There is a peculiar feature of the banks: they are ready for losses. Expecting profits in the second period they agree to suffer losses equal to expected gains. We will call this feature *the principle of zero total profits.*

3.2 Strategies.

An entrepreneur chooses the level of efforts in order to maximize his total undiscounted utility [1]. Consider rational expectations about future interest rates, but entrepreneurs cannot affect them, they are price-takers. It is worth noting that if the interest rate exceeds R^* an entrepreneur will not take the loan at all.

If a high-quality entrepreneur i does not borrow, he gets zero utility. If he borrows, then he maximizes the following utility function:

$$U_H(p_i) = p_i[(R^* - R_{j1}) + (R^* - E(R_{j2}))] - V(p_i) \tag{1}$$

where

R_{j1}- gross interest rate, assigned by bank j for the first period.

$E(R_{j2})$ - expected gross interest rate, assigned by bank j for the second period.

$V(p_i)$ - utility reduction, caused by efforts applied to reach p_i. This function has the following features:

$V' \geq 0$,

[1]The introduction of a discount factor makes the analysis more complicated, but does not have a dramatic impact on the results

$V'' > 0$,

$V(0) = V'(0) = 0$,

$V'(1) > 2R^*$.

Low-ability entrepreneur, being aware of the fact that all his projects yield nothing, chooses a zero level of efforts. The existence of entrepreneurs of this type could be explained by some nonnegative utility which these entrepreneurs receive "being in business".

A bank chooses the interest rate for the loan he offers. His choice depends on the amount of information about the borrower a bank has at its disposal. The banks offer their interest rates sequentially. In the second period each bank offers the rates first to its clients, and then to the clients of the competitor, i.e. the first offer is received from the bank, which has the information about the type of an entrepreneur. Suppose that in the first period the first offer is made by bank A (if we choose bank B, nothing will change, because in this period there is no information asymmetry). The entrepreneurs always choose the bank with cheaper credit. If the prices are the same, in the first period the borrowers choose bank A with probability σ and bank B with probability (1 - σ) (for simplicity let us mark these probabilities as σ_j); in the second period they choose the bank, which offered the rate first. This assumption is quite realistic, because the entrepreneurs usually prefer to borrow from the bank they had a chance to borrow from in the past and choose another one only if they are offered lower rates. Banks are characterized by the following profit function:

$$\Pi_j = \sigma_j[(\gamma p R_{j1} - \overline{R}) + \gamma(pR_{j2} - \overline{R})] \tag{2}$$

A bank also decides whether to share the information on the borrowers' types with another bank in the beginning of the second period or not. If it chooses to share, then it decides in what volumes to share and whether to report honestly. Sharing negative information increases the level of efforts compared with regimes with no information sharing and positive information sharing. A high-ability entrepreneur prefers to apply more efforts to repay a loan, because only in this case he will be identified as a high-ability one and will be offered a lower interest rate. If there is a default the rate will be based on the conditional probability $\mu(H|D)$ (probability that defaulted borrower is high-ability one) and will obviously be higher. Why an entrepreneur is offered a lower rate if he is identified as a high-ability one? In this case there is no more information asymmetry, so the banks compete only by interest rates. That is why the equilibrium rates are the minimum possible ones and are determined only by cost of capital for bank and the probability of success for high-ability entrepreneur - $\overline{R}/p$.

However, granting a loan in the first period a bank obtains the information on the type

of its borrower, therefore by the beginning of the second period each bank has a competitive advantage. A bank obviously prefers to preserve it, but that will destimulate borrowers.

Which strategy allows bank to extract informational rent on condition that borrowers choose high level of efforts? Is the dishonest behavior the strategy we are looking for?

To answer this question it is necessary to introduce some additional assumptions.

- *What does it mean to be "dishonest"?* A bank may report a case of success as a case of default, or vice versa. We analyze the former variant, because the latter one seems unrealistic: the state of a honest bank is deteriorated without any changes in a state of a dishonest bank.

- *Which type of information to report dishonestly?* We do not analyze the case, when banks share false information about the type of a borrower. Both banks are aware of the proportions of the population, so the same are the proportions of the competitor's clientele. If all the borrowers are reported as low-ability ones, there is no opportunity to gain anything - nobody will believe in reported data. The game will be identical to the regime with no information sharing. This assumption is close to reality. The bank usually receives positive information and makes the conclusion on the borrower's type himself, not on the base of the competitor's opinion. Therefore we analyze the case of dishonest behavior in the regime of information sharing about defaults.

At last we assume some constraints on the model's parameters and variables:

$\frac{\overline{R}}{\mu(H|D)} < R^*$,

$\overline{R}/\gamma p < R^*$,

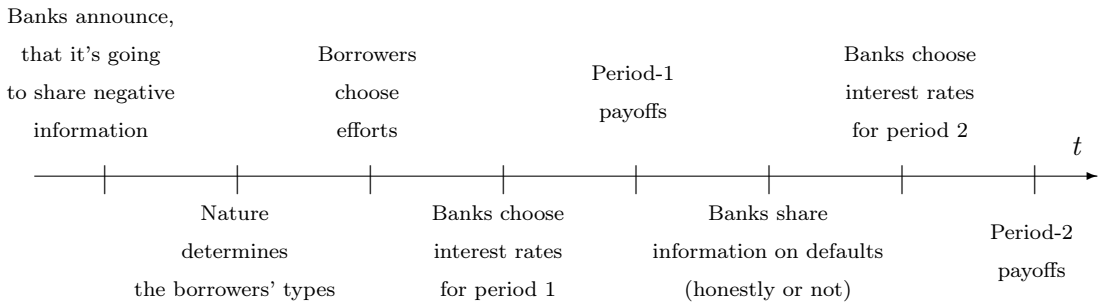
$p > \overline{R}/R^*$.

The first two inequalities help to avoid the multichoice interest rates in the second period [2]. The third one guarantees that the market exists: a bank may cover the costs of capital.

Thus the timing of the game is the following (Figure 1). At the beginning of the first period both banks announce that they are going to share negative information about their borrowers. The borrowers choose the level of their efforts according to their type and expectations about interest rates. Banks assign interest rates for the first period according to the principle of zero total profits. Then the projects are realized and the payoffs of the period are determined. At the beginning of the second period the banks share information about defaults, honestly or not. Interest rates for the second period are assigned subject to available information and keeping in mind the possible actions of the competitor. Then the projects are realized one more time and payoffs are determined.

[2] In the model offered in Padilla, Pagano, 1999) it was necessary to check, that the interest rates do not exceed project maximum yield, here we assume this condition a priori

Figure 1. Timing of actions in the model



3.3 Bank's choice.

Honest bank[3]

Suppose that at the beginning of the second period the banks share information on defaults honestly. Therefore if an entrepreneur borrowed from bank A in the first period, and in the second one decides to borrow from bank B, he will be offered a rate according his performance in bank A. The characteristics of this equilibrium are marked *is* (information sharing).

At this stage it is necessary to introduce more properly the conditional probabilities mentioned above:

$\mu(H(L)|D)$ - probability of being a high-(low-)ability entrepreneur conditional on having defaulted in the first period

$\mu(H(L)|\overline{D})$ - probability of being a high-(low-)ability entrepreneur conditional on not having defaulted in the first period

If an entrepreneur repays a loan he is identified as being high-ability, because a low-ability entrepreneur is not available to repay by no means. Therefore,

$\mu(H|\overline{D}) = 1$ - $\mu(L|\overline{D})$=1

If an entrepreneur defaulted it is not possible to reveal his type unambiguously. According to Bayes' rule for conditional probability:

$$\mu(H|D) = 1 - \mu(L|D) = \frac{\gamma(1-p)}{\gamma(1-p) + (1-\gamma)} \tag{3}$$

[3]Analysed in Padilla, Pagano, 1999

It is worth noting that $\mu(H|\overline{D}) > \gamma > \mu(H|D)$.

We start our analysis of bank's decisions from the second period. It offers the rates to its client according to whether the borrower defaulted in the first period, i.e. patterns the behavior on the behavior of the competitor, and does not offer loans to the competitor's clients or low-ability borrowers.

Bank's profit in the second period equals to:

$$\Pi_{j2}^{is} = \sigma_j \gamma (pE(R_{j2}^{H,is}) - \overline{R}), j = A, B \tag{4}$$

Expected interest rate depends on the probability of project's success:

$$E(R_{j2}^{H,is}) = pR_{j2}^{H,is}(\overline{D}) + (1-p)R_{j2}^{H,is}(D), p \geq \overline{R}/R^* \tag{5}$$

Bank chooses the interest rates for the first period according to the principle of zero total profits: it suffers losses equal to profits expected in the next period.

Thus for $p_A > p > p_B$, where p_A and p_B are obtained from comparing $\frac{\overline{R}}{\mu(H|D)}$ and R^*:

$R_{j1} = \overline{R}/p$

$R_{j2}^{H,is}(D) = \frac{\overline{R}}{\mu(H|D)p}$

$R_{j2}^{H,is}(\overline{D}) = \overline{R}/p$

Total interest payments are represented in a following way:

$$R_{j1}^{H,is} + E(R_{j2}^{H,is}) = \frac{\gamma + 1}{\gamma} * \frac{\overline{R}}{p} \tag{6}$$

It is worth noting that total interest payments are the same under any regime if the banks follow the principle of zero total profits.

Dishonest bank

We are going to start the analysis by finding out how the bank which reports dishonestly, may benefit from such a behavior. Characteristics of equilibrium are marked as *dh* (dishonest). Suppose bank A reports dishonestly, but bank B shares true information about defaults of its clients. Bank A claims that all its borrowers defaulted in the first period. In this case bank B would offer them the second period rate, which depends on conditional probability $\mu(H|D)$. The competitive advantage is that bank A may offer the high-ability borrowers, who did not default, the same interest rate. If a honest bank have known that the borrower had not defaulted, it would identify the high-ability entrepreneur and would offer the minimal interest rate, which provides zero profit ($\overline{R}/p$). Bank A would have to act in the same way. But as bank A reports

dishonestly, bank B cannot identify high-ability borrowers and has to assign higher interest rate ($\frac{\overline{R}}{\mu(H|D)p}$). Bank A makes good use of the situation, obtaining additional profit in the second period:

$$\Delta\Pi_A^{dh} = \frac{\sigma p\overline{R}(1-\gamma)}{1-p} \tag{7}$$

Now suppose that both banks report dishonestly. In this case no high-ability borrower is identified by competitor. Therefore informational rent is extracted by both banks. The banks receive the following additional profits:

$$\Delta\Pi_j^{dh} = \frac{\sigma_j p\overline{R}(1-\gamma)}{1-p} \tag{8}$$

The following figure (Figure 2) shows the groups of borrowers which add to banks' profits.

Figure 2. Additional profits of dishonest banks in period 2

Bank A reports dishonestly

		A	B
		σ	$1-\sigma$
γ	p	$\Delta\Pi$>**0**	$\Delta\Pi = 0$
	$1-p$	$\Delta\Pi = 0$	$\Delta\Pi = 0$
$1-\gamma$		$\Delta\Pi = 0$	$\Delta\Pi = 0$

Both report dishonestly

		A	B
		σ	$1-\sigma$
γ	p	$\Delta\Pi$>**0**	$\Delta\Pi$>**0**
	$1-p$	$\Delta\Pi = 0$	$\Delta\Pi = 0$
$1-\gamma$		$\Delta\Pi = 0$	$\Delta\Pi = 0$

At last we obtain the following matrix:

		B	
		honest	*dishonest*
A	*honest*	$(\Pi_A^h;\Pi_B^h)$	$(\Pi_A^h;\Pi_B^{dh})$
	dishonest	$(\Pi_A^{dh};\Pi_B^h)$	$(\Pi_A^{dh};\Pi_B^{dh})$

While $\Pi_j^h < \Pi_j^{dh}$ in equilibrium banks prefer the strategy of dishonest behavior. According to the principle of zero total profits:

$$\Pi_j = \sigma_j[(\gamma p R_{j1} - \overline{R}) + \gamma(pR_{j2} - \overline{R})], j = A, B \tag{9}$$

Therefore:

$$R_{j1} = \frac{\gamma - p}{\gamma(1-p)} * \frac{\overline{R}}{p} \tag{10}$$

So there may be the case of negative first period interest rate. It takes place when $\gamma < p$, i.e when the share of high-ability borrowers is low enough, but expected probability of their projects' success is higher. This result may be interpreted in the following way: a bank is ready to offer loans free of charge in the first period only to obtain the information about the type of the borrowers. When the bank understands that the borrower is high-ability it assigns higher second-period interest rate in order to cover the losses. The most surprising is that if $\gamma < p$ the interest rate is zero in the first period, because negative rates are not permitted in the model. So some share of the "loss opportunities" is not used, losses are smaller than expected profits. Therefore the total profits are positive, so the strategy of dishonest behavior is unambiguously more preferable than that of honest behavior. Appendix includes a numerical example which demonstrates that in the framework offered by the model the situation with positive total profits and free loans may really take place.

In the generic case the total profits are equal to zero. Why do banks choose the strategy of dishonest behavior? Additional profits in the second period allow banks to assign lower interest rates in the first period. As already mentioned above, competing for borrowers banks offer equal and minimal rates. The strategy of dishonest behavior allows assigning lower rates that is why it is preferable for both banks. Actually if only one bank reports dishonestly, it will become a monopolist, controling all the market in the first period. In order not to lose the market in the very beginning the second bank chooses the same strategy too.

3.4 Borrower's choice

According to the assumptions of the model p is not an exogenous parameter, this variable is chosen by the borrower in the first period. As the interest rates are assigned by banks after borrowers' decision, they cannot signal the banks' intention to behave itself dishonestly. In two-period model there is no source of suspicion, so a borrower makes his choice under influence of disciplinary effect. However the case of suspicious, distrustful borrower should also be considered (we could add this assumption to borrower's characteristics). So we are going to examine both cases one by one.

Trustful borrowers

The characteristics of this situation are marked with tr (trustful). First order condition for

high-ability borrower's utility function maximization is the following:

$$\frac{\partial U^H(p_i)}{\partial p} = MR^{tr}(p_i) - V'(p_i) = max[2R^* - (R_1 + E(R_2^H) - p_i(R_2^H(D) - R_2^H(\overline{D})), 0] - V'(p_i) \quad (11)$$

$MR^{tr}(p_i)$ is obtained taking into account that
$E(R_2^H) = p^{tr} R_2^H(\overline{D}) + (1 - p^{tr}) R_2^H(D)$

In equilibrium $MR^{tr}(p^{tr}) = V'(p^{tr})$, where

$MR^{tr}(p^{tr}) = max[2R* - (R_1 + E(R_2^H) + \Delta(p^{tr}), 0]$
$\Delta(p^{tr}) = p_i^{tr}(R_2^H(\overline{D}) - R_2^H(D)) = \frac{\overline{R}}{\mu(H|D)} - \overline{R}$

The function $\Delta(p)$, which determines the disciplinary effect of the information sharing process, is positive and strictly increasing in p.

A high-ability borrower has an incentive to apply more efforts to be identified and offered lower interest rate in the second period.

The equation $MR^{tr}(p^{tr}) = V'(p^{tr})$ may have several solutions. While zero solution always exists, there also may be unique and multiple equilibrium with positive levels of efforts. It is worth noting that equilibrium level of efforts may be higher or lower than the efficient one, i.e. disciplinary effect may be too strong or too weak.

Thus, if the borrowers cannot predict the banks dishonest behavior, the strategy of dishonest reporting is preferable. Levels of efforts are the same therefore the probabilities of success are the same too, so the profits differ by $\Delta\Pi > 0$. In this case only high-ability borrowers are at a loss: under the influence of disciplinary effect they chose higher level of efforts.

Distrustful borrowers

In this case a high-ability borrower understands that the second-period interest rate will not be based on the fact whether he repaid the first-period loan or not. The characteristics of this situation are marked with *dtr* (distrustful). First-order condition is represented by following expression:

$$\frac{\partial U^H(p_i)}{\partial p} = MR^{dtr}(p_i) - V'(p_i) = max[2R^* - (R_1 + E(R_2^H)), 0] - V'(p_i) \quad (12)$$

In equilibrium $p = p_i$, therefore:
$MR^{dtr}(p^{dtr}) = V'(p^{dtr})$

It is worth noting that $MR^{dtr}(p) < MR^{tr}(p)$, and the difference is equal to disciplinary effect. Thus an equilibrium level of efforts, chosen by distrustful borrower is always lower than that chosen by trustful one[4].

Thus if the borrowers are rational and are aware of the fact that the banks might prefer dishonest behavior, they are influenced by disciplinary effect. The choice is the same as in cases of no information sharing or information sharing about the types of borrowers, because total amount of interest payments is the same, and the second-period interest rate does not depend on borrower's performance in the first period. So the level of efforts is lower than that chosen under disciplinary effect influence. However in order to understand which strategy is preferable for a bank in the case of distrustful borrowers it is necessary to compare the reduction of profits caused by decreased probability of success with extra profits caused by dishonest behavior. A numerical example presented in Appendix demonstrates that there do exist such parameters of the market $(R^*, \overline{R}, V(p), \gamma)$ that additional benefits cover the profit reduction.

Thus the situations are possible when the banks prefer dishonest reporting even if the borrowers are aware of this strategy choice.

3.5 How to reach the first-best level?

In the case when there are equilibrium levels of efforts which are higher than the first-best level (i.e. the level for the situation characterized by information symmetry in both periods), it is possible to "fine-tune" the system, so that the borrowers prefer to apply less efforts and choose the first-best level exactly[5].

Suppose that if the borrowers are trustful this requirement is fulfilled. Consider the "fine-tune" of the following kind: if a high-ability borrower does not believe that the banks are honest, he should be provided with the guarantee that with some positive probability the information about his repayment will be revealed by the beginning of the second period.

Let us start from determining the first-best level of efforts. High-ability borrower maximizes the following utility function:

$$U^H(p_i) = p_i[(R^* - R_1) + (R^* - E(R_2))] - V(p_i) \tag{13}$$

If there is no information asymmetry, the function is described by following expression:

$$U^H(p_i) = 2p_i[R^* - \overline{R}/p] - V(p_i) \tag{14}$$

[4]Look Padilla, Pagano, 1999 for details of different regimes of information sharing.

[5]Shown in Padilla, Pagano, 1999

In equilibrium $p_i = p$

$$\frac{\partial U_H(\hat{p})}{\partial p} = 2R^* - V'(\hat{p}) = 0 \tag{15}$$

This equation has only one solution (taking into account that $V(p_i)$ increases in p and there are some constraints on $V'(p)$). Note that this solution is in the [0;1] interval so that $V'(1) > 2R^*$.

Consider the following fine-tune scheme. Suppose that a bank honestly reports the information about the share ω of borrowers, who repaid the loan. Then an expected second-period interest rate for high-ability entrepreneurs is the following:

$$E(R_2) = \omega p R_2(\overline{D}) + (p(1-\omega) + 1 - p)R_2(D) \tag{16}$$

Then we get that ω can be found from the equation:

$$\omega\hat{p}(R_2(D) - R_2(\overline{D})) = \frac{\gamma + 1}{\gamma} * \frac{\overline{R}}{p} \tag{17}$$

However honest reporting reduces bank's second-period profits anyway. Therefore some external control is needed, these functions may be realized by credit bureau. It is possible to calculate the share of credit reports that is necessary to check for accuracy in order to guarantee the proportion of honestly reported repayments we need.

If the banks are dishonest, then all borrowers are reported as being defaulters. Therefore there are $p\gamma$ borrowers who repaid the loan, $(1-p)\gamma$ borrowers, who defaulted but are still high-ability ones and $(1-p)(1-\gamma)$ borrowers, who are of low-ability type and are not able to repay the loan. So to reach the first-best the external agent, for example, the credit bureau, should check $\omega/p\gamma$ reports while performing the information exchange. This share guarantees that among these reports there are ω reports about repayments. If $\omega < p\gamma$ the share is less than 1, so there is no necessity to check all the reports.

Let us summarize our findings. We have examined the model, which allows analyzing one type of bank's opportunistic behavior - sharing false negative information. It shows that the banks have incentives to report dishonestly. Moreover we have offered one possible explanation of the "free-of-charge loan" phenomenon. Finally we have calculated the share of reports that should be checked for accuracy by an external agent to guarantee that the distrustful high-ability borrowers prefer to choose the first-best level of efforts.

4 Empirical evidence

4.1 The ways to solve the problem

In practice the problem of credit report data accuracy is being solved in two possible ways. First of all, an informational intermediary applies various sanctions to a dishonest bank. These sanctions vary from implying fines to excluding from the network. The latter variant causes the largest losses for a bank in the case of public credit registry being the informational intermediary. Mutual flows become one-sided, so the bank loses its competitive advantage, but does not receive an access to benefits of information sharing.

Secondly, informational intermediaries constantly improve their methods of accuracy control. For example experts from *Inter-American Development Bank* point out four common procedures of control: comparison with the data provided by other financial institutions, the opportunities for clients to check the data, regular statistical checks, software programs to identify abnormalities in the data. To characterize the quality of control systems an accuracy checks index was constructed. According to presence these or those procedures, this index is in the range from 0 to 4. One more important parameter is the legal requirement to respond to complaints. Table 1 presents this information (PCB - private credit bureau, PCR - public credit registry)[6]:

Table 1. Data quality.

Country/region	Legal requirement to respond to complaints	Accuracy checks index (from 0 to 4)	
		PCB	PCR
Latin America	47%-yes	2,54	2,14
United States	yes	4	-
Other OECD countries	yes	2,8	3,71
Other emerging markets	42%-yes	2,6	2,73

The US data accuracy control system is considered as being the most efficient.This may be explained by long, 170-year history of informational intermediation (for comparison in Latin America the industry has a 20-year history, transition economies informational intermediaries have been functioning only for several years), and therefore by rich databases and solid experience in the sphere of technical innovations.

[6]"Unlocking Credit. The Quest for Deep and Stable Bank Lending", The 2005 Report on Economic and Social Progress in Latin America, Inter-American Development Bank, The Johns Hopkins University Press, Baltimore and London, Ch.13, www.iadb.com

Private informational intermediation in European countries is limited by strict laws concerning borrowers' rights and data confidentiality. In the same time these laws provide for proper control in the sphere of data accuracy an reliability. Checking by borrowers is one of the most efficient methods of control, and in many countries the law does not impose restrictions on the quantity of times the borrower may obtain the access to his or her file free of charge.

Let us pay attention to Latin countries, where 2,5-3 out of 4 methods are commonly used, and in 53% of countries the borrowers are to prove the mistakes in their files. But the case is that the degree of trust of Latin banks is quite high: if some negative information is found in the borrower's report nearly 45% of banks will refuse to grant a loan[7]. Thus it may be supposed that even if the data accuracy control systems are not perfect, they are enough to provide that banks report honestly in necessary degree. On the other hand, this may be explained by sanctions for dishonest reporting - the topic we do not analyze here in detail.

At last it is important to outline that in transition economies, especially where the functions of informational intermediaries are performed by public credit registries, the control systems are still underdeveloped. It may explain the reason why the problems of banks' distrustfulness, unwillingness to invest money in formal credit report purchasing are still unsolved. Such sources of information as informal networks and bank's own databases prevail.

4.2 Misreporting

Another way to examine the problem, additional to how-to-solve point of view, is to look at actual data accuracy. A good example that demonstrates that theoretical results correspond with real state of affairs is surprisingly the USA. Cassady and Mierzwinski describe the results of the state Public Interest Research Groups study, which clearly demonstrate, that quite often incorrect information that the bank obtain from the intermediary influences the decision to grant a loan (Cassady, Mierzwinski, 2004). But these are not credit bureaus who should be blamed as the only wrongdoers. The mistakes of information intermediaries are mostly technical ones. The misreporting by creditors is more likely to be intentional. Cassady and Mierzwinski stress that sometimes banks deflate the credit scores of their clients in order to hide their true creditworthiness from potential competitors [8]. The report by Cassady and Mierzwinski shows

[7]According to "Unlocking Credit. The Quest for Deep and Stable Bank Lending", The 2005 Report on Economic and Social Progress in Latin America, Inter-American Development Bank

[8]The confirmation of this idea may be found in the release of the speech of chief national bank regulator, Comptroller of the Currency John D. Hawke, Jr.: "...borrowers may be rudely surprised when they discover that their good credit history as a subprime borrower isn't reflected in their credit files when they seek credit in the future and that they

that after a number of measures undertaken to improve the situation[9], the share of reports containing serious errors is still high. They asked adults from 30 states to check their credit reports for accuracy and found out that 25% of the reports surveyed contained the mistakes which in principle may cause the refusal to grant a loan (Cassady, Mierzwinski, 2004, p.11). Serious misreporting included incorrectly marking the accounts as delinquent or as being in collection, or - in the terms of our model - representing the borrower who had no defaults as a defaulter. Another reason for potential denial of loan is the fact that the consumer is over-extended in credit (the account that is already closed is reported as open one). 30% of the reports included such a mistake (Cassady, Mierzwinski, 2004, p.12) and it seems quite possible that these are not credit bureaus who are misreporting.

Given this state of affairs in the USA where the accuracy control system, as it was noted earlier, is well developed, it is not surprising that the borrowers in the countries where credit information reporting is in its infancy are likely to distrust information intermediaries. For example according to Metrobank's study, customers of Russian banks do not agree with their credit information transmission to credit bureaus because they are feared of information misreporting, not only of identity theft (Gazeta.ru, August, 2005).

5 Conclusion

One of the most serious problems of the credit market caused by information asymmetry: is lack of information about the borrowers. Information intermediaries are aimed to solve it, accumulating and distributing files, which contain credit histories and, consequently, the data on the borrowers' discipline. In many countries reporting to these agencies is obligatory. The reason is quite clear: the banks prefer not to share their databases, because in this case they loose the competitive advantage provided by access to exclusive information. On the other hand, the possibility to obtain the benefits of data sharing without these losses still exists: incorrect information reporting.

We have demonstrated that the banks have the incentives to report false information about credit discipline of their borrowers. Possessing unique databases a bank continues to extract informational rent and therefore enjoys a competitive advantage even being a member of the

are unable to obtain better rates based on their good credit record".

[9]Including the Fair Credit Reporting Act (FCRA) amendments introduced in 1996 and the enactment of Fair and Accurate Credit Transactions Act (FACT Act) in December 2003 among other things aimed to enhance the accuracy of information in credit reports.

system of information sharing.

That is why informational intermediary - an independent credit bureau or a public credit registry - should not be considered only as a mechanism of information transmission. One more important function is information quality control. Moreover this intermediary may become an agent, which guarantees that the system reaches the equilibrium equivalent to that without information asymmetry (the first-best). But for all that sometimes it is not necessary to check for accuracy all credit reports provided by banks. The case is that diligent borrowers may exert excessive efforts, that is why even a spot check is enough to provide for the first-best.

So the model described in this paper is an additional step in the direction of an information sharing system, which provides the availability of accurate and reliable credit files in quantity needed for bank credit market optimal functioning. "Reporting the failure helps to form the reputation of the chiseler and creates accountability against chiseling," - said Klein in his paper *"Credit-Information Reporting. Why Free Speech Is Vital to Social Accountability and Consumer Opportunity"*(Klein, 2001)."...One way to avoid a reputation for chiseling is not to chisel," - he continues. "And to make sure nobody says you chisel," - we should add.

APPENDIX

The case of positive total profits. Free-of-charge loans.

The model does not offer the mechanism which allows the borrower to suspect the bank of dishonesty. So the case of "free-of-charge loan" is examined for the situation when disciplinary effect influences borrower's decisions. Let us choose such parameters that the results are consistent with the condition that $\gamma < p$:

$R^* = 1,9$

$\gamma = 0,8$

$\overline{R} = 1,05$

$V(p) = 15p^{13}/13$

$V'(p) = 15p^{12}$

For a dishonest bank the following results are obtained:

$p = 0,88292$

$\mu(H|D) = 0,31895$

$\overline{R}/p = 1,18924$

$\Pi_2 = 1,79365$

$R_1 = -1,05282$

$\Pi_1 = -1,05$

$\Pi_\Sigma = \mathbf{0,74365}$

Total profits are positive. So given that borrowers trust banks there exist the parameters characterizing the market of bank loans, which guarantee that banks will report information dishonestly. The first period interest rate equals to zero, the second period one is too high to those borrowers who repaid a loan (but the utility is positive so the loan is accepted).

Additional profits in the case of distrustful borrowers.

Suppose the situation is characterized by following parameters:

$R^* = 1,9$

$\gamma = 0,9$

$\overline{R} = 1,1$

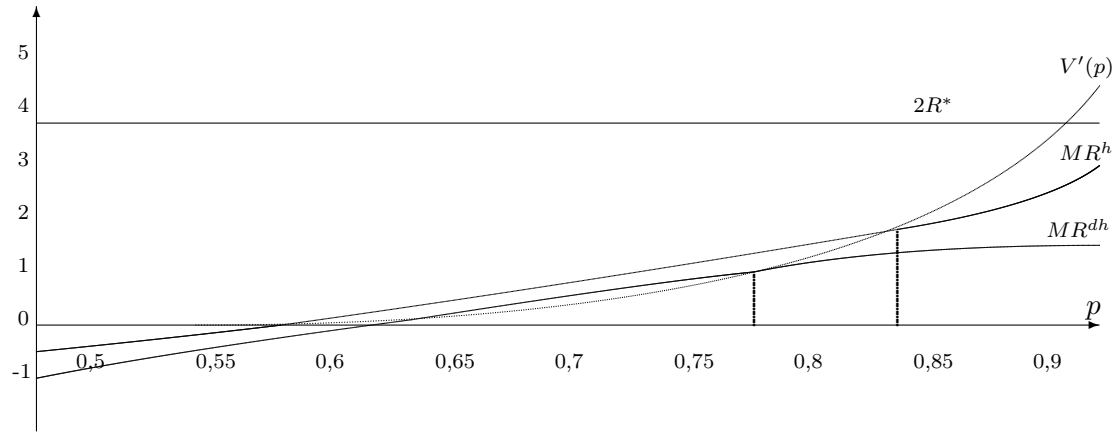
$V(p) = 10p^{11}/11$

$V'(p) = 10p^{10}$

The figures are chosen to guarantee the existence of positive solutions in case of honest behavior as well as in case of dishonest behavior and distrustful borrowers. The disutility function was chosen according to the model's requirements: $V' \geq 0$, $V'' > 0$, $V(0) = V'(0) = 0$, $V'(1) \geq 2R^*$.

Thus, it seems reasonable to compare the largest probabilities of success, which are consistent with the efforts chosen by entrepreneurs, and banks' profits in the second period. The solution for a borrower is represented by the Figure 3:

Figure 3. Utility maximization and effort choice.



We have obtained that specific case, when the efforts level chosen in a dishonest game is lower than that in a honest game. However the profit in a latter case is higher than in a former one:

Honest banks	*Dishonest banks*
$p = 0,84385$	p = 0,7784
$\mu(H\|D) = 0,58426$	$\mu(H\|D) = 0,66604$
$\overline{R}/p = 1,30355$	$\overline{R}/p = 1,41316$
$\Pi_2 = 0,11000$	$\Pi_2 = 0,49639$
U = 0,74396	U = 0,57791
$\hat{p} = 0,90778$	$\hat{p} = 0,90778$

Thus, dishonest banks may receive excessive profits in the second period even if the borrowers are distrustful and expect that banks will choose the strategy of dishonest behavior.

References

[1] Akerlof, G.A., *"The Market for "Lemons": Quality Uncertainty and the Market Mechanism"*, The Quarterly Journal of Economics, Vol. 84, No. 3 (Aug., 1970), pp. 488-500.

[2] Jappelli, T., Pagano M., *"Information Sharing in Credit Markets"*, The Journal of Finance, Vol. 48, No.5 (Dec., 1993), pp 1693-1718.

[3] Cassady, A., Mierzwinski, E., *"Mistakes Do Happen: A Look at Errors in Consumer Credit Reports"*, National Association of State PIRGs, June 2004.

[4] Jappelli, T., Pagano M., *"Information Sharing, Lending and Defaults: Cross-Country Evidence"*, CSEF Working Paper №22, May 1999, revised version March 2000

[5] Jappelli, T., Pagano M., *"Information Sharing in Credit Markets: The European Experience"*. CSEF Working Paper №22, March 2000.

[6] Jappelli, T., Pagano M., *"Information Sharing in Credit Markets: a Survey"*. CSEF Working Paper №36, March 2000.

[7] Klein, D.B., *"Credit-Information Reporting. Why Free Speech Is Vital to Social Accountability and Consumer Opportunity"*, The Independent Review, Vol.5, №3, Winter 2001, pp. 325–344

[8] Luna, S. A., *"Case Studies of Selected Credit Bureaus in Several Latin American Countries"*, J.E. Austin Associates, Inc., October 2001.

[9] Luoto, J., McIntosh, C., Wydick, B.,*"Credit Information Systems in Less-Developed Countries: Recent History and a Test"*, mimeo, UC Berkeley, September 2004

[10] Miller, M. J., *"Credit Reporting systems and the International Economy"*, The MIT Press, Cambridge, Massachusetts, London, 2003

[11] Olegario, R., *"Credit-Reporting Agencies: Their Historical Roots, Current Status, and Role in Market Development"*, mimeo, University of Michigan Business School, 2000

[12] Padilla A.J, Pagano, M., *"Endogenous Communication Among Lenders and Entrepreneurial Incentives"*, The Review of Financial Studies, Spring 1997, Vol. 10, No. 1, pp. 205-236

[13] Padilla A.J, Pagano, M., *"Sharing Default Information as a Borrower Discipline Device"*, CSEF Working Paper №21, July 1999

[14] Stiglitz, J.E., Weiss, A., *"Credit Rationing in Markets with Imperfect Information"*, The American Economic Review, Vol 71, No3 (June, 1981), pp. 393-410

[15] Vercammen, J.A., *"Credit Bureau Policy and Sustainable Reputation Effects in Credit Markets"*, Economica, New Series, Vol.62, No 248 (Nov., 1995), pp. 461-478.

[16] *"Financial Sector Assessment, A Handbook"*, The International Bank for Reconstruction and Development/The World Bank/The International Monetary Fund, 2005.

[17] *www.gazeta.ru* "Россияне не верят кредитным бюро", 11.08.2005

[18] *www.iadb.com*, "Unlocking Credit. The Quest for Deep and Stable Bank Lending", The 2005 Report on Economic and Social Progress in Latin America, Inter-American Development Bank, The Johns Hopkins University Press, Baltimore and London, Ch.13

[19] *http www.occ.treas.gov/ftp/release/99-51.txt*, "Comptroller Urges Industry to End Abusive Practices And Elevate Customer Service Standards", release of the speech by Comptroller of the Currency John D. Hawke, Jr, San-Francisco, June 7, 1999.

[20] *www.worldbank.org*, "Doing Business In 2004: Understanding Regulation", A copublication of the World Bank, the International Finance Corporation, and Oxford University Press, 2004, Ch.5