Thesis for Master of Science-degree.

Provision of banks' loans to enterprises in Russia

Olga Andreeva

May, 2002

Department of Economics

University of Oslo

Preface

The study, proposal and further analysis correspond to the period between the autumn of 2000 and spring of 2002.

The first part of the research was undertaken within the project on Russian economic and fiscal crisis at the Frisch Center. Especially, I am grateful to the coordinator of this project, Sheetal Chand, for his useful discussions and assistance, and discussant Olav Bjerkholt for his valuable comments. Also I have benefited a lot from the suggestions of the teachers and fellow students made on the presentations and at the final Workshop "Reviving the Russian Economy Through Restructured Incentives" held in St Petersburg on June 21-22, 2001.

For the further helpful guidance and assistance in my thesis work, I am indebted to my supervisor Tore Nilssen at the Economic Department of the University of Oslo.

At last but not least, I deeply appreciate valuable help and support of my family.

Summary

Extension of loans is being considered as one of the most important and useful functions of the universal commercial banks in the economy. Russian banking has been gradually restoring after the financial crises, when the default on the government debt has showed that only those banks that are more concerned with the non-financial sector can survive external shocks. However, the fact that banks become more and more willing to extend loans to the corporate sector, due to the absence of other profitable financial instruments, exposes them more to risks of particular borrowers. Unpredictable macroeconomic conditions and inefficient contract enforcement mechanism are overlapped with risks of borrowers' performance and value of their guaranties. To ensure themselves from risks on the micro level banks need to undertake costly and time-consuming process of assessment of their potential clients. In the situation when interacting parties possess different information or some data is not verifiable, credit relations demand not only a sound banking system and high management qualification, but also stability of financial records of the firms. Economic theory addresses different questions on this matter, and even we abstract from the commitment and moral hazard problem on the banks side, there exist a plenty of informational issues concerning borrowers.

Even general financial situation is improving; small and medium size enterprises in Russia are constrained in resources. Most of them cannot undertake cumbersome and expensive procedure of issuing public debt. Newly emerged enterprises do not have credit history and performance records, and even those that have been working quite efficiently during a certain period cannot provide reliable financial documentation due to the presence of underground activities. High credit risks and costs due to the difficulties in assessing and choosing potential borrowers in the situation of informational imperfections are reflected in the interest rate on loans. As a result, enterprises with stable but not very high profitability, that is usual for non-financial sector, are constraint in their access to credit resources.

While the situation in Russian banking is generally improving, risk of bad debts may affect the future of their financial stability. So both sides require recommendations in developing their strategies and possibility to rely on adapted theories of credit relations. In this respect, we illustrate bank-borrower relationships and bank decisions on the credit market in the context of the two game-theoretic models. We consider factors that influence

the interest rate on loans and especially particular conditions of the Russian credit market i.e. costs and uncertainty related to the pledged assets, wide tax evasion and non-payments in the economy along with an absence of the standardise financial records of the borrowers. In the first model, banks, as Cournot oligopolists, extend loans to finance production of the firms on the security of collateral. Firms have two types of technology available, and a choice between them depends on the level of prudence in the society and cost of loans, through such specific factor as firm's collateral valuation. Collateral requirements, set by the bank, are quite high and cover the principle with all interest and costs. But if the firms are able to provide falsified documentation and use illegally pledged assets, they will put a low value on their collateral in a loan agreement with a bank. Thus, particular conditions may lead to the choice of a risky investment, while improvement in the legal enforcement and relatively low interest rates will make a stable one more profitable.

The second model is based on the theory of signalling and provides a more detailed analysis of the interest rate decisions of a representative bank that provides loans to the non-financial sector. In the present state of the Russian economy, enterprises are engaged in the tax evasion and maintain arrears no matter their actual profitability and investment possibilities. Due to financial uncertainty banks are not able to distinguish potentially creditworthy borrowers, and therefore insure themselves with high interest rates on loans. Enterprises can try to build more transparent relationships with banks and provide them with information indicating their performance and ability to repay loans.

A bank's decision at a fist stage of the game depends on whether it can distinguish between the two types of borrowers: with high and low investment risks. In order to obtain cheaper loans, the high quality (i.e. low risk) firms need to distinguish themselves from a homogeneous mass. We obtain a possibility for the latter firms to provide a credible signal to the bank through the improvement in their financial performance. The model's results suggest that high quality firms can adjust their behaviour by refraining from chronicle non-payments in return for better credit conditions. This will serve as an indication of their efficient performance and ability to repay loans. The bank then conducts a particular credit policy separating high-risk borrowers from the low-risk ones and adjusts its interest rate on loans accordingly. L-type firms will continue to borrow at a high rate, as due to the limited liability and high upper values of their return distribution they benefit more from investing than from forgoing the project.

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1. Introduction

Financial institutions interact with other agents and fulfil an important role of the allocation of pecuniary resources from those who are willing to supply temporary free funds to those who require them for their current activities. Extension of loans is being considered as one of the most important and useful roles of the universal commercial banks in the economy.[1] Banks benefit more from economies of scale and scope advantages and higher diversification opportunities than other market agents engaged in the credit market.[2] Extensive empirical research shows that the amount of lending to non-financial sector has real effects on the economy, and thus a decline in it could trigger negative outcomes.[3] Moreover, seeking profitability in non-traditional activities like securities and derivatives lead to instability of the financial system and negative financial consequences for the non-financial economy.[4]

Russian banking has been gradually restoring after the financial crisis of 1998, which was one of the worst since the emergence of independent commercial banks in Russia in 1988. Due to the continuing formation of the financial markets, banks have an extremely tight array of alternative investment opportunities. Before and some period after the crisis, they were engaged almost totally in speculative activities on the money market including short-term investments in government debt (treasury bills). With some economic stabilisation, easy inflationary profits have become less possible for financial intermediaries and also the default on the government debt shows that only those banks that are more concerned with the industrial sectors can survive external shocks. However, loan extension continued to be a difficult and uncertain activity especially due to its longer horizon and inefficient risk management strategies. So most of the banks have been widely engaged in foreign exchange and other money-markets operation providing themselves a sufficient combination of current liquidity and profit. Nevertheless, being in transition from

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[1] Empirical research provides a support to the hypothesis of the uniqueness of banks loans compared with other possible activities (Fama, 1985; James, 1987). Recent empirical analysis confirms a positive relationship between financial and economic development of the country (Levine, 1997), specifically economic growth, savings rates and capital accumulation (Beck, Levine and Loayza, 2000; Levine, Loayza and Beck, 2000).
[2] Banks can gain from economies of scale (Lenard and Pyle, 1977; Campbell and Kracaw, 1980; Diamond, 1984, 1991) and an intrinsically efficient role of banks is in optimal investment decisions and screening of corporate borrowers (Campbell, 1979), monitoring them and predicting their future performance (Diamond, 1984); and also risk management as a new phenomenon (Scholtens and van Wensveen, 2000; Allen and Santomero, 2001).
[3] Christopher (1987).

speculative profits towards more stable banking, most of them began to adjust their management policy searching for new market niches and other sufficiently profitable possibilities of asset allocation. They now make attempts to establish closer relations with the corporate sector, offering a wider range of services, improving techniques of client's business evaluation and, of course, providing financing for reliable borrowers.

However, the fact that banks become more and more willing to extend loans to the corporate sector due to the absence of other profitable financial instruments exposes them more to specific credit risks along with general macroeconomics risks. Unpredictable macroeconomic conditions and inefficient contract-enforcement mechanisms are overlapped with particular risks of borrowers' performance and value of their guarantees. To insure themselves against at least some risks on the micro level, banks need to undertake a costly and time-consuming process of assessment of the potential borrower. This requires not only well-qualified management qualification but also a stability of borrowers' financial records. Moreover, banks encounter a lot of obstacles, including legislation imperfections, informational uncertainty, and mainly absence of transparent financial documentation including standardised accounting and credit records. This is one of the most concerns in the provision of loans to potential and new clients. Informational problems makes it difficult to distinguish reliable borrowers, who are conducting sound economic activities and are potentially creditworthy, from those who are unable to repay their debts.

Giving up the possibility of irrational behaviour of the agents, we will try to provide some suggestions for improving borrower-lender interactions on the Russian credit market. Apparently, with a lack of financial instruments, banks are turning back to traditional banking services and at the same time try to improve the quality and variety of operations for customers. However, enlarging the loan portfolio is risky and may involve a high percentage of bad debts. Banks try to insure themselves from risks with higher interest rate so that credit conditions are very troublesome and detrimental for potential borrowers.

In this respect, we illustrate bank-borrower relationships and bank decisions on the credit market in the context of two game-theoretic models. In the thesis, we consider factors that influence the interest rate on loans and especially particular conditions of the Russian credit market i.e. costs and uncertainty related to the pledged assets, wide tax evasion and non-payments in the economy along with an absence of the standardise financial records of

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[4] Edwards and Mihkin (1995) study the effects of the decline in traditional banking in favour of more risky operations with derivatives and off-balance sheet activities observed in many developed countries.

the borrowers. In the first model banks, as Cournot oligopolists, extend loans in return for a collateral to finance production of the enterprises. The latter have one stable and one risky technology available, and a choice between them depends on the level of prudence in the society and cost of loans, through such specific factor as firm's collateral valuation. Thus, particular conditions may lead to the choice of a risky investment, while improvement in the legal enforcement and relatively low interest rates will make a stable one more profitable.

The second model is based on the theory of signalling and provides a more detailed analysis of the interest rate decisions of a representative bank that provides loans to the non-financial sector. In the present state of the Russian economy, enterprises are engaged in the tax evasion and maintain arrears no matter their actual profitability and investment possibilities. In the situation of high risks and financial uncertainty, banks are not able to distinguish potentially creditworthy borrowers and insure themselves therefore with high interest rates on loans. Enterprises can try to build more transparent relationships with banks and provide them with information indicating their performance and ability to repay loans. Both sides require recommendations in developing their strategies and possibility to rely on adapted theories of credit relations. Bank's decision at a fist stage of the game depends on the fact whether it can distinguish between the two types of borrowers: with high and low investment risks. In order to obtain cheaper loans, the high quality (i.e. low risk) firms need to distinguish themselves from a homogeneous mass. We obtain a possibility for the latter to provide a signal to the bank through the improvement in their financial performance.

In section 2 we provide a brief history of the development of the Russian credit market, including the current situation on the market for corporate loans and problems with the enterprise financing. Section 3 describes the related literature, and section 4 discusses problems specific to the Russian credit market. In section 5, we model decisions of banks as Cournot oligopolies and show implications of the collateral cost and valuation. Section 6 develops a signalling model and suggests implications of the interest rate for indistinguishable borrowers, as well as elaboration of signalling possibilities for them. Section 7 concludes.

2. Russian credit market: history and present specific conditions

2.1 A brief history of the development of the Russian credit market

The actual beginning of the reforms dates back to 1988 when the sole functioning of the State Bank was replaced by the tree-level bank system of the former USSR. The first stage was marked by the appearance of specialised banks, financing particular areas of the economy, before the independent commercial banks emerged. The whole system has been regulated by the Central Bank from that time on (known as Gosbank in the former USSR), while specialised banks were transformed to the commercial banks afterwards. The banking system received independence from the state, at least formally, while presence of the specialised banks maintained signs of the old system. Their main functions included persistent financing of related industries on the favourable for the latter conditions. Thus, these banks had narrow and specified functions in the absence of any financial markets.

Only in 1991 was the banking system set up according to the practice known in the West, in particular in its bank-dominating form as in Germany and Japan[5]. Commercial banks are responsible for their really independent managing decisions and have relatively equal conditions under the new banking legislation and supervision of their local branch of the Central Bank. Newly appeared commercial banks have faced unfamiliar tasks such as investment and risk management. With the appearance of the financial markets they received also an opportunity of portfolio management using securities and money market instruments beyond traditional lending.

As the economic and financial situation produced high inflation, making high inflationary money became a very profitable business for the Russian financial sector. Thus, most banks almost completely turned towards speculative operations on the money market and short-term investments in bonds and shares. This situation was aggravated by the fact that Russian banks were already established as universal organisations with a standard range

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[5] Dewatripont and Maskin (1995) compare "Anglo-Saxon" and "German-Japanese" financing practices and consider a level of decentralisation as a source of financial discipline.

of services.[6] Thus, they jeopardised their customers' money and threatened repayments to their depositors by being involved in risky operations. During following financial crises and bank-runs, many of banks went bankrupt but some of them, those with more flexible and qualified management, survived and even acquired large assets. They didn't match assets and liabilities, although, in some cases, new banks, free from any obligations, emerged on the ruins of the old ones.

2.2 The current situation in the market for corporate loans

Economic instability and information problems create highly risky environment for the banks operations. During the period of high-inflation profits, banks were exposed to speculative risks of money-market operations and government debt financing. All transactions were extremely short-horizon and usually provided sufficient liquidity. Following changes in the asset structure demand more attention to the credit risks and asset duration risks.[7]

Stabilisation and potential signs of growth in the Russian economy have a positive influence on the banking system. A tendency of overcoming consequences of the systemic crises was reinforced in year 2001. Banks' assets[8] and capital[9] have been continuing to grow significantly (i.e. current nominal value of bank assets has been increased more than three times since the beginning of 1999 and constituted 3156 bill. rub. on the beginning of 2002). A process of the consolidation of banking capital goes along with a continuing decrease in the number of banks, as is seen from the figure 1, even after the disappearance of the main crisis consequences.[10]

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[6] Positive and negative sides of the universal and specialised banks are discussed on the Ber, Jasef and Yosha (2001).

[7] This and all following information on the banking system are taken from the banking statistics of the Central Bank of the Russian Federation (monetary indicators and banking statistical bulletins). All data is aggregated on a monthly basis from the balance sheets of banks, including their branches abroad.

[8] Assets include credit extended to non-financial sector, banks and households; investment in shares, bills and government securities; corporate and budgetary funds with banks; personal deposits and negotiable debt.

[9] Data on own funds is from the capital accounts of banks and includes authorised capital, which is based on shares and provides a minimal amount of assets as a guarantee for depositors, supplementary capital and other funds formed through profits, reserves formed to cover possible losses on active transactions, current-year financial results and profits/losses of previous years.

[10] Number of banks is represented by the registered credited institutions. The yearly numbers of actually functioning banks are indicated below in the table 2.

Figure 1.

A number of credit institutions in Russia, dynamics of their total assets and
corporate loans extended (April 1998- December 2001)
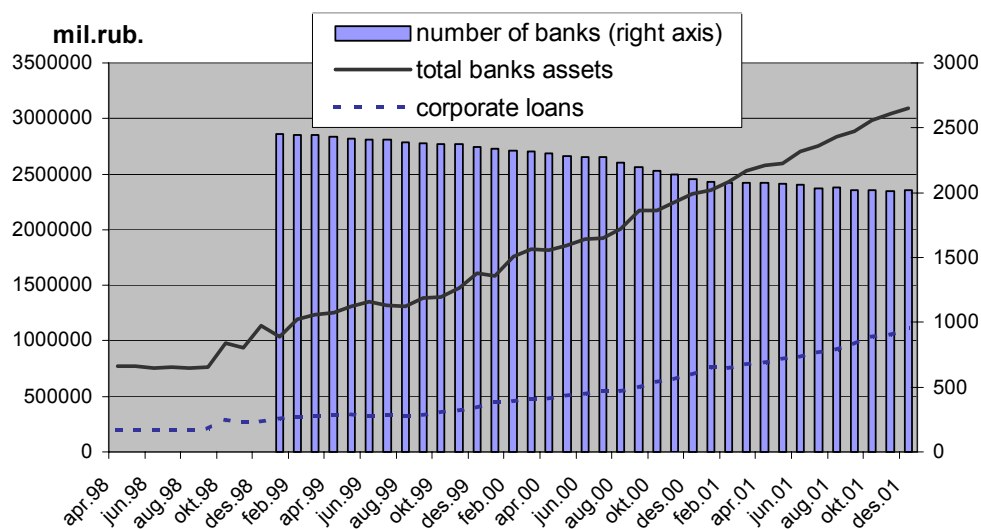
In 1999 and almost through 2000, the share of loans constituted a lower percentage of Russia's gross domestic product than before the crisis of 1998. However, banks' loan portfolios have begun to grow at an extraordinary pace due to the lack of the possibilities of profitable asset allocation.

Table 1.

CREDITS EXTENDED[11]

(at the beginning of quarter; bln. roubles)

	To enterprises and organizations[12]	To banks[13]	to individuals[14]
1998 II quarter	196,3	29,4	18,2
1998 III quarter	201,1	33,8	18,5
1998 IV quarter	287,8	55,3	22,2
1999 I quarter	300.2	58.2	20.1
1999 II quarter	329.6	71.9	22.8
1999 III quarter	331.7	77.0	22.3
1999 IV quarter	354.5	83.6	26.1

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[11] Data of the State Committee of Statistics (Goskomstat)
[12] Excluding credits to non-resident legal entities.
[13] Excluding deposits and other funds deposited with the banks.
[14] Including credits to individuals - private entrepreneurs and non-residents.

2000 I quarter	445.2	89.7	27.6
2000 II quarter	483.6	94.4	30.3
2000 III quarter	543.9	83.0	35.0
2000 IV quarter	626.5	110.0	42.5
2001 I quarter	763.3	104.7	44.7

The main progress has been achieved by the change in the structure of revenues (figure 2), which are now mainly due to the increase in the credit operations, in contrast to government securities in 1996-1997 and currency operations in 1998-1999.

Figure 2

Banks' asset allocation (quarterly data for 1998 - 2001)[15]
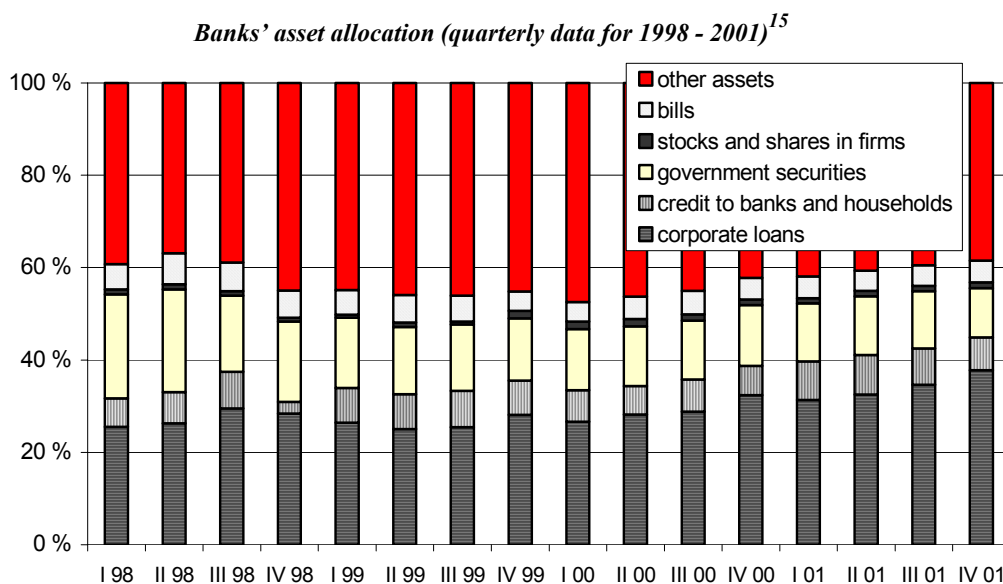
The market for government debt failed to retain its pre-crisis amounts (i.e. 10 % in the beginning of 2002 versus 22 % in April 1998). Its reliability and liquidity highly decreased after the default of 1998 and banks do not credit the government in large amounts anymore. Operations on the corporate stock market continue to be negligibly small with only 1-2% of the total assets. Low volumes and liquidity, high volatility and risks make it uninteresting for the banks unless they decide on purchasing shares for corporate control purposes. Thus, credits to the non-financial sector gradually become the main source of banks' revenues.

The share of loans extended to the corporate sector out of total assets of major banks approaches 40 per cent on the end of 2001, which is the highest value since 1994. Loans in

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[15] Corporate loans and credit to households and banks include debt overdue. Funds provided on REPO terms are shown as allocation into securities.

domestic currency have always been in a higher demand by enterprises due to the high exchange risks, and now their share in the banks` loan portfolio is increasing. Thus, a current positive tendency of stabilisation and growth of the banking sector is based on the increasing credit portfolio. However, it will continue to be positive only in the absence of bad debts and perseverance of good quality of extended loans. As it is seen from the figure 3, nominal outstanding debt to corporate borrowers is quite high and doesn't have any clear decreasing tendency. To some extent it can be justified by enlarged lending and hopefully overdue debt is growing at a relatively lower pace.

Figure 3

Nominal value of the outstanding debt on loans and
growth rates of outstanding debt and loans extended (1998 - 2001)
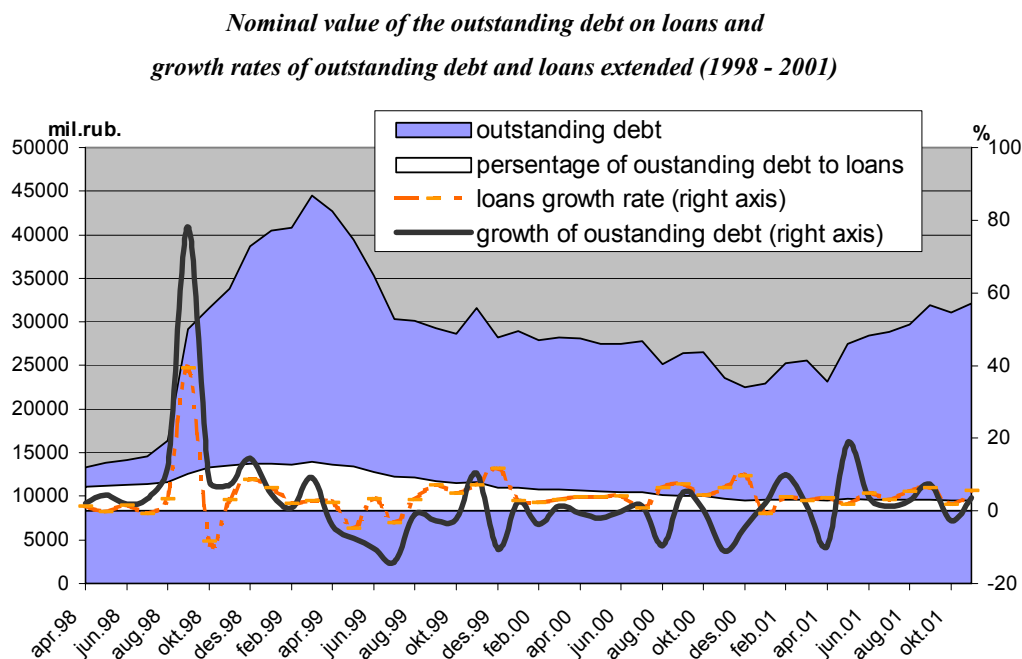
During 2001, the share of outstanding loans constituted 3 per cent in the banks' credit portfolio that is almost twice as low as before the crisis of 1998. Nevertheless, credit expansion may lead to its increase as banks broaden their client bases and enhance extension of loans to existing clients.

In the current situation of low information transparency and high exposure to risks in the entrepreneurial activities, an almost total orientation on credit operations will lead to a deterioration of banks' assets if banks will not use new strategies towards borrowers. Credit institutions need to conduct a quite sensitive policy according to the borrowers' potential and creditworthiness.

It is interesting to compare Russian the situation with the banking industry in Poland, another transitional country whose banking is known for its quality guaranteed by

transparency and confirmed by the absence of banking crises.[16] It has performed quite well since the period of similar to Russia financial problems of 1992-1994. Domestic lending is one of the most important segments of their activities, as Poland became the first country in Eastern Europe that managed to maintain stable growth of bank loans provided to the non-financial sector. It has been indicated a 15.7% (9.7% in real terms) increase in gross loans.[17] In 1999, the share of loans to the non-financial sector constituted 41% of total aggregate assets of the commercial banks. Deposits, which traditionally are the core source of funding for banks, accounted for 60% of the liabilities of Polish banks versus approximately 45% of total aggregate liabilities of Russian banks. These figures still support the idea that the lending activities of Russian banks are far, not only from sound financial behaviour, but also from the time-honoured approach in assets-liabilities management.

2.3 Problems with enterprise financing

The last few years have resulted in some improvement in the economic situation of Russian industries. The non-financial sector has started a gradual recovery with more or less successful signs depending on the particular sector, such as demand of its goods and general economic conditions favouring production.

Table 2

MAIN INDICATORS[18]

	1996	1997	1998	1999	2000	2001
Gross Domestic Product: bln. roubles (in current market prices)	2256	2562,6	2696.4	4607.0	6946.5	
as percentage of the previous year (in constant prices)	95,1	100,8	95.1	103.5	107.7	
Volume of industrial output (in actual prices)[19] , bln. roubles	1414,2	1601	1681	2995	4763	
Number of enterprises, thous.	156	159	159	158	158	
Number of credit organisations registered on the territory of the Russian Federation (at the beginning of the year)			2555	2483	2378	2126
Including functioning credit organisations			1697	1476	1349	1311
Investments in fixed capital		541,6	402,4	670.4	1165.2	
Volume index of investments in fixed capital (in constant prices),			93.3	105.3	117.4	

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[16] Economic Survey of Poland (OECD, January 2000).
[17] All data form the summary evaluation of the financial situation of the polish banks (National Bank of Poland, 2000).
[18] Data of the State Committee of Statistics (Goskomstat)
[19] Taking into account informal activities.

as percentage of the previous year					
of which by sources of financing: from total 100[20]					
Retained earnings	52,2	60,8	53,6	53,4	46.1
Out of them: profit at disposal of organisation		11,9	13,3	16,2	23.4
Attracted funds	8,4	7,1	46,4	46,6	53.9
Out of them: budget funds (funds of the consolidated budget)	20,1	20,7	19,2	17,4	21.2

In spite of the beginning of the economic recovery there are still many inefficiencies, and entrepreneurs have to run their businesses in the same difficult macroeconomic and legislative environment. A complex tax system with an unbearable tax burden (approximately one third of profits in the case of profit tax) condemns a significant part of the companies to operate in the underground economy. Shortage in financing has been experiencing by a significant part of enterprises and still keeping barter and non-payment in the economy among other negative tendencies.[21] Growth of the nominal and real gross domestic product, industrial output and investments is accompanied by a positive tendency of decreasing overdue debt of industrial enterprises (see figure 4), which started in the middle of 2001.[22] However, overdue debt still shows quite high values, which has not yet reached before-crises values.

Figure 4

Quarterly dynamics of the gross fixed investment and industrial overdue debt
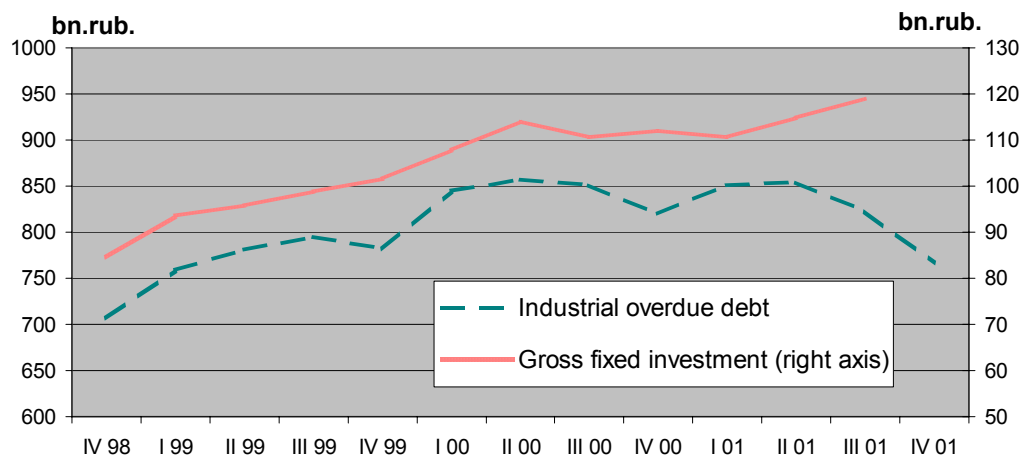
The economy experiences a large deficit of funds, as many Russian enterprises require resources for different purposes, from solving short-term liquidity problems,

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[20] For the large and medium size enterprises.
[21] Dolgopyatova (1998).

purchasing raw materials and supplements, as working capital financing, to investments in machinery renovation and production expansion. Table 2 represents a structure of investments in fixed capital, which are almost equally financed by own and attracted funds, where quite large part of the later is due to the budget financing. There was a first large drop in the amount of the budget support to the industrial sector in 1998, which aggravated their investment problems. For example, in the end of 1998, 82 per cent of the examined enterprises were already detached from budget financing but near 70 per cent of them didn't use bank loans.[23] They tried to utilise their internal funds, if any, while only 17 per cent of companies used credit resources and only 3 per cent - foreign investments.

Developed financial markets usually provide a possibility of issuing direct debt, equity or using trade credit. Currently only limited number of firms in Russia can afford a procedure of issuing bonds;[24] even in with the efficient capital markets external public debt can be considered as a cheaper and more flexible source compared with bank loans.[25] Trade credit is costly and thus many enterprises can appeal mainly to bank loans.[26] Presumably small and medium-size firms can also experience problems with obtaining loans.[27] They are usually more flexible, engaged in different kinds of activities, and have a lower probability of being checked by the authorities; thus their performance is less observable. Large enterprises are more in the centre of public attention, their activities are observed and evaluated by the market, and so it is easier to distinguish their creditworthiness. Typically they are permanent clients of particular banks, which provide specific customary services for them, including financing. Moreover, due to the customer-creditor relationships they can get quite mild credit conditions. At the same time, some of the large enterprises, inherited from the soviet economy, obtain governmental subsidies through banks, but it is done by means of different mechanism and decisions are made not by the bank themselves.

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[22] Information is based on the data from the key economic indicators, Stockholm Institute of Transition Economics and East European Studies.

[23] Data according to the sociological investigation of the Center of Economic Research

[24] The reason is that the whole process is quite complicated and requires large initial costs in the form of tax payments (0.8% from the face value of issued securities). Moreover, the firm should pay to financial consultants and marketmakers, who organize and support the market for these securities, or just bear the costs undertaking the whole procedure by itself).

[25] More stable firms are able to raise public financing due to their market reputation, and they will prefer it to the bank loans as they usually pay lower interest on the former funds. Boot and Thakor (1997) consider a coexistence of bank loans and external financing and a possible dominance of one of them. The firms with a lower reputation have a tendency to borrow from the bank, while other borrow from the capital markets.

[26] However, if we consider possible credit rationing trade credit is the more likely outcome for the small firms without stable bank relationships (Biais and Gollier, 1997).

[27] There is a contradiction between the theory of funds availability for financing positive NPV projects and known reality of capital shortages of small companies. Stiglitz and Weiss (1981) suggested possible explanations of this phenomenon in terms of information asymmetries and agency costs.

Hence, it is more interesting to consider crediting decisions of banks with respect to different numerous small and medium size firms. On the one hand, their demand and repayment possibilities are constrained by the prevailing high interest rate. On the other hand, they are less distinguishable by the external parties and their operations are more plagued by shadow activities. Figure 5 shows the dynamics of the interest rate on corporate loans and deposits [28], Central Bank refinancing rate (i.e. a formal rate used by the Central Bank for its operations in the open market) and consumer price index.[29]

Figure 5

Interest rates dynamics (1999-2001)
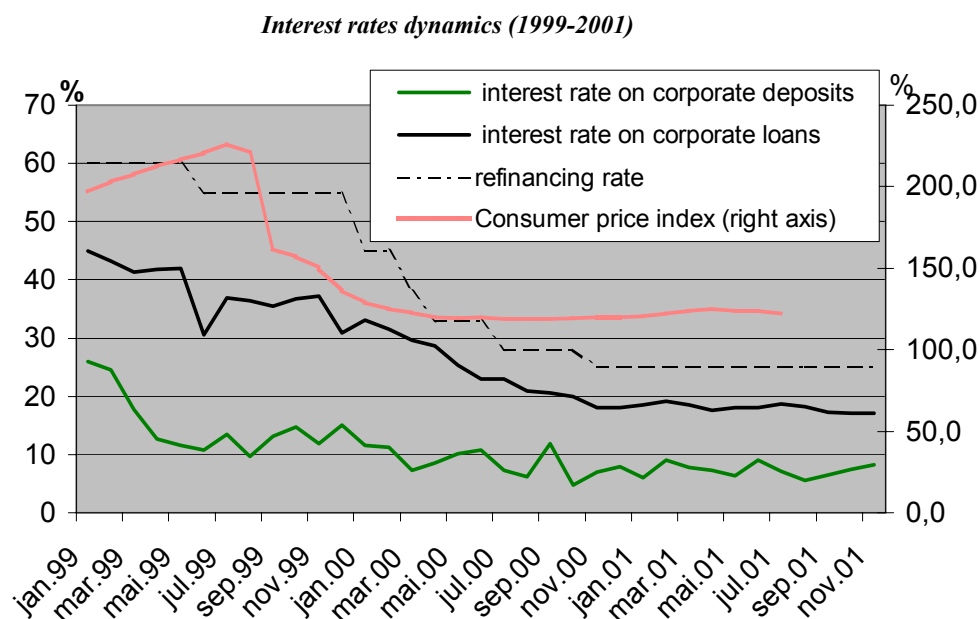
Deciding on the required rate of return on their investments, banks take into account high risks of borrowers, especially due to their uncertain future performance, collateral value and ambiguous financial records. Large part of the interest rate margin on the corporate loans includes this type of uncertainty in the credit decisions.

Consequently, many companies with good market perspectives cannot finance their sustainable development because of various reasons. A successful recovery of manufacturing and agriculture requires vast investments in their capital and current assets along with financing innovations and new competitive technologies. Moreover, the shortage of investments increases the share of unproductive activities in the economy, lows profitability

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[28] Interest rate on both loans and deposits are taken as an average weighted on length of the loan/deposit for industrial sector respectively.
[29] Average percentage change in the consumer price index.

and slows economic growth.[30] It is important to have a more developed investment market including loans to the non-financial sector, leasing operations and investment projects financing, which will considerably support development in industries. It is appealing to elaborate on a proposal for improvement from the part of enterprises, which want to obtain cheaper loans proving their financial reliability and creditworthiness.

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[30] Beck, Levine and Loayza (2000), Levine, Loayza and Beck (2000) discuss relationship between the level of the financial development and economic performance.

3. Description of some related literature

Not only a sound banking system[31] but also the financial stability of borrowers play an important role in the situation when interacting parties possess different information or some data is not verifiable. Economic theory addresses various questions on this matter and even if we abstract from the commitment and moral hazard[32] problem on the bank side there exist plenty of informational issues concerning borrowers.

Informational economics theory tries to explain and to solve different problems additional to simply risk sharing, emerging when banks decide on loans to borrowers on whom they possess imperfect information. Most of the researchers agree that monitoring of clients and foreseeing their potential is an intrinsically inherent role of financial intermediators[33] and extension of loans if a most natural and efficient activity for a bank.[34] A recent wave of investigation suggests that, with respect to new borrowers, banks may not have informational advantages, while they highly benefit and gain insider information on the stage of relationship lending.[35]

The solutions and their practical applications in the developed financial markets are related to making optimal decisions on credit rationing (for example Besanko and Thakor (1987), Bester (1985), Jaffee and Russell (1976)), establishing the optimal size of collateral, choosing different screening devices to prevent moral hazard (Berger and Udell (1995), Best and Znang (1993)). However, collateral itself serves as a cause of moral hazard, e.g. with respect to the maintenance of the pledged assets.[36]

Utilising data from developed economies, empirical research provides different support to hypothesis of the optimal monitoring techniques employed by banks. The results of Best and Znang (1993) suggest that a bank apply monitoring not equally to all borrowers and only after the initial screening. The bank has incentives to use costly financial evaluation

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[31] Billett, Flannery and Garfinkel (1995) identify also an importance of the lender's rating.

[32] This is one of the possible informational problems that in the current context can appear between creditors and borrowers. It becomes important when parties obtain information and make some decisions, i.e. investment choices, after the loan contract is sighed.

[33] Diamond (1984).

[34] Fama (1985), James (1987).

[35] Banks achieve informational advantages from long-term relationship with clients (Lummer and McConnell, 1989; Sharpe, 1990), especially in their broadened services to small business (Peek and Rosengren, 1998).

[36] Igawa and Kanatas (1990) show that in equilibrium their will be underinvestment in the maintenance of the pledged collateral with the requirement of higher expected collateral value in exchange for loans. High quality firms can obtain overcollaterised loans, while other choose between unsecured loans and self-financing. The former is preferred by the low quality ones.

only when it detects distorted signals about the borrowers' behaviour. At the same time, it is not optimal to exercise further evaluation if positive indicators are observed. These conclusions support those of Lummer and McConnell (1989) and are to contrary to those of Boyd and Prescott (1986). The latter have concluded that it is optimal for a bank to apply screening only to those clients who provide positive information of their performance. At the same time, both approaches are questionable in the present conditions in Russia. Informational deficiencies and specific legal environment change assumptions, major influential factors and, consequently, relevant approaches to the problems. On the one hand, banks may try to employ quite thorough evaluation and monitoring of borrowers. But this will involve exceptionally high costs and monitoring can be even impossible due to the absence of such institution in the corporate credit market practice. The level of complexity and relative costs will depend on the status of borrower, degree of its credibility and quality of information provided. On the other hand, high risks and costs drive up the interest rate on loans far above the risk-free rate and reduce availability of funds for a group of less risky borrowers.

Such problems stimulate moral hazard as asymmetric information may provide a possibility to extract additional private benefits. In this situation firms avoid to reveal it to many agents as informed parties can decrease their profitability.[37] This situation is aggravated in the underdeveloped financial markets where we observe a lack of restrictions on the usage of insider information.

Thus, further investigation relevant to the Russian specific conditions is needed to obtain optimal monitoring devices for different types of borrower.

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[37] Degryse and Ongena (2000).

4. Postulated problems specific to Russian credit market

Informational and legal environment in Russia differs from countries with sound financial markets, informational transparency and efficient enforcement mechanisms. Then techniques employed by optimising agents as well as adjustment on their behaviour should be based on dissimilar approaches. Such environment for the interaction between a bank and a borrowing firm can be shown as follows:

MACROECONOMIC FRAMEWORK
- ✓ Monetary and fiscal policy
- ✓ Inflation and exchange rates
- ✓ Economic growth

MICROECONOMIC FRAMEWORK
- ✓ Loan/debt policy
- ✓ Technologies
- ✓ Market environment

- Lending policy
- Risk-free rate (g)
- Probability of default
- Collateral value (K)
- Costs (C)

- Interest rate on loans
- Collateral requirements
- Regulatory policy

Repayment: $(1+r)L$

Default: $\min[K, L((1+r)+C)]$

BANK   **FIRM**

- Evaluation of borrowers
- Interest rate on loans (r)
- Collateral requirements $L((1+r)+C)$

Loan (L)

Collateral (v)

- Technology choice
- Financial documentation
- Tax evasion and areas
- Collateral valuation (v)

SUPERVISION AND PRUDENCY
- ✓ Central Bank
- ✓ Management/Shareholders
- ✓ External auditors
- ✓ Institutional constraints

LEGAL FRAMEWORK
- ✓ Legislation
- ✓ Contract enforcement
- ✓ Information transparency
- ✓ Standardised accounting

In the present situation of increasing credit activities of the Russian banks, lack of investment funds for the corporate sector can be related to two main issues: liquidity shortages of the banking industry due to problems with attracting resources to the banks, and high costs of loans for many small and medium-size firms. Here we approach the second financial issue using relevant game theoretic approach and providing possible policy recommendations.

4.1 Collateral requirements

In the first model of the thesis we will consider particular conditions of the Russian credit market that influence the determination of the interest rate on loans. Apart of the oligopolistic competition among financial intermediaries and available lending technology, interest rate may be affected by the uncertainty of loan repayment and following compensation from the collateral. In the case of borrower's default the bank needs to undertake a complicated and costly procedure of claiming a compensation and realisation of the pledge.

Avoiding consideration of exceptional cases, a standard Russian bank lends money only on the secured conditions, requiring either a reliable bail or adequate collateral. Since the third-party guarantee bears the same counteragent risks, it is adopted rather rarely[38]. Thus, collateral can serve as a common guarantee and usually covers the value of the loan with a huge margin, up to 200 per cent. It includes a principle with all interest payments and costs of extending and serving the debt. The latter factor can make a large contribution to its value due to a costly legal procedure of collateral realisation in the case of the borrower's default. However, collateral does not fully insure the bank in case of the borrower's default, as the value of the realised assets may be insufficient to cover due debt. Market risk is quite high in Russia (i.e. securities market may shrink even twofold, the real estate property may lose more than 50 percent of the market value, etc). Moreover, collateral value after the initiated bankruptcy procedure may be reduced due to claims of other creditors (i.e. creditors of the first and second order according to the Bankruptcy law in Russia).[39]

The whole procedure of dealing with collateral is very cumbersome. High costs associated with the system of secure lending can be split into those, occurring before and during extension of the loan, and those, occurring in the case the borrower defaults. The former may include the process of evaluation, perseverance and guarantees of a safe pledge, while the latter are costs of the legal court procedure of claiming and further realisation of the pledged assets. Additional problems may arise if the firm management is shrewd enough to cheat, providing falsified collateral. It is extremely actual in nowadays Russia when

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[38] Besides the pure economic reasoning, banks often use so-called "window curtain". The Central Bank of Russia applies the highest grade of risks to unsecured borrowers. Paradoxically, but banks consider such credits most secure as most of them are built on the relationship lending. Hence, not to worsen its reporting data, bank may adopt the guarantee from the company, which is more trustless, than the creditor himself.

[39] Creditors of the first order are citizens who have injury claims to the debtor. Wage arrears with respect to the working agreements and remuneration for the authors' contracts are reimbursed in the second order.

lenders try to secure themselves with very high collateral requirements while borrowers are involved in different type of illegal operations (i.e. pledging the same of assets to different creditors, illegally registered securities or mortgages, etc).

Collateral may have different valuations for the counteracting agents and may be not connected with the real value of the underlying asset. A bank's evaluation is based on the market price of the pledged assets because the bank is concerned with obtaining a repayment from the collateral realisation after the firm's default. The firm is usually not interested in realisation of its assets at the end of the loan agreement. So its valuation may be less connected to the real market value but rather to the firm specific value of the pledged asset. It can be higher or lower than the market value depending on how important are these particular assets to the firm. The value may be high if the assets are essential in the production, or the firm has made some specific investments in them. On the contrary, the firm may have a low valuation if it has a possibility to manipulate with these assets in a loan agreement. Nevertheless, the real value of the asset outside the credit relations cannot be lower for the firm because if the bank values it higher than the firm, latter may simply sell this asset to the bank with profit.

Thus, it is interesting to focus on the case when collateral valuation is lower for the firm than to the bank due to the informational and legal environment imperfections. The firm may have a possibility to manipulate information about its property or hide some details about maintenance of the asset. This asset may be illegally pledged in the several loan agreements and the firm may provide a falsified documentation on it. Saying in another words, there can be some distortions in its value that will lead either to the lower market price at the end of the loan agreement or will affect only it worth to the firm. The former situation is less interesting as if the bank knows that the firm will cheat on it afterwards and the market price will fall, it can reasonably require higher collateral initially. However, this can lead to extremely high collateral constraint, which may be not possible in practice. At the same time, a possibility of pledging the same collateral in more than one credit contract erodes its value to the firm without influence on the price of the asset itself. These circumstances may result in a different perception of the collateral by the two players. In general all these present and expected expenses may play some role in the determination of the interest rate on loan.

4.2 Financial stability of borrowers

Thus, enterprises' demand for loans is pressed by the high interest rate, while most of them are unable to consider other sources of financing due either to their direct and indirect costs, or to underdeveloped mechanisms of issuing direct debt. However, general market conditions and specific factors associated with the collateral, discussed in the previous section, are not the only ones that play a role in the resulted cost of credit to the enterprises. Financial stability of the borrowers is essential for the credit relations and associated conditions of a loan contract, while collateral issue becomes important when the firm fails to repay the loan. The bank first of all tries to secure itself from the risk of the firm's default and associated collateral realisation procedure, and therefore provides different contracts, at least in terms of the interest rate, to the more and less reliable borrowers.

Almost all small firms in Russia are either operate in the underground economy or are widely engaged in the tax evasion, maintain wage arrears and other non-payments, including debt to creditors and suppliers, etc. The main peculiarity is that they are used not only by inefficient and close-to-bankruptcy firms, but also by quite well operating and really profitable ones. Low contract enforcement and possibilities to "interpret the law in ones own favour" create a situation when firms can benefit from underground activities. However, banks probably have more effective enforcement possibilities to ensure repayment than other market agents or tax authorities.

Apart from the negative effects on the federal and local budgets, another drawback is that these operations influence financial documents of the firm and worsens a formal picture of its well-being. Due to tax evasion financial documentation underestimates the true values of their assets, turnover, and obtained profit, which ideally serve for a bank as a formal basis for the involvement in the credit relations with a firm. If the firm persistently shows low or zero profit (even though the real reason is tax evasion) and large indebtedness (even though it is able to pay its creditors) this inevitably will influence a bank's decision to extend credit to this firm.

If the whole financial picture is not very bad and the firm is able to provide liquid collateral and adequate economic justification for its credit needs, the bank will extend a loan. However, the conditions of the loan contract can be quite unfavourable for the firm, for example, interest rate level, type of repayment schedule, type and size of collateral, etc. At least a bank may require rather high interest payments on its loans due to the high

probability of the firms' default. If a firm is not credible according to its financial documents, a bank will not be interested in attracting it as a potential client but to the contrary will try to insure itself and will spend more effort on checking documentation and evaluating its performance. The costs of this effort and the remaining possibility of the firm's default will then be reflected in the higher interest rate on the loan.

Banks in Russia are information-constrained due to the underdeveloped techniques of information gathering, utilisation and communication in the market. In the absence of standardised accounting documentation, absence of such institutions as credit history, rating agencies, recognised auditing standards,[40] etc some activities like promotion of reputation[41] or signalling devices, can be employed by market agents in their interrelations to reduce informational distortions. In the chapter 6 we will consider the latter mechanism as a possibility to improve and stabilise borrow-lender relationship. Now we will turn to the analysis of the Russian environment specific factors influencing the determination of the interest rate on loans.

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[40] Levine, Loayza and Beck (2000) conducted en empirical analysis of how legal and accounting systems explain differences in the level of financial development. Their results suggest that provision of contract enforcement and creditor rights, legal and accounting reforms can enhance both economic growth and better developed financial intermediation.
[41] Reputation as a self-enforcement mechanism to the credit market was introduced by Wood (1975), and Shapiro (1983) studied the effects of reputation on the equilibrium price and quality in product markets.

5. Banks' decisions on the loan market

5.1 Description of the model

First, we illustrate a lender-borrower relationship as a static two-stage game with imperfect information of banks about the firms' choice of technology. Banks act in the credit market as competing oligopolies[42] and determine the amount of loans provided to the firms.[43] Homogeneous firms are engaged in production using credit resources supplied by the banks in return for a certain collateral. A representative firm's choice of technology depends on the prevailing market interest rate on loans and on the worth of the pledged assets for this particular firm. We restrict our attention to the credit market, given risk-free interest rate, and assume that the bank bears certain costs of dealing with the collateral in case of borrowers default.[44]

Agents are risk neutral expected utility maximisers, which is easier justified for the banks as they diversify risks and allocate their resources in several available market assets.[45]

5.1.1 Firm's problem

Expected profit of a representative firm depends on its choice of technology reflected in a value of project return (Y). Amount of obtained loans, used in production, is normalised to one.

Consider for simplicity two types of technologies available in the market: a modest good technology can bring a certain return of Y_S, while a risky technology provides $\overline{Y}$ and $\underline{Y}$ with corresponding probabilities p and $(1-p)$ with $\underline{Y} < r < Y_S < \overline{Y}$ and $Y_S > E(Y) = p\overline{Y} + (1-p)\underline{Y}$. So in case of risky technology the firm is able to repay a loan only if the good state occurs with probability p. These assumptions on the returns from two available technologies generate a moral hazard problem for a firm.

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[42] According to the number of functioning banks in Russia, oligopolistic competition is a more justifiable and adequate form of market interactions than a monopoly or perfect competition.

[43] Starting from the contribution of Sealey, James and Lindley (1977) behaviour of the financial institutions is analysed not only from the point of view of the portfolio theory but also using a production and cost theory. The authors suggest a model where they consider a financial institution as a profit maximising producer.

[44] Other possible costs (i.e. general costs of lending and attraction of deposits) are assumed to be zero.

[45] It can also be explained by their possibility to buy market portfolio of securities.

If the firm would be able to finance the project independently of the bank, its choice of technology would be different, as it would just maximise expected return and finance all positive net present value projects. In a simple case with borrowing, the firm is concerned only about the upper part of the distribution of risky returns, when it obtains a positive profit and thus the more it can get, even at the expense of a high risk, the better. However, with collateral requirements that formally cover a total size of the loan, the firm will not jeopardise its pledged assets but only if it really value them at least as much as the bank. In the current case, an important role is played by the assumption that valuation of the collateral may be different for the firm and the bank. Banks' requirements for the collateral are given as $L((1+r)+C)$ and bank's appraisal of the collateral is based on its expected market value. If the firm assess its pledged assets according to their real value, it will try to avoid defaults and will prefer a stable technology. But if the collateral is almost worthless for the firm we will be back to the simple case of borrowing with default liability limited only to the obtained return.

In the first case, collateral valuation does not create any specific problems and even stimulate a choice of superior technology. The second case is more interesting and we will use in our analysis some factors that reflect a level of informational transparency, legal enforcement and tightness of the institutional constrains in the society. In a prudent society with a high enforcement level there is less possible for the firms to manipulate information, use falsified documentation and provide an illegal pledge. Let the firm's valuation of collateral be expressed as $v = \gamma Z_i$, where Z_i is the amount of the collateral required by the bank and γ is a parameter reflecting decreased collateral value for the firm due to the illegal manipulations with the pledged assets $(0 \leq \gamma \leq 1)$. Then, γ can represent, for example, a state of the legal enforcement with a high level when $\gamma \rightarrow 1$ and a low level when $\gamma \rightarrow 0$.

We assume that the bank has informational advantage to check a status of the collateral provided by the firm (i.e. property rights, registration of the pledge, etc). So the firm cannot cheat on the bank, and the latter can always legally claim compensation from the pledged assets if the firm defaults on a loan. However, due to the above-mentioned factors the firm has a possibility to pledge illegally the same assets to another market agent, with less informational power than the bank. Then, it will put a very low value on this collateral in a given loan agreement with a bank. Nevertheless, the bank will still have a legal advantage in this case, as it is highly probable that the first pledge will be officially authorised by the court, and the bank will receive a loan repayment from the sold asset.

5.1.2 Bank's problem

There are *N* banks in the market and L_i is the amount of lending chosen by bank *i, i=1...N*. Uncertainty in the credit operations is related to the possibility of borrower's default, expected by the bank with probability *(1-q)*, which depends on the firm's choice of technology and a corresponding probability that obtained return will be insufficient to cover the debt. Then the bank will be confronted with a necessity to undertake a formal legal procedure of claiming compensation from the pledged assets and will incur all associated costs. These costs can include negotiations with the firm's management, costs of the court procedure and organisation of the assets sale, possibly in the form of an auction.

Formally, in the case of borrower's default the bank should obtain a full compensation from the collateral, as it was discussed in the previous chapter the loan agreement requires a collateral that totally covers the debt. This means that the firm pays *(1+r)L_i* from its profit or *((1+r)+C)L_i* from the pledged assets. However, due to the uncertainty associated with the future value of the pledged assets and inefficient legal procedure, future collateral value may be insufficient to cover due debt to the bank. $\widetilde{K}$ is a random collateral value with a probability distribution *f(K)* perceived by the banks when they decide their lending policy. On the one hand, the price of an asset may change during the period of a loan contract and, for example, drop just before the time when it should be realised by the court order. On the other hand, the firm may have a lot of claims from the creditors of the first and second order, while the bank, as a secured creditor, has a right only for compensation in the third order. This specific feature of the current Russian legislation may lead to the situation when the bank is left only with a partial compensation if the firm does not have enough assets to satisfy all claims of its creditors of a higher order.

For a more clear representation, uncertainty created for banks by a firm's default can be expressed by some stochastic parameter ξ (i.e. variance in the collateral price and/or indebtedness of the insolvent firm and demands of its creditors of the order higher than the bank). Then repayment to the bank in the case of the firm's default is expressed as $E\Omega(r,\xi) = E\min\{\widetilde{K}, L_i(1+r(L)+C)\}$. It obtains a full repayment $L_i(1+r(L)+C)$ only if collateral value is sufficient to cover the debt including associated costs, otherwise it obtains some value *K*.

Expected repayment $E\Omega$

$L_i\big[1+r(L)+C\big]$

Realisation of K
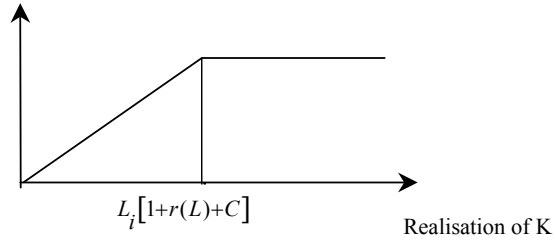
The cost function CL_i is linear in the amount of loan, and we focus only on the costs incurred by the bank in the case of the firm's default on the loan. Opportunity costs of funds are represented by possible investments under the risk-free rate g.

5.2 Equilibrium conditions

We solve the game using backward induction. Knowing a reaction function of the other player, namely the firm, the banks choose amount of loans and thus implicitly determine a prevailing interest rate r, and ask for corresponding collateral. The firm optimises its choice of technology, given r and its own collateral valuation v. A solution of the joint problem will lead to the pure-strategy Nash equilibrium of the game. So we start from the consideration of the firm's problem and its optimal choice of technology.

5.2.1 Optimal conditions for the firm's problem

For the choice of the stable technology the following condition on the firm's expected profit must be satisfied:

$$\left(Y_S - r\right) \geq p\left(\overline{Y} - r\right) + (1 - p)\left(\underline{Y} + 1 - v\right)$$

Then the value, below which the firm's optimal technological choice will coincide with a stable technology, is:

$$(1 + r) - v < \frac{Y_S - p\overline{Y} - (1 - p)\underline{Y}}{(1 - p)} = \widetilde{Y}$$

This expression shows that firm's collateral valuation should not be very low compared with a required gross repayment on loans. For sufficiently low values of v such divergence will exceed the difference between expected returns from the two projects corrected on the probability of the default. It also provides a range of possible collateral values for the firm that for a given interest rate on loans make the firm to choose stable technology. The lower bound on it can be rewritten as:

$$v > (1+r) - \frac{Y_S - E(Y)}{(1-p)}$$

So the critical level for the firm's collateral valuation is then given by:

$$\hat{v} \equiv (1+r) - \widetilde{Y}$$

Remember the expression for the firm's collateral valuation $v = \gamma Z_i$. Then the bank can be sure about the purpose of its loan and the firm will invest in a secure technology if the level of the legal enforcement is high enough to prevent manipulation with the collateral and following low valuation of it by the firm. The critical level $\hat{\gamma}$ is given by:

$$\gamma > \frac{1+r}{1+c+r} - \frac{Y_S - E(Y)}{(1-p)(1+c+r)} \qquad \Leftrightarrow \hat{\gamma} \equiv \frac{1+r-\widetilde{Y}}{1+c+r}$$

The critical level depends on the interest rate on loan, and when the higher is in general the latter the more legal enforcement is necessary in order to prevent weak investments. Hence, the probability of repayment to the bank, which is lower in the case of risky technology, is affected by the collateral valuation through this parameter γ. When $\gamma < \hat{\gamma}$, the valuation is $v < \hat{v}$, and the repayment on the loan will be uncertain and will happen only with a probability p:

$$q = \begin{cases} p_s = 1, & if \ v \geq \hat{v} \\ p_r = p, & if \ v < \hat{v} \end{cases}$$

Thus, from the bank point of view, the repayment on loans depends on these probabilities and they take them into account when considering expected profit from the credit operations.

However, as γ depends on r, it is reasonable to invert this expression and take into account also a bound on the interest rate:

$$r < \frac{\gamma(1+c) - (1-\widetilde{Y})}{1-\gamma} = \hat{R} \tag{1}$$

Under the certain value of the model parameters γ, c, p, Y, the interest rate found from the banks optimality conditions can be below the bound $\hat{R}$. Then under such a contract, the firms will efficiently implement a stable technology. However, it can be optimal for the banks to set a higher interest rate (as under certain parameters $\hat{R}$ can be very low or even negative), which will take into the account risk of the firm's default. So the higher is a comparative expected return from the stable technology and the higher is the

level of legal enforcement γ, so that the firm has less possibilities to manipulate with the collateral, the higher the chance that the firm will implement a stable technology.

5.2.2 Optimal conditions for the banks' problem

The total demand for loans is given by *L(r)*. Each bank maximises its expected profit with respect to the amount of loans extended, L_i, given the inverse demand *r(L)*, $(\frac{dr}{dL} < 0)$ and the optimal choices of other banks L_j, $j \neq i$. If we consider a special case of only two strategically interacting banks, each of them will optimise knowing the downward sloping response function, $L_2(L_1)$ and $L_1(L_2)$, and a negative effect of the decision of the other on the profit and marginal profit of the former. Assuming equal cost functions, banks are equally aggressive in the market and a symmetric Cournot equilibrium occurs at the intersection of their reaction functions.

In a general situation with several banks, a vector L_i, *i=1…N* maximises their expected profit, and banks equally divide the market with each setting $L_i^* = L^*/N$. In the equilibrium the total demand for loans is equal to the total supply at a given interest rate r^*. Then expected profit of the *i*-th bank can be written in the following form:

$$\max_{L_i} E\pi = q\left[L_i\left(1 + r(L_i + \sum_{i \neq j} L_j^*)\right)\right] + (1-q)\left[E\Omega(r,\xi) - C\right] - L_i(1+g)$$

Before we derive the F.O.C. for the profit maximisation, let consider expected value of the repayment in the case of default, assuming a continuous distribution of the collateral value:

$$E\Omega(r(L),\xi) = \int_0^{L_i(1+r(L)+C)} Kf(K)dK + \int_{L(1+r(L))+C_K}^{+\infty}\left(L(1+r(L)+C\right)f(K)dK =$$

$$= E(K) - \int_{L(1+r(L))+C_K}^{+\infty} Kf(K)dK + \left[L(1+r(L)+C)\right]\left(1 - F(L(1+r(L)+C))\right)$$

We will first differentiate this expected default repayment with respect to the amount of loan L_i:

$$\Omega'_{L_i} = \left[1 + r(L^*) + r'(L^*)\frac{L^*}{N} + C\right]\left(1 - F(\frac{L^*}{N}(1+r(L)+C))\right) = \left[1 + r(L^*) + r'(L^*)\frac{L^*}{N} + C\right]\Pr(K \geq Z_i)$$

Then we can implicitly obtain amount of loans for bank i:

$$\frac{\partial E\pi}{\partial L_i} = q\left[1 + r(L^*) + r'(L^*)\frac{L^*}{N}\right] + (1-q)\times\left[1 + r(L^*) + r'(L^*)\frac{L^*}{N} + C\right]\Pr(K \geq Z_i) - (1+g) = 0$$

Adapting the standard approach for oligopolistic model to a particular uncertainty case, this condition can be rewritten in a profit margin form using the elasticity of the demand for loans $\varepsilon(r) = -\frac{\partial L}{\partial r}\frac{r}{L} > 0$

Then, (2) will be given by:

$$\frac{[q + (1-q)\Pr(K \geq Z_i)](1+r) - (1-q)(1-\Pr(K \geq Z_i))C - (1+g)}{r} = \frac{q + (1-q)\Pr(K \geq Z_i)}{N\varepsilon(r)}$$

This expression provides a connection between the market power of the bank and its profit margin on the credit markets.[46] It is possible to consider it as an implicit determination of the optimal interest rate r^* set by the banks on the credit market.

5.3 Model results for the interest rate policy and implications of the asymmetric collateral value

Intermediation margin is a value obtained by the oligopolistic banks in addition to the simple coverage of their risk and costs of the credit. Uncertainty influences the result with a probability that the firm fails on its loan repayment, so the remaining part is due to the probability of obtaining a compensation either from the firm or from the realised collateral: $q + (1-q)\Pr(K \geq Z_i) \leq 1$. The costs, incurred in our model in the case of the firm default, also require a higher interest rate in order to preserve a margin. Hence, the interest rate is affected by the possible default on the loan (risk component), expected costs and risk-free rate. The first two effects alter this case form the standard one. Higher risk-free return required on the market also induces higher interest rates on loans as $\frac{\partial r^*}{\partial g} > 0$. Negative effect of this was clearly seen before the crises of August 1998, when soaring profits obtained through operations with government treasury bills influenced market interest rates. However, in the present conditions when banks are not engage in speculative operations with

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[46] Equation is based on the Lerner index.

government debt and have less possibilities of asset allocation apart of lending, interest rates on loans become more accessible for borrowers.

However, we need to check the condition (1) on the interest rate obtained from (2), as it may be profitable for the bank to decrease it in order to stimulate the firm to choose a stable technology. If (1) is not fulfilled (i.e. $r^* > \hat{R}$), then market conditions are such that an interest rate, under which a stable technology is preferred, is too low to be possible. Firm's collateral valuation is quite low, and it is optimal to invest in a risky technology, which provides a possibility of the loan repayment only in a case of success with a probability p. So the bank optimally insures itself from the risky investment with a high interest rate, and the firm's optimal investment is inefficient.

However, under sufficiently high γ and $\widetilde{Y}$, we can obtain an efficient case, when the firms invest in a stable technology, and the banks obtain a profit with certainty. Then the amount of loans and a corresponding interest rate will be as follows:

$$\max_{L_i} \pi = \left[L_i\left(1 + r(L_i + \sum_{i \neq j} L_j^*)\right) \right] - L_i(1 + g)$$

$$\frac{r^* - g}{r^*} = \frac{1}{N\varepsilon(r^*)}$$

A simple case of constant elasticity will lead to:

$$r^* = \frac{g}{1 - \dfrac{1}{N\varepsilon}}$$

Given comparative returns on a stable and risky technologies, we can influence the size of the parameter γ by improving the legal enforcement in the society and reducing the possibility to manipulate with the pledged property. This will lead to the higher critical level for which a stable technology will prevail in the market. At the same time, decreased risk of the stable investments makes the banks optimal choices of the interest rate lower, given a certain risk-free rate.

However, when the latter case prevails and the firms invest efficiently in the stable technologies, collateral itself may be a source of distortions. Some inefficiency from the social point of view may arise in the case when the firm values its collateral sufficiently high ($v \geq \hat{v}$) and its valuation is even higher than the one used by the bank. It may be the case when the firm has too few assets and they are very valuable for its production technology, need to pledge some materials and divert them from the production process for a period of a

loan, or has made some specific investments into the asset or into the technology related to this particular asset, which it needs to pledge. Then it may value collateral much higher than the market price is (i.e. $v>K$, where δ is a discrepancy between the valuation of the firm and the bank, $\delta=v-K$).

The problem may appear in a more general model, when a stable technology has some probability of success p_s and default $(1-p_s)$, with $p_s\overline{Y}_s+(1-p_s)\underline{Y}_s > p_r\overline{Y}_r+(1-p_r)\underline{Y}_r$ and $\overline{Y}_s > \underline{Y}_r$. Then the firm cannot repay the loan with a probability $(1-p_s)$ and loses its collateral. Such situation can arise also when the firm can be bankrupted by some of its other creditors than bank (the latter will not have a reason to do it if the firm repays its loans). In its production process the firm usually have many relations with other creditors besides the bank. And given a high level of non-payments in the economy even for the stable firms, such a bankruptcy can be quite probable. This will have clear consequences for the social costs and benefits.

A good case when the firm totally repays its obligations obviously results in a positive increment to total surplus, where L – amount of the loan extended, r – interest rate on loans, $r+d$ – return on investment for the firm.

Table 3. Costs and benefits for the agents in the case of repayment of loans

Repayment	For the bank	For the firm	Total
Credit	-L	L	0
Return on credit	(1+r)L	(1+r+d)L-(1+r)L	(1+r)L+dL>0
Profit	rL	dL	RL+dL>0

Obviously, the case of default/bankruptcy has negative consequences on the social surplus. If the firm is not able to repay its loan it loses at least collateral,[47] but probably also other assets and returns in the bankruptcy, if other creditors have claims against the firm. Moreover, the disparity in the perception of the collateral value for the firm and the bank adds its negative impact of size δ along with the cost of bankruptcy.

Table 4. Costs and benefits for the agents in the case of bankruptcy or a default on loans

Case of	For the bank	For the firm	Total

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[47] The pledged assets are sold after the court procedure, which is initiated because of the firm's default.

default						
Credit	K>(1+r)L+c	K<(1+r)L+c	K>(1+r)L+c	K<(1+r)L+c	K>(1+r)L+c	K<(1+r)L+c
	-L-c		L		-c	
Revenue	(1+r)L+c	K	-V+(K-L(1+r)-c)	-V	-δ<0	-δ<0
Profit	rL	K-L-c	L-V+(K-L(1+r)-c)	L-V	-δ-c<0	-δ-c<0

The discrepancy in the collateral valuation increases the costs for the society of such bankruptcy because firm's assets are realised according to the market valuation, while they cost much more for the firm.[48] It is interesting to note that the market price of the asset realisation does not play any role from the social point of view. Even when it is quite high so that the bank does not lose but has a positive profit, the social loss is as high as in the lower market price case.

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[48] Extending the analysis for the third group, i.e. small creditors who may initiate the bankruptcy, will not change the result. Then in addition to the bank loan, the firm obtains from them some payments of a size S. While in the bankruptcy they receive firm's cash flows Y and all that is left from the collateral realization K-L(1+r)-c, in order to compensate for provided S. As before all values cancelled and the total surplus -δ-c obtains, no matter the market value of the collateral.

6. Modelling of the interaction of a bank and a firm in a loan contract

After the consideration of the specific factors influencing the interest rate on loans, let us turn now to a more detailed analysis of the interactions between a representative bank and two types of borrowers. In what follows, we will concentrate less on the case of the firms' default but more on the difference in the firms' ability to repay the loans. In order to get an explicit solution in a convenient form and compare different situations resulting from the solutions of a game, let us simplify further and assume a perfect-competition environment. A representative bank's choice of the interest rate depends on the risk of a particular borrower or of a pool of borrowers if the bank cannot distinguish them. We continue to use a two-stage game-theoretic setup with information asymmetry between the parties. The focus of the model is again maid on the conflict of interest between the firms' owners and outside investors, with the insiders possessing private information about the firms' internal possibilities. A signalling model is used to present some suggestions for the improvement of the bank-borrower relationship, in particular with respect to the possibility to obtain lower repayment on credit for the more reliable group of borrowers.

6.1 Agents choices and key features of the model

All banks are identical and a representative risk neutral bank makes its decision about the rate of return on its loans to the firms depending on what it observes in the market, i.e. a risk-free market interest rate (g) and business prospects of the firms formalised in the expected rates of return on their investments. The firms are identical in all respects except their type (high quality or low quality, expressed in the level if riskiness of their activities), which is their private information. It is possible to consider that all firms are investing in the same project (i.e. each firm is the same project from the bank's point of view) but have different firm-specific investment risks. Such investment possibilities are expressed in terms

of the firm's cash flows with an equal mean for both types and a lower variance for the high type.[49] All firms are rational expected utility maximisers.

Firms need to finance their investments and the only possibility available to them possibility is to obtain a loan from the bank with a requirement to repay with a rate of return (r), specified by the bank.[50] I assume that neither external financing opportunities like using direct debt or equity, nor internal as retained profit are available to them. The former is because I consider only small and medium size firms, some of them are also only at the initial stage of their activities, which makes it difficult to attract external funds in terms of both costs and revenues, especially when financial markets are not very developed. The latter is due to the fact that firms hide profit for tax purposes and thus, even efficient ones, usually do not have a possibility to retain it for investment purposes. I assume here that all firms utilise possibilities arising from legislation inefficiencies and generally low contract enforcement between most of agents in the economy. By tax evasion and tax arrears, postponing payments including debt to suppliers and other trade creditors,[51] and other arrears, firms obtain some amount N of illegal sources. These operations are reflected in the firms' financial statements,[52] so the bank cannot make a distinction between them according to these criteria, assuming bank employees cannot participate in the firm's activities and are not aware personally of the true state of the firm's finance. However, these illegal sources of funds are limited and, which is more important, these funds cannot be used as legal investments.[53] So it cannot be considered as a part of possible financing, and the firm inevitably has to ask for credit in order to exploit available investment opportunities.

Distribution of returns depends on such factors as business environment, style of management or technological capabilities because firms bear different risk in their activity while dealing with partners, deciding on the risky market strategies and executing their projects, etc. But they may also differ in their ability to bribe tax inspectors, to renegotiate debts with creditors and suppliers, and to settle down different conflicts with other market agents, which is reflected in the costs aimed on these purposes. Let k_H and k_L be an "informal

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[49] As it was shown by Giammarino and Neave (1982), in such a case the pecking order hypothesis will result in firms issuing only equity. However, in our model, the opportunity for firms to issue equity is not considered among the available financing choices and the standard pecking order doesn't work.

[50] Let g be a gross interest rates.

[51] A benefit from having overdue debt to trade creditors can be calculated as Q ?g/(1+g), where Q is a size of the debt and g a discount rate.

[52] It's know that most firms in Russia use double accounts and thus, they can have internal financial records reflecting their true state of finance (i.e. the level of profit). It may be argued that they can submit them to the bank, however, we will assume that bank's financial analysts take into account only official documentation, verifies by the tax authorities and external auditors.

costs" for the H- and L-type firms respectively, where $0<k_L<k_H<1$[54]. It is natural to assume that it is easier to utilise illegal funds for the high-risk firm, while H-type firm waste more resources on such "informal costs".

The credit management department of the bank evaluates firms' performance according to observable factors and using credit management theory. First, the bank abolishes apparently inefficient firms and then considers a provision of loans to the rest of the borrowers who satisfy some necessary criteria (i.e. justified purpose of loan, agreement on the collateral and repayment schedule, good credit history, if available, etc). We assume that the firms are similar in these terms and have the same purpose and length of the loan with a possible repayment after the investment return is realised. From now on we will restrict our attention to these particularly chosen firms. The analysis of the firms' investment opportunities provides the bank with an adequate picture of the firms' distribution of risk and return, but it cannot identify which group of firms has higher variance of returns that the other. Consequently, the bank's decision behaviour will be based on its judgement about the share of each group in the considered economy, narrowed in the above-mentioned sense.

The bank offers to the firm a contract *(1, r)* where the amount of the loan and thus of the financing required by the firm amounts to one. We continue to assume here that the firm wishes to finance all positive NPV investments available, hence firms will turn to the bank only if the outside market option g is not too high compared with their expected rate of return from internal investments. The bank in its turn has enough resources to provide but will do it only in return for the adjusted to the risk a repayment rate *r*. The borrowers accept the rate *r* as long as it allows them to obtain a positive gain from investment. This is always the case unless *r* is too high to exceed the maximum investment return, and so the market clears.

The main model assumptions are summarised as followers:

There is no conflict of interest between managers and owners[55], both within the firm and within the bank;

Firms obtain financing only through bank loans and direct it only to their investment opportunities (i.e. no private benefit from it is possible);

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[53] One of the possible explanations can be that they are in the form of "black cash".
[54] It is possible to assume firm's informal costs to be related to its variance by the inverse exponential function:
$k_H = e^{-\sigma_H^2}$, $k_L = e^{-\sigma_L^2}$, which will provide a required relation between the cost of H- and L-type firms.
[55] This is quite relevant for the small and medium size firms and even can be assumed that the firms are managed by their owners.

There is no moral hazard problem neither from the bank's nor from the firm's side. It is not possible to bribe bank managers in order to avoid repayment on the loan, and the firm considers the bank the senior creditor;[56]

All firms evade taxes, and this cannot be efficiently prevented by supervision and legislation;

Officially certified financial documents submitted to the bank serve as a source for the borrower evaluation.

For simplicity, we assume limited liability of the firm and do not consider any significant collateral value that can be realised in the case of default.

According to the priority rules of the Russian bankruptcy legislation the amount of the legal claims on the firm's assets with higher priority than the bank's one can be quite high. While, I assume that exactly in the case when realised investment returns are lower than the repayment, the creditors set up all their claims against the firm and turn it bankrupt. So when the high priority claims exceed the firm liquidation value[57], the bank can be left with nothing, which justifies the last assumption about insignificant realised collateral value in the case of bankruptcy. So we assume that in the case of default a collateral can cover only incurred costs but repayment on loan is zero.

We continue to assume a discrete distribution of the firm's cash flow, where (X^S_H , X^d_H) and (X^S_L , X^d_L) are the corresponding successful and downward investment returns for the H-high type and L-low type firms. These returns have the property that $X^d_L < X^d_H < X^S_H < X^S_H$ and are verifiable by outsiders. Realisations of X have corresponding probabilities (p^S_H , p^d_H) and (p^S_L , p^d_L) with $p^S_H + p^d_H = 1$ and $p^S_L + p^d_L = 1$. These distributions of returns have the following properties:

the mean is equal for both types:

$E(X) = p^S_L X^S_L + (1-p^S_L) X^d_L = p^S_H X^S_H + (1-p^S_H) X^d_H$, and is a common knowledge;

the variance is asymmetric information and is higher for the lower type, which thus bears higher risk in its activities:

$\sigma^2_H = p^S_H (X^S_H - E(X))^2 + (1-p^S_H)(X^d_H - E(X))^2 < p^S_L (X^S_L - E(X))^2 + (1-p^S_L)(X^d_L - E(X))^2 = \sigma^2_L$.

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[56] This means that if the firm is performing good anmail_old can repay its debts, it will always repay the bank loan, while it can extensively delay payments to other creditors. The firm fails to repay the loan only in the case of insolvency, which in the context of our model means that the firm has obtained a return on investment less than the required repayment to the bank.

[57] Not to mention a possibility that the firm possibly has provided a damaged or already pledged assets as a collateral, which also diminishes the realized collateral value.

The distributions of firms' returns, or in other words, the two ways of conducting business activities corresponding to the two types of firms, is a common knowledge, but the bank cannot distinguish between these two types. The only thing that distinguishes them is the variance of the returns, which is private information. So the bank cannot distinguish the firms' type but it assigns a probability λ of the firm being of type H and $1-\lambda$ of type L, which is a common knowledge in the economy according to the relative possible shares of firms with each type of riskiness.

6.2 The model and equilibrium conditions

The bank observes the firms' actions and makes its choice about the interest rate on loans, taking into account its believes about the firm being of some type and relative probabilities of the loan repayment. The probability that the bank will receive its money back (i.e. the ability of the firm to pay its bill to the bank) is connected to the distribution of investment returns. The bank is concerned only about the upper part of the realised distribution, which exceeds the amount of the due debt, when the probability that the rate of return on firm's investment is higher than the required gross repayment rate set by the bank; as otherwise the firm gets bankrupt and the bank obtains nothing. In this competitive economy the size of the interest on loans will be set as a risk adjustment to the observed risk-free rate, assuming for simplicity zero costs of asset-liabilities management (i.e. loans extension and deposits attraction).

Let us consider cases depending on whether the firms' types are known to the bank or not, and how the latter situation can be improved.

Firm's type is a common knowledge

First, suppose that the types of the firms are known and thus the bank can infer probabilities of successful repayment or default. Probabilities of repayment from the lender point of view depend on the interest rate on loan, which it sets. Market competition leads to the following condition for interest rates that maximise bank expected profit for the respective H- and L-type of firms:

$$E\pi - g = 0 \quad ,$$

$$p_H(r_H)r_H + [1 - p_H(r_H)]0 = g \Leftrightarrow \quad r_H = \frac{g}{p_H} \quad ,$$

$$p_L(r_L)r_L + [1 - p_L(r_L)]0 = g \Leftrightarrow and \quad r_L = \frac{g}{p_L} \quad ,$$

where p_H and p_L are corresponding probabilities of the debt repayment by the firms, i.e. probability that realised investment return is higher than required repayment rate on loan r_H and r_L. Thus, depending on the level of the interest risk-free rate g the bank will choose an interest rate on loan, which will affect the probability of repayment. According to the distribution of the firms' returns there are five possible intervals for r, which lead to different repayment probabilities:

$$r < X^d_L \qquad \Rightarrow \quad p_H = p_L = 1 \qquad\qquad\qquad g < X^d_L$$

$$X^d_L < r < X^d_H \Rightarrow \quad p_H = 1, p_L = p^S_L \qquad\qquad X^d_L < g < p_i X^d_H$$

$$X^d_H < r < X^S_H \Rightarrow p_H = p^S_H, p_L = p^S_L, \text{ which is valid when } \quad p_i X^d_H < g < p_i X^S_H, \quad i=H,L$$

$$X^S_H < r < X^S_L \Rightarrow \quad p_H = 0, p_L = p^S_L \qquad\qquad p_i X^S_H < g < p_i X^S_L$$

$$X^S_L < r \qquad \Rightarrow \quad p_H = 0, p_L = 0 \qquad\qquad\qquad p_i X^S_L < g$$

It is clear that the first and the last interval eliminate all uncertainty and will be irrelevant afterwards for the private information case. For the first interval the bank's choice of $r = g$ does not depend on the type, while the last interval eliminates any choices as neither the bank will credit nor the firm will ask for a loan on the conditions that lead to a certain bankruptcy. Initially, which interval r falls in depends on the rate g. And excluding extreme cases it is natural to assume that market risk-free rate is higher than the lowest possible return and is lower than the highest possible investment return. Hence from now and on we will concentrate attention on three interim intervals.

It is easy to see that in the fourth interval is valid, the H-type firm will not receive any financing. But in the second interval, it obtains a lower rate on loans, i.e. $r = g$, than the L-type firm. H-type firms cannot borrow in the fourth interval, as, due to level of the prevailing risk-free market rate, the return required by the bank is so high that it can attract only very risky borrowers. Relative size of the interest rate in the third interval will depend on the ratio p^S_H / p^S_L. So if we assume $p^S_H > p^S_L$ and thus, always higher probability of repayment for the H-type, the interest rate on loan will be decreasing in the firms' type.

Consequently, in the case of observable information, H-type firms can enjoy borrowing on better terms as the bank sets a higher interest rate to the riskier firms of type L.

These results are quite natural for the credit market when banks can provide more favourable conditions for more reliable firms. At the same time, banks compensate themselves with a higher interest rate required from firms which returns are more uncertain.

Firm's type is private information

As it was already mentioned above the bank actually cannot distinguish between firms' types, as all considered firms independent on their efficiency avoid taxes and postpone payments, which negatively influence their financial statements and distort the real picture of their operations. Bank's choice of the interest rate is guided by its beliefs - probability with which it can observe each firms' type. Then the bank revises its beliefs depending on the observed firms decisions about getting financing from the bank so that the banks actions and its beliefs are consistent with the firms actions.

Thus, in the case of asymmetric information the bank will choose a common rate r for both types of firms according to the following:

$$E\pi - g = 0$$

$$\lambda\left[p_H r + (1 - p_H)0\right] + (1 - \lambda)\left[p_L r + (1 - p_H)0\right] = g$$

$$r = \frac{g}{\lambda p_H + (1 - \lambda)p_L}$$

$$\frac{dr}{d\lambda} = -\frac{g}{\left[\lambda p_H + (1 - \lambda)p_L\right]^2}(p^S_H - p^S_L) < 0 \quad when \quad p^S_H > p^S_L$$

Here we should further take into consideration all three mentioned above as relevant for the problem intervals for the interest rate on loans and different possible types of banks beliefs.

Pooling beliefs:

We will consider possible choices of interest rate when the bank assigns a probability λ that it is a H-type firm that borrows, and a probability 1-λ that it is a L-type firm.

1. In case $X^d_L < r < X^d_H$, with the rate $r = \dfrac{g}{\lambda + (1 - \lambda)p^S_L}$ set by the bank if the risk-free market return is observed on the level $X^d_L < g < X^d_H [\lambda + (1-\lambda)p^S_L]$, H-type firms repay with certainty and L-type with a probability p^S_L.

Then H-type expected profit is: $N(1 - k_H) + p^S_H(X^S_H - r) + (1 - p^S_H)(X^d_H - r)$

L-type expected profit is[58] : $N(1-k_L) + p^S_L(X^S_L - r)$.

2. In case $X^d_H < r < X^S_H$, with the rate $r = \dfrac{g}{\lambda p^S_H + (1-\lambda)p^S_L}$ set by the bank if the risk-free market return is observed on the level $X^d_H[\lambda + (1-\lambda)p^S_L] < g < X^d_H[\lambda p^S_H + (1-\lambda)p^S_L]$, H-type firms repay with a probability p^S_H and L-type with the same probability p^S_L. Then H-type receives $N(1-k_H) + p^S_H(X^S_H - r)$ and the form of expected profit of the L-type firm is the same as in the previous case.

3. In the last considered case when $X^S_H < r < X^S_L$, with the rate $r = \dfrac{g}{p^S_L}$ set by the bank if the risk-free market return is observed on the level $X^d_H[\lambda p^S_H + (1-\lambda)p^S_L] < g < X^S_L p^S_L$ H-type firms cannot repay any loan while L-type repays with the same probability. Then H-type does not obtain a loan and receives only $N(1-k_H)$, while the form of type-L expected profit is maintained unchanged.

It follows that L-type firms will always apply for a loan and invest, disregarding the interest rate level, as it always obtains a positive expected profit from such investments due to the upper part of its returns distribution. H-type firms, on the other hand, refrain from investing in the latter case with a high required rate of return on bank loan relatively to its investment returns. Hence, we obtain a pooling equilibrium in all cases except the last one, when $X^S_H < r < X^S_L$.

Separating beliefs:

When the bank separates firms it is necessary to consider the situation when it assigns beliefs λ=0 to the H-type firm, which never borrows, and believes 1-λ = 1 to the L-type firm, who are the only possible borrows. The opposite situation is never possible as L-type firms always borrows and invest. Then the first two intervals are not relevant as H-type has relatively high investment returns and will borrow, which is inconsistent with the initial separating beliefs of the bank. Thus, we will check the later case, when $X^S_H < r < X^S_L$, with the rate $r = \dfrac{g}{p^S_L}$ set by the bank if the risk-free market return is observed on the level $X^S_H p^S_L < g < X^S_L p^S_L$. As before H-type firms cannot repay any loan with such an interest rate and will not borrow. Thus, on this interval banks beliefs are supported by the firms' actions

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[58] When the firm fails to repay its loan obligations and goes bankrupt its returns equal zero as all formal assets are

and a separating equilibrium obtains with H-type left with only $N(1-k_H)$ and L-type receiving: $N(1-k_L) + p^S{}_L(X^S{}_L - r)$.

Consequently, taking into account all possible ranges for the interest rate, we obtain a pooling in the first two cases and a separating equilibrium in the third case. The latter is characterised by the underinvestment from the H-type firms and worsening of the quality of the firms, which borrow from the bank.

6.3 Signalling possibilities of the firms

All firms get some utility from the illegal funds and it is costly for them to cancel "cheap" resources. However, they cannot finance investments with these funds and need to borrow under the interest rate r. At the same time, the firms are indistinguishable for the bank and this influence obtained by them interest on loans. Thus, H-type firms have either to mix up with the L-type and to repay loans with a high interest due to the high uncertainty of the lender, or try to signal their quality and less risky performance. In order to provide an adequate signal to the bank H-type firms should undertake an action that cannot be imitated by the L-type firms. By refraining from the illegal sources of money firms can prove their belonging to the high type by the quality of their financial records, which not always can be copied by the low-type firms. If such signal is credible it is rewarding, since the bank will then distinguish the H-type from the total pool by its signal. It will adjust its beliefs accordingly and set an interest rate specifically to each type of firms according to the case when types were fully observable. Thus, H-type will gain in the possibility to obtain cheaper bank loans. However, the signal will be credible if it is really valuable for the H-firms to send it and it is not worthwhile for the L-type to imitate it. Thus, to prove existence of a signalling equilibrium we need to show that cutting off N is profitable for the H-firm in return for the corresponding to its type interest rate on loans, and cannot be mimicked by the L-firms at least for some values of illegal funds, and some or all ranges of interest rate r.

We need to check the following conditions: $EU_H{}^{signal} \geq EU_H$ and $EU_L{}^{signal} \leq EU_L$.

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liquidated, but the amount of illegal benefits N(1-k) is saved.

1. Case $X^d_L < r < X^d_H$, with a rate $r^{signal} = g$ when the lender recognises a signal from the H-type firms and reviews his believes setting $\lambda=1$ and $(1-\lambda)=0$, and a

$$r = \frac{g}{\lambda + (1-\lambda)p^S_L} \text{ otherwise.}$$

It is profitable for the H-type firms to signal if:

$$p^S_H(X^S_H - g) + (1 - p^S_H)(X^d_H - g) > N(1 - k_H) + p^S_H\left(X^S_H - \frac{g}{\lambda + (1-\lambda)p^S_L}\right) +$$

$$+ (1 - p^S_H)\left(X^d_H - \frac{g}{\lambda + (1-\lambda)p^S_L}\right)$$

This is fulfilled when they have illegal funds in the amount not higher than some limit $\hat{N}$: $N < \frac{g(1-\lambda)(1-p^S_L)}{(1-k_H)\left[\lambda + (1-\lambda)p^S_L\right]} = \hat{N}^1$,

where subscript 1 stands for the first case when level of the observed market risk-free rate falls in the corresponding interval.

$$\frac{\partial \hat{N}^1}{\partial g} > 0$$

$$\frac{\partial \hat{N}^1}{\partial \lambda} = -\frac{g(1 - p^S_L)}{(1 - k_H)\left(\lambda + (1-\lambda)p^S_L\right)^2} < 0$$

$$\frac{\partial \hat{N}^1}{\partial p^S_L} = -\frac{g(1 - \lambda)}{(1 - k_H)\left(\lambda + (1-\lambda)p^S_L\right)^2} < 0$$

$$\frac{\partial \hat{N}^1}{\partial k_H} > 0$$

These results mean that the higher is the risk-free market rate, so that H-type is more discriminated by the level of loan repayment relative to its quality, the more valuable is signalling for the H-type firms and they will do it even when they have to give up quite large sums of illegal sources. If there are many H-type firms in the market relative to the L-type firms, from which the former try to distinguish themselves, high quality firms are ready to sacrifices less amount of funds. Signalling is less valuable if there are few L-type firms and thus interest rate set by the bank in the pooling equilibrium is quite acceptable. Also better repayment possibilities of the L-type firms have the same negative influence on the willingness of H-firms to signal. The last condition shows that the more costly is for the firm to hide taxes the more likely it will refrain from doing it in order to obtain better loan conditions.

At the same time L-type firms will not mimic actions of the H-type if:

$$p_L^S(X_L^S - g) < N(1-k_L) + p_L^S\left(X_L^S - \frac{g}{\lambda + (1-\lambda)p_L^S}\right) \quad \Leftrightarrow$$

$$N > \frac{gp_L^S(1-\lambda)(1-p_L^S)}{(1-k_L)\left[\lambda + (1-\lambda)p_L^S\right]} = \widetilde{N}^1$$

It is not profitable for the low quality firms to imitate the high ones if such action requires refusing from sufficiently large amounts of illegal resources. Clearly $\widetilde{N}^1 < \hat{N}^1$, so a standard condition for a signalling equilibrium to hold is that it is necessary for the H-type firms to give up at least amount $\widetilde{N}^1$. However, in our model it should be interpreted in a different way. The H-type firms will send a credible signal to the bank if the amount of illegal funds that they need to refrain from falls into the interval $(\widetilde{N}^1, \hat{N}^1)$, because they need to retrain from the whole sum N and it should be sufficient to prevent others from mimicking.

So in terms of market parameters when a risk-free rate is rising, this interval is also increasing because of the larger increase in $\hat{N}^1$ than in $\widetilde{N}^1$. So the equilibrium will hold for higher values of illegal funds and high value firms will be willing to give up larger sums that certainly will not make worthwhile for the low type to mimic. However, when the overall quality of the firms is improving this interval getting smaller and even much smaller by the larger decrease in $\hat{N}^1$ than in $\widetilde{N}^1$. A possibility of the equilibrium in this case can be justified by the fact that less tax evasion and overdue debt will be relevant for economy with the increased quality. But those H-type firms that pursue to maintain large arrears will not be interested to distinguish themselves from the pool.

2. Case $X_H^d < r < X_H^S$, with the rate $r^{signal} = \frac{g}{p_H^S}$ when signal and

$r = \frac{g}{\lambda p_H^S + (1-\lambda)p_L^S}$ otherwise.

It is profitable for the H-type firms to signal if:

$$p_H^S(X_H^S - \frac{g}{p_H^S}) > N(1-k_H) + p_H^S\left(X_H^S - \frac{g}{\lambda p_H^S + (1-\lambda)p_L^S}\right) \quad \Leftrightarrow$$

$$N < \frac{g(1-\lambda)(p_H^S - p_L^S)}{\left(\lambda p_H^S + (1-\lambda)\right)p_L^S\left(1-k_H\right)} = \hat{N}^2$$

where:

$$\frac{\partial \hat{N}^2}{\partial g} > 0, \frac{\partial \hat{N}^2}{\partial \lambda} < 0, \frac{\partial \hat{N}^2}{\partial k_H} > 0,$$

$$\frac{\partial \hat{N}^2}{\partial p_H^S} = \frac{g(1-\lambda)p_L^S}{(1-k_H)\left(\lambda p_H^S + (1-\lambda)p_L^S\right)^2} > 0, \frac{\partial \hat{N}^2}{\partial p_L^S} = -\frac{g(1-\lambda)p_H^S}{(1-k_H)\left(\lambda p_H^S + (1-\lambda)p_L^S\right)^2} < 0$$

The non-mimicking condition in this case is fulfilled if:

$$p_L^S(X_L^S - \frac{g}{p_H^S}) < N(1-k_L) + p_L^S\left(X_L^S - \frac{g}{\lambda p_H^S + (1-\lambda)p_L^S}\right) \quad \Leftrightarrow$$

$$N > \frac{g(1-\lambda)(p_H^S - p_L^S)}{\left[\lambda p_H^S + (1-\lambda)p_L^S\right](1-k_L)} \frac{p_L^S}{p_H^S} = \tilde{N}^2$$

As $\tilde{N}^2 < \hat{N}^2$ is fulfilled for $p^S{}_H > p^S{}_L$, $k_H > k_L$ we will again have a signalling equilibrium for a corresponding level of N.

It follows that in the case when the risk-free rate interest rate level is near but below average returns in the economy the critical levels for credible signalling possibilities depend also on the difference in the probabilities of successful outcomes for the H- and L-type firms. It is exactly the probabilities of repayment to the bank by these firms. If firms' return distributions do not differ in this respect then they will be completely alike from the lender point of view.

At the same time it can be seen from the conditions on g that if it is equal to *E(X)* we encounter in the situation of the case 3 with no borrowing by the H-type firms.

It is interesting to notice that for some level of g we will have a subcase in which signalling can be even more profitable for the H-type as they will receive a risk-free rate $r^{signal} = g$ and will be able to repay the loan with certainty as in the first case.

$$p_H^S(X_H^S - g) + (1 - p_H^S)(X_H^d - g) > N(1-k_H) + p_H^S\left(X_H^S - \frac{g}{\lambda p_H^S + (1-\lambda)p_L^S}\right) \quad \Leftrightarrow$$

$$N < \frac{X_H^d(1 - p_H^S)}{(1-k_H)} + \frac{g(1-\lambda)(p_H^S - p_L^S)}{(1-k_H)\left[\lambda p_H^S + (1-\lambda)p_L^S\right]}$$

Then the critical value is higher and this confirms improving possibilities for signalling.

But in order to obtain a possible equilibrium region for N we need the following conditions for L-type to be satisfied:

$$p_L^S(X_L^S - g) < N(1-k_L) + p_L^S\left(X_L^S - \frac{g}{\lambda p_H^S + (1-\lambda)p_L^S}\right) \quad \Leftrightarrow$$

$$N > p_L^S \frac{g(1-\lambda)(p_H^S - p_L^S)}{(1-k_L)[\lambda p_H^S + (1-\lambda)p_L^S]}$$

However, critical level for L-type firms is lower now as we miss a multiplicative term $1/p_H^S > 1$. Consequently, existence of such subcase can give the best signalling possibilities and higher occurrence of the equilibrium.

3. The third case corresponds to the polling interest rate in the rage $X_H^S < r < X_L^S$, which creates infeasibility of the loan for the H-type firms. However, for some levels of the risk-free rate signalling can be possible even in this case, as signal will correspond to revised beliefs and the level of r that encourages to signal. The level of g for which the interest rate on loans for the H-type will be set as in the second case between X_H^S and X_L^S is $X_H^d [\lambda p_H^S +(1-\lambda)p_L^S] < g < X_H^S p_H^S < E(X)$. Then H-type can obtain interest rate $r^{signal} = \frac{g}{p_H^S}$ by signalling if the following two conditions are fulfilled:

$$p_H^S(X_H^S - \frac{g}{p_H^S}) > N(1-k_H) \quad \Leftrightarrow \quad N < \frac{p_H^S X_H^S - g}{1-k_H} = \hat{N}^3$$

$$p_L^S(X_L^S - \frac{g}{p_H^S}) < N(1-k_L) + p_L^S(X_L^S - \frac{g}{p_L^S}) \quad \Leftrightarrow \quad N > \frac{g(p_H^S - p_L^S)}{p_L^S(1-k_L)} = \widetilde{N}^3$$

From the comparison of the critical levels we can see that equilibrium can be obtained in this case also, as $\hat{N}^3 = \dfrac{p_H^S X_H^S - g}{1-k_H} > \dfrac{g \dfrac{p_H^S}{p_H^S} - g}{1 - k_L} = \widetilde{N}^3$ is fulfilled for $g < p_L^S X_H^S$.

6.4 Policy recommendations for the market for corporate loans

We will summarise obtained results in the table below:

Table 5. Signalling equilibrium conditions

Level of rate r with signalling	$\widetilde{N}$	$\hat{N}$
$r^{signal} = g$	$\dfrac{gp_L^S(1-\lambda)(1-p_L^S)}{(1-k_L)\left[\lambda+(1-\lambda)p_L^S\right]}$	$\dfrac{g(1-\lambda)(1-p_L^S)}{(1-k_H)\left[\lambda+(1-\lambda)p_L^S\right]}$
$r^{signal} = \dfrac{g}{p_H^S}$	$\dfrac{g(1-\lambda)(p_H^S-p_L^S)}{(1-k_L)\left[\lambda p_H^S+(1-\lambda)p_L^S\right]}\dfrac{p_L^S}{p_H^S}$	$\dfrac{g(1-\lambda)(p_H^S-p_L^S)}{(1-k_H)\left[\lambda p_H^S+(1-\lambda)p_L^S\right]}$
$r^{signal} = g$	$p_L^S\dfrac{g(1-\lambda)(p_H^S-p_L^S)}{(1-k_L)\left[\lambda p_H^S+(1-\lambda)p_L^S\right]}$	$\dfrac{X_H^d(1-p_H^S)}{(1-k_H)}+\dfrac{g(1-\lambda)(p_H^S-p_L^S)}{(1-k_H)\left[\lambda p_H^S+(1-\lambda)p\right.}$
$r^{signal} = \dfrac{g}{p_H^S}$	$\dfrac{g\left(\dfrac{p_H^S}{p_H^S}-1\right)}{1-k_L}$	$\dfrac{p_H^S X_H^S-g}{1-k_H}$

A signalling equilibrium was obtained in all four considered situations. The most important influence from the market on the likelihood of the occurrence in one of the considered cases is by the risk-free rate g. This rate can be formally considered on the level of the current refinancing rate set by the Central Bank. Referring to the financial and economic situation on the Russian market as described in the sections 2.2 and 2.3 it is more likely that this rate will lead to the second and third case as normal returns in the economy are still quite low in comparison with financial market returns. Thus, in absence of signalling possibilities we can have a situation with underinvestment by the high quality firms. Moreover, this will force banks to require a high return on their loans, which will attract only risky borrowers and worsen the pool of potential clients of the bank. Hence, a situation when banks have to increase their credit portfolios because of the absence of other profitable financial opportunities will expose them to a much higher risk. This can lead to high rate of defaults on loans and increased levels of overdue debt on their balances.

A possibility to provide a credible signal to the bank can be very valuable for the H-type firms in terms of obtaining adequate to its quality interest rate on loans and a possibility to invest in a positive NPV projects in the latter case. In order to obtain lower interest rate it is worthwhile for these firms to reschedule their payments in such a way that they avoid any arrears and thus improve their financial record. It is natural to assume that the size of these arrears can be sufficiently small relative to the investment levels and it will be profitable to signal. While, for the L-type firms these funds are more valuable relative to the gain from cheaper credits. This happen both due to the lower informal costs of illegal funds and the whole structure of distribution of their investment returns. Moreover, riskiness of their returns makes them enjoying borrowing and thus investing in all considered cases.

So we can conclude that signalling by the improvement of financial records and refraining from different forms of arrears by high quality firms in their economic activity creates a possibility to distinguish them from other firms. This in turn will result in lower interest rate on loans as the bank with have incentives to favour this group of borrowers and will require less return given higher probability of obtaining it. However, the H-type firms are worse off comparing with the full-information case as they pay informational signalling costs, while L-type have the same outcome.

H-type's benefit form signalling compared with the private information case can be expressed in terms of saving on the interest on loans, while signalling costs equal to N. An important feature of the model is that these costs are neither a deadweight loss of the economy nor any wasted resources by the firms. These amounts is labelled costs only because it reduces firms profit and is sacrificed in order to prove its quality by the ability to do it. So these payments are going to their claimants and beneficial for the whole economy and from the social point of view.

It is difficult and demanding to implement at once an efficient mechanism of legal enforcement, improve interactions between agents and confine all forms of illegal evasions. At the same time valuable effect can be obtained not only by legal procedures and enforcement but also by stimulating agents' incentives and also norms of behaviour. "What is important is to recognise that changing of social norms can alter not only society but even the prices of goods and loans."[59]

How can policymakers encourage and promote signalling by the agents? There are several possibilities to promote better performance. For example, costs and risks of illegal

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[59] Basu (1984)

operations should be quite high. Then it would be unprofitable for most of the agents to stick to illegal methods and resources. Those who can benefit from legitimate behaviour should have enough incentives to provide convincing signals, which is a form of sharing private information and adding more certainty in relations between agents.

At the same time, while high market rates and thus a risk-free rate observed by the bank formally stimulates signalling it is a dangerous factor as it leads to negative results. Market interest rate should not be higher than the average return for productive firms because financing and associated development will be unaffordable. However, even being lower than average return, risk-free rate can dangerously increase an uncertainty in repayments and even in extreme - impossibility to borrow by both types of firms. Then only exceptionally risky businesses, which are out of the consideration of this model, will survive and apply for bank loans.

Another important mode of promoting signals concerns their costs. There are two sides of the problem: too low and too high costs. If signals are almost costless they may bring no information or be falsified and thus, be not credible. At the same time, agents will have no chance to benefit from signalling when is costs are too high. Concerning this particular model it means that a share of illegal funds utilised by the firms in the economy comparing to their financing needs should fall exactly into the equilibrium interval in each considered case of observed rate *g*, if we require a full signal, i.e. a complete indication of quality by showing *N=0*, to realise.

It is natural that a decrease in the risk-free rate will make mimicking less profitable for the L-type firms. But apart of this in order to prevent falsified signals in the economy where credible business reputation is still not very common, it is necessary to improve requirements to the business conditions and technological process. It will positively influence firms' quality by decrease managerial ambitious in taking extensive risks. It may have an ambiguous result for the signalling critical level as higher λ and lower costs *k* (due to lower σ^2) will decrease $\widetilde{N}$ and $\hat{N}$. While restricted financial reporting and unified standards of financial accounting together with general improvement in financial discipline can also cause higher informal costs for L-type firms, which increases $\widetilde{N}$. It is more natural that the total effect will be in favour of lower $\widetilde{N}$. At the same time financial discipline will also create a proper environment and incentives for more ordered and payments in the

economy and thus total level of illegal funds utilised by the firms will be lower. All these can serve as possible signal facilitation devices according to this model.[60]

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[60] Cooper (1992) studied a signal facilitation approach for the market of used cars.

7. Conclusion and extensions

Complex informational and legal environment creates additional uncertainty for the banks in their lending to the non-financial sector. Complicated bankruptcy law and cumbersome procedure of collateral realisation would decrease possible returns to the banks if they do not take these factors into account. The first model shows that apart of the effects of the oligopolistic competition the level of the interest rate on bank loans is influenced by the uncertainty of repayment, and following uncertain and costly procedure of compensation from the pledged assets. However, borrowers have an opportunity to manipulate with pledged assets, which results in a lower valuation of the pledged assets than their market value. As a consequence, relatively high repayment on loans, required by banks due to the high uncertainty and costs, together with the eroded collateral value, as view by the firms, may lead latter to choose a risky technology. This happen when high cost of loans along with a low level of prudence, reflected in lack of informational transparency and absence of the efficient enforcement mechanisms, create disincentives to use a stable technology. At the same time, improvement in the legal enforcement and relatively low interest rates will make a stable one more profitable.

The model may be developed further in the attempt to reduce investments in the risky technology and avoid a situation when such investments can be profitable for the firm. It is interesting to obtain some incentive mechanism that will motivate the firm to invest efficiently. In a more complicated version of the model the required size of the collateral may be also endogenously determined in the model. As a possible extension, collateral value may be derived as a bargaining solution between the bank and the firm. The game can be played in tree stages with a bargaining over collateral on the last stage. Then the optimal solution will depend on the agents bargaining power in addition to their profit parameters.

Providing a linkage from actual lenders (depositors) to borrowers, banks also have to be able to establish the creditworthiness of potential borrowers. Our model shows that banks are able to improve their strategies on the credit market even in the current situation of high uncertainty and doubtful returns if credible signals from their clients are possible. By building more transparent relationships with banks and other market agents and providing good quality financial records borrowers will be able to send such signal. The model results suggest that firms can adjust their behaviour by refraining from chronicle non-payments if

they need investments in their production process and can give up illegal funds in return for milder credit conditions. This will serve as an indication of their efficient performance and ability to repay loans. The bank then conducts a particular credit policy separating high-risk borrowers from the low-risk ones and adjusts its interest rate on loans accordingly. L-type firms will continue to borrow even at a high rate as limited liability and high upper values of their return distribution still make them to benefit from investing than from forgoing the project. What is more important, high quality firms will be rewarded by banks with lower interest rate on loans and will be able to finance their investment needs with lower costs. In an extended version this model can be combined with the previous one. Then both collateral requirement and interest rate on loans will be determined from the banks' problem in such a way that the moral hazard is prevented and the firms invest efficiently. However, this analysis may become very complicated due to the presence of both hidden action and hidden information problem, as the firms still need to distinguish themselves for the banks and provide a credible signal. In addition to the mentioned conditions, it is possible to extend the analysis for a continuum of types and some form of the continuos investment return distribution. This can be a task for the further research.

References

I. Refered to in the text:

Allen, F. and A.M. Santomero (2001): «What do financial intermediaries do?», *Journal of Finance* 25, 271-294.

Basu, K. (1984): «*The Less Developed Economy. A critique of Contemporary Theory*», Basil Blackwell, Oxford.

Beck, T., R. Levine and N. Loayza (2000): «Finance and the source of growth», *Journal of Financial Economics* 58, pp. 261-300.

Ber, H., Y. Yafeh and O. Yosha (2001): «Conflict of interest in universal banking: Bank lending, stock underwriting, and fund management», *Journal of Monetary Economics* 47, 189-218.

Berger, A. N. and Robert DeYoung (1997): «Problem loans and cost efficiency in commercial banks», *Journal of Banking & Finance* 21, 849-870.

Berger, A. N. and G.F.Udell (1995): «Relationship lending and lines of credit in small firm finance», *Journal of business* 68, 351-381.

Best, R. and H. Znang (1993). «Alternative information sources and the information content of bank loans», *Journal of Finance* 48, 1507-1522.

Besanko, D. and A.V. Thakor (1987): «Collateral and rationing: sorting equilibria in monopolistic and competitive credit markets», *International Economics Review* 28, 671-690.

Bester, H. (1985): «Screening versus rationing in credit market with imperfect information», *American economic Review* 75, 850.855.

Biais, B. and C. Gollier (1997): «Trade credit and credit rationing», *Review of Financial Studies* 10, 903-937.

Billett, M.T., M. J. Flannery and J. A.Garfinkel (1995): « The effect of lender identity on a borrowing firm's equity return», *The Journal of Finance* 50, pp. 699-718.

Boot, A. W. and A. V. Thakor (1997): « Financial system architecture », *The Review of Financial Studies* 10, 693-733.

Boyd, J. H. and E. C. Prescott (1986): «Financial intermediary coalitions», *Journal of Economic Theory* 38, 211-232.

Campbell, T. (1979) «Optimal investment financing decisions and the value of confidentiality», *Journal of Financial and Quantitative Analysis* 14, 913-924.

Campbell, T. and W. Krakaw (1980): «Information production, market signalling, and the theory of intermediation», *Journal of Finance* 35, 863-882.

Cooper, T. E. (1992): «Signal facilitation: a policy response to asymmetric information», *Journal of Business* 65, 431-450.

Christopher, J. (1987): «Some evidence on the uniqueness of bank loans», *Journal of Financial Economics* 19, 217-235.

Degryse, H. and S. Ongena (2001): «Bank relationships and firm profitability», *Financial Management* 30, 9-34.

Dewatripont, M. and E. Maskin (1995): «Credit and efficiency in centralized and decentralized economies», *The Review of Economic Studies* 62, 541-555.

Diamond, D. (1984): «Financial intermediation and delegated monitoring», *review of Economic studies* 51, 393-414.

Edwards, F. R. and F. S. Mihkin (1995): «The decline in traditional banking: implications for financial stability and regulatory policy», Federal Reserve Bank. New York, Economic Policy Review.

Fama, E. (1985): «What's different about banks?», *Journal of Monetary Economics* 15, 29-36.

Igawa, K. and G. Kanatas (1990): «Asymmetric information, collateral, and moral hazard», *Journal of Financial and Quantitative Analysis* 25, 469-490.

Jaffee, D. and T. Russell (1976): «Imperfect information, uncertainty and credit rationing», *Quarterly Journal of Economics* 90, 651-666.

James, C. (1987): «Some evidence on the uniqueness of bank loans», *Journal of Financial Economics* 19, 217-235.

Lenard, H. and D. Pyle (1977): «Informational asymmetries, financial structure and financial intermediaries», *Journal of Finance* 32, 371-387.

Levine, R. (1997): «Financial development and economic growth: views and agenda», *Journal of Economic Literature,* vol. XXXU, 688-726.

Levine, R., N. Loayza and T. Beck (2000): «Financial intermediation and growth: Causality and causes», *Journal of Monetary Economics* 46, 311-77.

Lummer, S. L. and J. J. McConnell (1989): «Further evidence on the bank lending process and the capital-market response to bank loan agreements», *Journal of Financial Economics* 25, 99-122.

«*Neformalnyi Sektor v Rossiiskoj Ekonomike*». (Informal Sector in Russian Economy), Dolgopyatova (eds) (1998). Moscow. ISARP.

Peek, J. and E. S. Rosengren (1998): «The evolution of bank lending to small business». *Federal Reserve Bank of Boston, WP.*

Scholtens, B. and D. van Wensveen (2000): «A critique on the theory of financial Intermediation», *Journal of Banking and Finance* 24, 1243-1251.

Sealey, C. W., Jr. James and T. Lindley (1977): «Inputs, outputs, and a theory of production and cost at depository financial institutions», *Journal of Finance* 32, 1251-1266.

Shapiro, C. (1983): «Premiums for high quality products as returns to reputations», *Quarterly Journal of Economics* 98, 659-680.

Sharpe, S. A. (1990): «Asymmetric information, bank lending and implicit contracts: a stylised model of customer relationships», *Journal of Finance* 45, 1069-1087.

Stiglitz, J. E. and A. Weiss (1981): «Credit rationing in markets with imperfect information», *The American Economic Review*, 71, 393-410.

Thakor, A.V. (1996): «Capital requirements, monetary policy, and aggregate bank lending: theory and empirical evidence», *Journal of Finance* 51, 279-324.

II. Not specifically refered to in the text but used in writting the thesis:

Freixas, X. and J. C. Rochet (1997): «*Microeconomics of Banking*», Cambridge. MIT Press.

Mazzoli, M. (1998): «*Credit, Investment and Macroeconomy*». Cambridge University Press.

Salanie, B. (1996): «*The Theory of Contracts*». Cambridge. MIT Press.

Salanie, B. (1997): «*The Economics of Contracts*». Cambridge. MIT Press.