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ВЫПУСКНАЯ КВАЛИФИКАЦИОННАЯ РАБОТА

на тему: Markets with Mixed Ownership Structure

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Introduction.

In the paper, I will discuss Russian banking industry in the context of markets with mixed ownership structures, i.e. markets, where one or more participants (but not all) are at least partially owned by the government or other state authorities. Usually, such markets are modeled as oligopolies with very few number of participants (particularly, two), while for the Russian banking industry the Forchheimer's model of price leadership is much more suitable: there are more than 800 participants in it, while only few of them hold significant share of the market, and these few are partially controlled by the Russian government.

Firstly, I will outline the theoretical and empirical basis for the model.

Then, I will derive equilibriums and their key parameters (such as total welfare in the equilibrium) for three different cases: perfect competition, price leadership of privately owned bank and price leadership of bank partially (or fully) controlled by the government.

On the basis of derived equilibriums, I will formulate some policy implications under certain conditions, specified at the beginning of the paper.

The main result is that in terms of total welfare of the society perfect competition is the best market structure, price leadership of the bank, controlled by the government is the second-best option, and price leadership of privately owned bank is the least desirable market structure out of the market structures examined. So, introduction of price leader, controlled by the government, can be justified only in the case of price leadership of privately owned bank, while in the case of perfect competition it is obviously a bad decision.

Moreover, under certain conditions, the only thing that should create an incentive for the Central Bank to bind the number of participants of the banking industry is the costs of monitoring of the banks. In this context, the recent policy of increased capital requirements in banking industry in Russia can be considered as questionable.

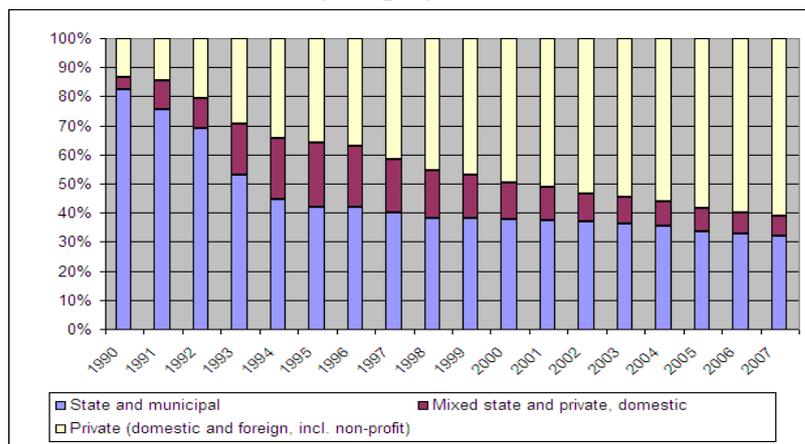
Review of the literature.

Sometimes, the economic sphere in Russia is called “Government capitalism”. It means that quite in every industry one or more players is directly controlled or owned by the government. So, obviously, quite every market in Russia can be called a market with mixed capital structure.

This statement can be verified by the following empirical evidence:

According to the evidence of Carsten Sprenger, presented at the OECD Roundtable on Corporate Governance of SOEs (2008), before the crisis of 2008-2009, the government ownership of companies in Russia has been declining, though remaining rather large.¹

Share by employed staff



However, after the crisis, the government ownership in Russia increased substantially: by 2011, government-controlled firms account for 60% of market capitalization.²

Thus, Russia is exactly the country in which the issues of state ownership, and thus, of markets with mixed capital structures, are especially timely.

From my point of view, banking sphere is one of the most important industries of every country (if it is developed enough) due to the fact that specifics of the industry allow the participants of this market to influence to some extent the development of the country as a whole. What I am trying to say, is that the decisions of banks regarding financing of the investment projects in the country can greatly influence the direction of development of the country. Moreover, though deposit and loan mechanisms the participants of the market can to some extent redistribute the income in the country. For these reasons, the motivation for participating in the banking industry for the government should be higher than the average motivation for participating in any industry in the country.

¹Carsten Sprenger: “State-owned enterprises in Russia” – Presentation at the OECD Roundtable on Corporate Governance of SOEs, ICEF, HSE, Moscow, October 27, 2008

²Mariana Pargendler: “State ownership & Corporate Governance”, *Frodman law review*, 2012, Volume 80, Issue 6, Article 19

Following from the logic described above, there definitely exists some motivation to go deeply into studying the banking industry in Russia in the context of markets with mixed capital structures.

From my point of view, one of the most general, and, at the same time, one of most fundamental empirical studies of government ownership in the banking sector is the study by Rafael La Porta, Florencio Lopez-de-Silanes and Andrey Shleifer “Government ownership of Banks”³. The research addresses three main questions. Firstly, the researchers are interested in the degree of prevalence of the government ownership of the banks. They conclude that the state control of financial institutions is really widely spread, as, according to their findings, by 1995 approximately 41.6% of banks’ assets in the world were controlled by the government. Secondly, they examined the main characteristics of the countries in which the government ownership of banks is relatively larger than in other countries. They find numerous characteristics, which are significant. But, from my point of view, all these characteristics are interrelated. They can be generally described as follows: the lower is the level of development of the country in terms of both economic conditions and democracy, the more is the government participation in the banking industry. Thirdly, they investigated influence of relatively high degree of ownership of government in the banking sector. They came to the conclusion that government ownership in the banking sector has negative effect on productivity growth and development of financial sphere of the country. This result gave them the opportunity to reconcile the debate between “development” view of government ownership and “politics” view. Development view means that the government ownership of banking sector can increase welfare of the society due to more efficient allocation of loans (for example, government will give loans for implementation of innovative projects. Politics view, on the other hand, supposes that the welfare of society can decrease because of government ownership of the banks, as the banks will be used for political interests of the government and thus lead to inefficient allocation of resources in the economy and decrease of welfare. The finding of Rafael La Porta, Florencio Lopez-de-Silanes and Andrey Shleifer that the subsequent growth of productivity is lower in countries with higher control of the banks supports the “politics” view. The findings of their research make obvious firstly that Russia is exactly the country that should be suspected in really high level of control of the banks by the government.

³ La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R. (2000). “Investor protection and corporate governance”. *Journal of Financial Economics* 58, 3–27.

This fact is verified in the research of Andrei Vernikov “Direct and indirect state ownership of banks in Russia”⁴. In the paper it is indicated that by January 2010 State-owned banks contributed more than 50% of the whole banking system of Russia.

Moreover, we can simply look at the ranking of the biggest banks in Russia by assets by 01/01/2013 (Expert Rating Agency):

1	OJSC Sberbank	State
2	OJSC VTB	State
3	OJSC Gazprombank	State
4	OJSC Rosselkhozbank	State
5	CJSC VTB 24	State
6	OJSC Bank of Moscow	State
7	OJSC Alfa Bank	Private
8	CJSC UniCredit Bank	Private
9	OJSC PromSvyazBank	Private
10	OJSC Rosbank	Private

A couple of papers, developed by Zuzana Fungáčová et al indicate some anomalies in the Russian banking market that can indicate scope for future investigation. In the paper, devoted to interest margins in Russia⁵ it is found that coefficients of the determinants of interest margins of state-owned banks differ from that for private banks. Particularly, state-owned banks’ interest margins, compared with that of private domestic banks and foreign banks, respond much less to liquidity risk. It is obvious that the state-owned banks can simply be always sure that in case of liquidity problems they can always rely on government. Moreover, Zuzana Fungáčová underlines that private domestic banks compared with foreign banks and state-owned banks are the only one that respond somehow to credit risk (but, unfortunately, the sign of the effect is not very intuitive: the higher is credit risk, the lower are the interest margins for domestic private banks in Russia). From my point of view, there can exist an

⁴ Direct and indirect state ownership of banks in Russia, Andrei Vernikov (Higher School of Economics, Moscow, Russia, and Institute of Economics RAS, Moscow)

⁵ Determinants of bank interest margins in Russia: Does bank ownership matter? Zuzana Fungáčová and Tigran Poghosyan (Bank of Finland, BOFIT Institute for Economics in Transition)

explanation which is in line with my thesis of different funding opportunities for domestic private banks and state-owned banks. When the credit risk increases, domestic private bank either increases the interest for deposit, or decreases the interest for loans. Obviously, the first opportunity is the more likely one. It can mean that when the credit risk increases, private domestic bank expects smaller cash inflow from debtors, as default rate is likely to increase. At the same time, in order to pay the promised interest for existing deposits, he has to take money from somewhere. Thus, he tries to attract new deposits with higher interest rates. So, maybe, from my point of view, in Russia the fact that for domestic private banks the bigger is credit risk, the smaller is interest margin can be explained by building of “pyramids” by private banks in absence of liquidity. So, this fact indirectly can be interpreted as supporting my hypothesis of different per-unit costs of private and public banks in Russia due to different funding opportunities.

Surprisingly, in another research by Zuzana Fungáčová et al, devoted to investigation of market power in Russian banking industry⁶, no connection between ownership structure and market power is detected. I would hope that in this paper this connection is captured by nonlinear effect of size of the bank on its market power (as we know, in Russia government banks are incredibly large).

To sum up the empirical basis of the paper, I would like to point out the following key points:

1. The capital structure of the Russian banking industry can be characterized as mixed capital structure, i.e. there is strong evidence of government participation in the capital structure of the banks.
2. There exists difference in the funding costs for private banks and partially owned by the government banks, with cheaper funding for partially state-owned banks.

Now, let's discuss the theoretical basis of subsequent modeling.

As I outlined above, the model will concern the mixed capital structure. Usually, the markets with mixed capital structures are modeled as oligopolies with limited number of participants (usually two) where one of the firms is partially or totally owned by the government. In all of the papers, the main feature of the firms that are partially owned by the government is that they make the decisions (either about the quantity or about price) taking into account not only the profits of the firm, but also the social welfare, as ideally the government is concerned exactly about the social welfare. The papers concerning modeling of markets with mixed capital structure can be divided into two big categories:

⁶ Market power in the Russian banking industry, Zuzana Fungáčová, Laura Solanko and Laurent Weill (Bank of Finland, BOFIT Institute for Economies in Transition)

In the first one, the model is such that the firm partially owned by government simply competes in the market with the others, and the government makes a decision about the degree of ownership of the partially state-owned firm. Then, the firm, like the other, makes a decision about either quantity or price. Examples of the papers following this tradition are the papers by de Fraga & Delbono, 1989⁷ and Toshihiro Matsumura, 1998⁸.

In the second one, the government both participates in the capital of one of the firms and regulates some parameters of the market, such as taxes, quotas, etc. Examples of such papers are those by K. Kato, 2006⁹ and T. Naito & N. Ogawa, 2009¹⁰.

In the paper, I will examine both cases where government is only a participant of the market and the cases where the government both participates and introduces some regulatory restrictions.

But, when looking at the Russian banking industry, it seems that usual oligopoly (Cournot or Bertrand) are not suitable for describing it. There are more than 800 banks in the industry, while only a couple of them possess significant shares of the market. Interestingly, there banks are partially owned by government. So, it is better to use the framework of price-leadership oligopoly, particularly, the form of price leadership which is referred to by Yoshiyasu Ono¹¹ as Voluntary price leadership, which is described as the leadership resulting from the fact that it is more profitable for a leader to be a leader than to be a follower, and it is more profitable for the followers to be the followers than to be a leader. Such price leadership usually results from superior technology or quality of the price leader. As I outlined above, it is reasonable to suspect that the funding is cheaper for partially state-owned bank. So, it is exactly technological superiority in terms of lower marginal costs.

So, the theoretical basis is the following: the partially state-owned firm is a voluntary price leader, and its objectives are connected with the objectives of society. But for the purpose of comparison and contrasting, other market structures will be examined too.

⁷ De Fraga, G. and F. Delbono (1989), 'Alternative strategies of a public enterprise in oligopoly,' *Oxford Economic Papers*, 41, 302-311.

⁸ Matsumura, T. (1998), 'Partial privatization in mixed duopoly,' *Journal of Public Economics*, 70, 473-483.

⁹ Kato, K., 2006. Can allowing to trade permits enhance welfare in mixed oligopoly? *Journal of Economics* 88, 263-283.

¹⁰ Naito, Tohru, Ogawa, Hikaru, 2009. Direct versus indirect environmental regulation in a partially privatized mixed duopoly. *Environmental Economics and Policy Studies* 10, 87-100.

¹¹ Yoshiyasu Ono, Price Leadership: A Theoretical Analysis, *Economica*, New Series, Vol. 49, No. 193 (Feb., 1982), pp. 11-20

Specification of the model.

As I outlined above, the banking industry in Russia has rather unusual structure: there is a huge number of banks participating, but the majority of the industry is controlled by the banks that are at least partially controlled by the government. Moreover, the number of these partially owned by the government banks is not very large, but each of them controls rather big share of the market.

I propose the following way to model the industry:

- For simplicity sake, let's model the following market: suppose at the beginning of the period the volume of the loan market in that period is determined. All the loans are given out at the beginning of the period, each of them last for one period only, i.e. at the end of the period the borrowers return the face value of the loan and pay interest for the loan. In fact, it does not matter, what is the length of the period we are talking about.
- There are $(n+1)$ firms participating, one of them is partially state-owned. From my point of view, without a loss of generality it is possible to say that there is *one* bank that is partially controlled by the government, instead of a limited number of such banks. All the other banks participating are private.
- Although we can see rather large number of banks participating at the market, particularly, in Russia, as of May, 2013, there are 897 banks, the access to the market is limited: capital requirements, together with licensing of various banking activities allow us to assume that at least in the short run the number of participants of the industry is fixed.
- The demand for loans for the particular period is given by:

$$L = A - \delta \times i$$

Obviously, the demand for loans is given as the total volume of loans that agents at the economy are ready to take at the beginning of the period for the given interest rate. In case of banking industry number of loans taken does not describe the market. To understand the volume of the market, we need both number of the loans and, for example, the volume of an average loan. And for economy as a whole it does not matter in fact, whether there is larger number of smaller loans, or smaller number of larger loans. Below, I provide a simplified example to illustrate my opinion. Suppose the following situation. An interest rate decreases. There are two different producers. One of them responds by increasing the scale of one particular investment project in two times. The initial investment planned for the project was I_0 , but now, as the interest rate decreases and NPV of the project increases, the producer is going to

build the factory that is two times larger than initially planned. So, now the producer borrows $I_1 = 2 \times I_0$. The other producer initially planned to invest the same I_0 , but now he is going to launch two investment projects simultaneously instead of only one. His second investment project costs the same I_0 , so the total sum the second producer decides to borrow after the interest rate has decreased is $I_1 = 2 \times I_0$. So, as we see, for the economy as a whole it does not matter whether the scale of one investment project is increased or the number of investment projects has increased. What I am trying to say is that even if it is possible to model the demand for loans as a number of loans multiplied by average amount of loans, both of these variables depending on some exogenous determinants, there is no need to do it as the effect on the economy does not depend on what is changed, number of loans or average amount of each loan. Moreover, in case of investment loans, from my point of view, it is reasonable to expect very similar or even exactly the same determinants for these two variables. If we treat the loans in the economy as the loans taken for investment projects only (we do not take into account the consumer loans), then A can be regarded as the total cost of the investment projects in the economy whose NPV is ≥ 0 for the interest rate equal to zero, while δ can be regarded as the sensitivity of NPVs of the investment projects with respect to the interest rate. This sensitivity is described by the length of the investment projects and the expected pattern of the cash inflows and outflows associated with each of the projects.

- As I went through derivation of equilibriums in different cases, described below, I understood that some simplification of the model is needed. That is why, let's assume that $\delta = 1$.
- Banks, both private and partially public, do not face any costs other than the interest rate costs. From my point of view, interest rate costs are exactly the costs that are ultimately important in the case of banking industry as they are the costs that directly arise from the business, and as their importance is incomparable with the importance of all other sources of costs, we can drop all other costs without loss of intuitive connection with the real world. Moreover, the funding interest rate that each particular bank faces increases with the amount of funding the bank is willing to attract. There can be three different explanations for this assumption. The first one is connected with the concept of risks. As the investors are willing to diversify their assets in order to decrease standard deviation of the expected return of their assets portfolio, when one bank is willing to attract more funds it means that investors should place larger weight on the assets put in this particular bank in their portfolio. Obviously, as they increase the weight placed on one bank higher than the level they initially chosen, their benefits for the risk-return profile of their portfolio that they extracted from diversification

decrease. If so, the bank should reward the investors for the benefits of diversification foregone in order for the investors to be willing to give additional money to the bank. So, the more the bank is willing to attract as funding for the loan operation, the more interest it has to pay.

The second one is connected with the other source of banks' funding – not investors, but households who are willing to save some funds in order to smooth their consumption path. As we know, each household is willing to smooth its consumption between today and tomorrow. On the aggregate level, there is some limited amount of the funds which the households are willing to save for tomorrow. In this case, if one bank is willing to attract additional amounts for funding, the only thing that the bank can do is to raise the interest rate offered for deposits and hope that the substitution effect will prevail the income effect in the intertemporal consumption choice problem of the households and as a result the households will be willing to save more in this particular bank. This explanation is not very suitable for the case of this model, as it does not explain why the interest rate for funding in case of increase of funding increases for one particular bank, but not the industry as a whole. From this point of view, the first explanation referring to the investors composing their portfolios is more suitable for this case.

The third explanation can arise from the possibility that the risks connected with banking operations increase with the scale of banking operations of this particular bank. From the first sight, it should not be the case. But we can remember the famous example Of Fanny May and Freddy Mac. When the scale of banking operations increases in one particular bank, it can be the case that the quality of monitoring of prospective borrowers decreases. Consequently, the quality of loans given out by the bank in term of the probability of default on these loans decreases (i.e. probability of default on the loans on average increases). Consequently, as the investors (i.e. depositors) evaluate the risk connected with the assets of the bank they are willing to deposit money as higher, they require higher return on their deposits. Probably, this is the most suitable explanation why the funding interest rate increases for the one particular bank if this bank is willing to attract more funding. So, let's give the funding rate for each particular private bank as a function of the amount of funding the bank is willing to attract.

$$i_f^p = \alpha \times V_p$$

Where V_p is the volume of funding the private bank is willing to attract.

- Another assumption is that the defaults of the borrowers of the bank are implicit in the funding interest rate. That is, I do not assume that there are no defaults at all, but I rather assume that they are implicitly included in the model by the following relation:

Suppose that the time value of money is equal to zero in the economy. That is, the risk-free rate is zero. Firstly, recently this proposition has become rather consistent with empirical evidence (Japan, EU, etc). Secondly, we can include positive risk-free interest rate, but it will just make the calculations more complicated without bringing any additional intuition. Suppose that the small private bank gives out loans at the interest rate i . Suppose that fraction θ of the borrowing are not returned at the end of the period, together with interest. So, the bank effectively “looses” $\theta \times V_i^p \times (1 + i)$. Now, suppose that $\theta \times (1 + i) = \alpha$.

In this way, the function of the interest rate for funding defined above can be interpreted as the “cost” of bankruptcies of the borrowers of the bank.

- As I went through derivation of equilibriums in different cases, described below, I understood that some simplification of the model is needed. That is why, let’s assume that $\theta \times (1 + i) = \alpha = 1$
- Now, let’s define the funding rate for the bank which is partially owned by the government. The interest rate for funding partially state-owned bank is $i_f^g = \beta \times \alpha \times V_g$, $\beta < 1$ where β can be regarded as the degree of confidence in creditworthiness if the state. Agents expect that even if the bank is not fully state-owned, it nevertheless will be saved by the government in case of possibility of default, that is why for the same volumes of funding required the interest rate for funding will be lower for partially state-owned bank than for the fully private bank. In Russia, however, according to my opinion, the difference in funding rates of private and partially state-owned banks is simply due to the deposits of the Central Bank of Russia which are mostly put at the partially state-owned banks and that are with rather low interest rate. Moreover, most state enterprises also cooperate exclusively with partially state-owned banks. Obviously, this preferred cooperation gives rise to competitive advantage of partially state-owned banks in terms of attraction of funding. If we use interpretation for the interest rate of funding as the implicit costs of the bankruptcies of the borrowers, we can explain the multiplier β which lowers the interest rate with the help of the following logic: In Russia, it frequently happens that the banks, that are at least partially controlled by the government, give out loans to the firms that are at least partially controlled by the government too. And the firms that are partially controlled by the government operate in Russia mostly in industries with higher profitability (oil&gas, for example). And if the profitability in these industries is higher, there is lower probability of default of the companies from these industries. So, the “costs” of the bank, associated with bankruptcy of borrowers, are lower.

- Taking into account the simplification that $\theta \times (1 + i) = \alpha = 1$, $i_f^g = \beta \times \alpha \times V_g = \beta \times V_g$, $\beta < 1$
- As I outlined above, the partially state-owned banks have competitive advantage. In our model we have only one partially state-owned bank. So, this bank has competitive advantage over private banks. That is why it is quite intuitive to suggest a market structure in the banking industry in Russia which is characterized by presence of a price-leader (i.e. partially state-owned bank) and competitive fringe, where the price leader faces the residual demand for loans. So, when the price-leader sets the interest rate for loans, he takes into account the expected reaction of the private banks, which will depend on the interest rate set by the price-leader. But let's discuss the motivations (i.e. objective function) of the partially state-owned bank first.
- As the bank is partially owned by the government, it should partially take into account objectives of the government of the country. Ideally, objectives of the government of the country would refer to the total welfare generated by the loan market in the particular period. The total welfare is defined as “the sum of the welfares (utilities) of all constituent individuals”¹²(O. Lange, 1942). So, let's define the total welfare of the society generated by the loan market in the particular period. Firstly, as usual, producers' surplus, which is equal to profits should be included. In our case, producers are banks. It is important that both profits of private banks and profit of partially state-owned bank should be included.

Secondly, again, as usual, consumers' surplus should be included. In the case of the loan market, for every unit of money taken as a loan, the surplus in fact represents the difference between the market interest rate and the interest rate for which the NPV of the corresponding investment project (for which the unit of money was borrowed) is equal to zero. So, the consumers' surplus represents the excess return of the all investment projects in the particular period, which goes to the pocket of the borrowers. The welfare function:

$$W_1 = \sum_{i=1}^{n+1} \pi_i + CS(i) = \sum_{i=1}^n \pi_i^p + \pi_g + \frac{1}{2} \times (A - i) \times (A - i)$$

- Let γ be the share in the partially state-owned bank controlled by the government, $(1 - \gamma)$ be the share of the bank controlled by private agents. Obviously, the benefit of private agents participating in the partially state-owned bank is defined as the proportion if the profits of the state-owned bank. So, private agents are interested in maximization of profits of the bank. On the other hand, government is interested in

¹²Oscar Lange, The Foundations of Welfare Economics, Econometrica, Vol. 10, No. 3/4 (Jul. - Oct., 1942), pp. 215-228

maximization of the total welfare of the society. It is rather intuitive to suggest that the objective function of the partially state-owned firm is a weighted average of the corresponding objective functions of private agents and the government. For example, in case of some important decisions regarding future actions of the bank, if there is a population of m decisions to be taken, on average, $(\gamma \times m)$ decisions will be taken in line with the objectives of the government, while $((1 - \gamma) \times m)$ decisions will be taken in line with objectives of the private participants of the capital of the bank. It may seem in first glance that due to median voter theorem, if government controls at least 50%+1 stocks, all the decisions of the bank should be taken according to objectives of the government, and vice versa. But in case of publicly traded companies, in my opinion, this should not be true: if government controls 50%+1 stocks and takes all the decisions according only to its own objective function (not taking into account the objectives of minority shareholders), the price of the stock of the bank in the open market should drop, as minority shareholders will be willing to sell their stocks. And if the government is unable to finance the capital of the bank on its own, the bank will soon be unable to expand its capital at all. So, in order to convince minority shareholders to continue participation in the capital of the bank, the controlling shareholder (government) should take into account objectives of minority shareholders while making decisions. The same is true in the reverse situation: if private agent controls 50%+1 stocks, he should take into account objectives of the government while making decisions in order to convince government to continue participation in the capital of the bank. But, maybe, here there is an interesting point for further research. I would like to outline the possibility that if the government controls 50%+1 stocks, it has to take into account objectives of private agents participating in the capital of the bank because if the government is unable to finance the full capital of the bank on its own, it in fact does not have any substitutes for the private agents participating in the bank – what I am trying to say is that if the private agents that are currently participating in the capital of the bank do not want any longer to do it, there is no reason for other private agents to be willing to replace the current private shareholders. If there is a reverse situation, i.e. private agents control 50%+1 stocks of the bank and do not take into account objectives of the government, which owns the remaining stocks (it means that the only thing they do is profits maximization), there is certainly a reason why the other private agents (outside of the capital structure of the bank at the moment) will be willing to replace the government in the capital structure of the bank: they are definitely willing to participate in the capital of the bank the only objective of which is profit maximization. From my point of view, it is rather strong argument why the government should be willing to be

controlling shareholder. In case it is not, the decisions of the bank will not take into account objectives of the government, even if the government participates on the capital structure of the bank. Going back to formulation of the objective function of the bank which is partially controlled by the government, aside from the last digression, the objective function of the bank should take into account objectives of government and objectives of private owners proportionally. As the only objective of the private owners is profit, and the only objective of the government is the welfare of the society (putting aside possible frictions connected with corruption and conflicts of interests), the objective function of partially state-owned bank should look in the following way:

$$\begin{aligned}
 F &= \gamma \times W + (1 - \gamma) \times \pi_g \\
 &= \gamma \times \left(\sum_{i=1}^n \pi_i^p + \pi_g + \frac{1}{2} \times (A - i) \times (A - i) \right) + (1 - \gamma) \times \pi_g \\
 &= \pi_g + \gamma \times \left(\sum_{i=1}^n \pi_i^p + \frac{1}{2} \times (A - i) \times (A - i) \right)
 \end{aligned}$$

- Rather important assumption of the model is that the only aim for funding attracted by the banks is to give it out as loans. And the only source of funding is that defined by the cost of funding (the funding interest rate) as a function of the funding attracted by one particular bank.

Equilibriums.

As I outlined above, as the partially state-owned bank possesses competitive advantage due to lower funding rate for each volume of funding, it is intuitive to suppose that this bank is a price leader in the market in the sense that it sets the interest rate for loans in the market, which the other privately owned banks have to follow. Due to this reason the price-leader is able to take into account the expected reaction of competitive fringe on each interest rate set. So, regardless the form of the objective function of the price leader, we can derive the reaction functions of each of the small private banks participating in the competitive fringe. Later, for the purpose of comparing and contrasting, we will outline the objective functions of the price-leader in two different cases: the price leader is without government participation in its capital structure and the price leader is with participation of government in its capital structure. Besides, for the purpose of comparison, it makes sense to introduce an equilibrium in case of perfect competition. We will derive equilibriums in these three cases.

Reaction function of a representative firm from the competitive fringe.

So, first of all, let's define the reaction function of a representative fully privately owned firm from the competitive fringe. The aim of the firm is to maximize its own profits. If the price leader sets the market interest rate equal to i , the representative firm from the competitive fringe has to decide about the volume of funding it attracts and gives out as loans. The costs of the bank are represented by the interest it has to pay for the funding attracted. The interest rate, as explained above, is defined in the following way:

$$i_f^p = V_p$$

Then, the amount of interest that the bank has to pay at the end of the period, which is effectively the total costs of the bank, is:

$$TC_i^p = i_f^p \times V_i^p = (V_i^p)^2$$

The revenue of the bank is represented by the interest that it receives at the end of the period for the loans given out at the beginning of the period.

$$TR_i^p = i \times V_i^p$$

So, the profit of the representative private bank from the competitive fringe can be expressed as:

$$\pi_i^p = TR_i^p - TC_i^p = i \times V_i^p - (V_i^p)^2$$

The objective of the bank is to maximize its profits, making a decision about the volume of loans given out, and thus, the volume of funding attracted at the beginning of the period. So, we simply take a derivative of the profits of the private bank with respect to the volume of loans (which is the same as the volume of funding attracted) and equate it to zero.

$$\frac{d\pi_i^p}{dV_i^p} = i - 2 \times V_i^p = 0$$

So,

$$V_i^p = \frac{i}{2}$$

$$\pi_i^p = TR_i^p - TC_i^p = i \times V_i^p - (V_i^p)^2 = i \times \frac{i}{2} - \left(\frac{i}{2}\right)^2 = \frac{i^2}{2} - \frac{i^2}{4} = \frac{i^2}{4}$$

The Volume of one private bank, which the bank selects depending on the interest rate set by the price leader, should be taken into account by the price leader when he selects the market loan interest rate for the forthcoming period.

Perfect competition.

For the purpose of further comparison, let's see how the equilibrium is determined in the case of perfect competition in the market. In this case, there is no reason to suppose that one of the firms has any competitive advantage. So, there is no price leader. But, in this case we should examine a market where there are $(n+1)$ firms for the comparison with other market structures to be valid. Again, I would like to outline that what we are examining are short run effects, so the firms participating in the market can have positive economic profits. As we know, $V_i^p = \frac{i}{2}$ is the reaction function of one private firm. Now, we have $(n+1)$ firms.

So, the supply of loans in the market will be given as

$$\sum_{i=1}^{n+1} V_i^p = \frac{i(n+1)}{2}$$

While the demand for loans is

$$L = A - i$$

So, the equilibrium is given as

$$\frac{i(n+1)}{2} = A - i$$

$$i = \frac{2A}{n+3}$$

$$L = A - i = A - \frac{2A}{n+3} = \frac{A(n+1)}{n+3}$$

$$\pi_i^p = \frac{i^2}{4} = \left(\frac{2A}{n+3}\right)^2 \times \frac{1}{4} = \left(\frac{A}{n+3}\right)^2$$

$$CS(i) = \frac{1}{2} \times (A - i)^2 = \frac{A^2(n+1)^2}{2(n+3)^2}$$

$$W_1 = \sum_{i=1}^{n+1} \pi_i + CS(i) = \frac{(n+1)A^2}{(n+3)^2} + \frac{A^2(n+1)^2}{2(n+3)^2} = \frac{1,5A^2(n+1)^2}{(n+3)^2}$$

Privately owned price leader.

The price leader does not have any government participation in the capital structure. In this case, the objective function of the price leader does not take into account the total welfare of the economy.

Objective of the price leader is to maximize its own profits, while he knows the demand function and the reaction function of the banks from the competitive fringe. As there are n firms in the competitive fringe, and each of them has the reaction function of the following form,

$$V_i^p = \frac{i}{2}$$

The price leader knows that total amount of loans given out by the competitive fringe for each interest rate set by the price leader will be equal to:

$$\sum_{i=1}^n V_i^p = \frac{n \times i}{2}$$

So, the price leader knows, that for every interest rate i that he sets the amount of loans that people will be willing to attract for him will be equal to:

$$L_{residual} = L - \sum_{i=1}^n V_i^p = A - i - \frac{n \times i}{2}$$

So, his interest revenue at the end of the period will be equal to:

$$TR_g = i \times V_g = i \times L_{residual} = i \times \left(A - i - \frac{n \times i}{2} \right)$$

While his interest costs will be equal to:

$$TC_g = i_f^g \times V_g = \beta \times (V_g)^2 = \beta \times \left(A - i - \frac{n \times i}{2} \right)^2$$

So, the profits of the price leader can be expressed from the interest rate set by the price leader in the following way:

$$\begin{aligned} \pi_g &= TR_g - TC_g = i \times \left(A - i - \frac{n \times i}{2} \right) - \beta \times \left(A - i - \frac{n \times i}{2} \right)^2 \\ &= \left(A - i - \frac{n \times i}{2} \right) \times \left(i - \beta \times \left(A - i - \frac{n \times i}{2} \right) \right) \end{aligned}$$

In order to find the optimal interest rate set by the price leader, we simply differentiate his profits with respect to the interest rate, and equate the derivative to zero.

$$\frac{d\pi_g}{di} = \left(-1 - \frac{n}{2} \right) \left(i - \beta \left(A - i - \frac{ni}{2} \right) \right) + \left(1 + \beta + \frac{\beta n}{2} \right) \left(A - i - \frac{ni}{2} \right) = 0$$

So, if

$$(n+2)(\beta(n+2)+2) \neq 0$$

then

$$i = \frac{2A(\beta(n+2)+1)}{(n+2)(\beta(n+2)+2)}$$

$$L_{total} = A - i = A - \frac{2A(\beta(n+2)+1)}{(n+2)(\beta(n+2)+2)} = \frac{A(\beta n(n+2)+2(n+1))}{(n+2)(\beta(n+2)+2)}$$

$$\sum_{i=1}^n \pi_i^p = \frac{ni^2}{4} = n \left(\frac{A(\beta(n+2)+1)}{(n+2)(\beta(n+2)+2)} \right)^2$$

$$V_g = A - i - \frac{n \times i}{2} = \frac{A}{\beta(2+n)+2}$$

The result regarding the volume of loans supplied by the price leader is rather intuitive: the more there are the banks in the competitive fringe, the lower volume is supplied by the price leader, and the greater is the competitive advantage of the price leader over the participants of the competitive fringe (i.e. the lower is β), the higher is the volume of loans supplied by the price leader.

Lets see what is going on with the profits of the price leader, consumer's surplus and welfare.

$$i_f^g = \beta \times V_g = \frac{\beta A}{\beta(2+n)+2}$$

$$\pi_g = TR_g - TC_g = (i - i_f^g) \times V_g = \frac{A^2}{(n+2)(\beta(2+n)+2)}$$

$$CS(i) = \frac{1}{2} \times (A - i)^2 = \frac{A^2(\beta n(n+2)+2(n+1))^2}{2(n+2)^2(\beta(n+2)+2)^2}$$

$$W_1 = \sum_{i=1}^{n+1} \pi_i + CS(i)$$

$$= n \left(\frac{A(\beta(n+2)+1)}{(n+2)(\beta(n+2)+2)} \right)^2 + \frac{A^2}{(n+2)(\beta(2+n)+2)}$$

$$+ \frac{A^2(\beta n(n+2)+2(n+1))^2}{2(n+2)^2(\beta(n+2)+2)^2}$$

$$= \frac{A^2((n+2)^2(2\beta(2n+1)+\beta^2 n(n+2))+(n+2)(n+3)2)}{2(n+2)^2(\beta(n+2)+2)^2}$$

$$= \frac{A^2((n+2)(2\beta(2n+1)+\beta^2 n(n+2))+(n+3)2)}{(n+2)(\beta(2+n)+2)^2}$$

State ownership of the price leader.

Now, let's introduce government participation in the market.

As I outlined above, now the price leader is partially owned by government (by the fraction γ), and thus maximizes not simply profits, but the objective function that partially takes into

account interests of government and thus society.

The reaction functions of the private banks from the competitive fringe nevertheless stay the same.

$$V_i^p = \frac{i}{2}$$

$$\sum_{i=1}^n V_i^p = \frac{n \times i}{2}$$

$$\sum_{i=1}^n \pi_i^p = \frac{ni^2}{4}$$

The objective function of the price leader now has the following form:

$$F = \gamma \times W + (1 - \gamma) \times \pi_g$$

$$= \gamma \times \left(\sum_{i=1}^n \pi_i^p + \pi_g + \frac{1}{2} \times (A - i) \times (A - i) \right) + (1 - \gamma) \times \pi_g$$

$$= \pi_g + \gamma \times \left(\sum_{i=1}^n \pi_i^p + \frac{1}{2} \times (A - i) \times (A - i) \right)$$

As far as I understand, when the price leader of the market is partially owned by the government, the objective function of the price leader nevertheless takes into account the profits of the price leader fully: that is because the profits of the price leader enter the objective function twice: due to objectives of the private owners of the bank (profit maximization) and due to objectives of the government (profits of the price leader constitute part of the welfare of the society).

$$\pi_g = TR_g - TC_g = i \times \left(A - i - \frac{n \times i}{2} \right) - \beta \times \left(A - i - \frac{n \times i}{2} \right)^2$$

$$= \left(A - i - \frac{n \times i}{2} \right) \times \left(i - \beta \times \left(A - i - \frac{n \times i}{2} \right) \right)$$

$$F = \left(A - i - \frac{n \times i}{2} \right) \times \left(i - \beta \times \left(A - i - \frac{n \times i}{2} \right) \right) + \gamma$$

$$\times \left(\sum_{i=1}^n \pi_i^p + \frac{1}{2} \times (A - i) \times (A - i) \right)$$

$$= \left(A - i - \frac{n \times i}{2} \right) \times \left(i - \beta \times \left(A - i - \frac{n \times i}{2} \right) \right) + \gamma$$

$$\times \left(\frac{ni^2}{4} + \frac{1}{2} \times (A - i) \times (A - i) \right)$$

We have an expression of the objective functions through the interest rate set by the price leader and through parameters only. So, we can find the optimal for the partially owned by the government price leader interest rate set at the loan market by simply taking the derivative of

the objective function with respect to the interest rate and equating the derivative to zero.

$$\begin{aligned}\frac{dF_1}{di} &= \left(-1 - \frac{n}{2}\right) \left(i - \beta \left(A - i - \frac{ni}{2}\right)\right) + \left(1 + \beta + \frac{\beta n}{2}\right) \left(A - i - \frac{ni}{2}\right) + \gamma \left(\frac{ni}{2} - A + i\right) \\ &= 0\end{aligned}$$

So, if

$$(n + 2)(\beta(n + 2) - \gamma + 2) \neq 0$$

then

$$i = \frac{2A(\beta(n + 2) - \gamma + 1)}{(n + 2)(\beta(n + 2) - \gamma + 2)}$$

$$L_{total} = A - i = A - \frac{2A(\beta(n + 2) - \gamma + 1)}{(n + 2)(\beta(n + 2) - \gamma + 2)} = \frac{A(\beta n(n + 2) + 2(n + 1) - \gamma n)}{(n + 2)(\beta(n + 2) - \gamma + 2)}$$

While looking at the expression of the total volume of loans in the market, it is not obvious that it depends positively on the fraction of the price leader owned by government, while intuitively it should. The intuition here is that due to the market power of the price leader, the price leader extracts additional profits, setting the interest rate higher and lowering the volume of loans. When the government is entering the capital of the price leader, it is interested in the total welfare: so, the government partially offsets the intense of the price leader to extract additional profits by raising the interest rate above optimal.

Let's check the relationship between the fraction of the price leader owned by the government and the total volume of loans given out at the market at the given period.

$$\frac{dL}{d\gamma} = \frac{A(n+2)(\beta n(n+2)+2(n+1)-\gamma n)-An(n+2)(\beta(n+2)-\gamma+2)}{(n+2)^2(\beta(n+2)-\gamma+2)^2} \text{ VS } 0 \Rightarrow$$

$$\Rightarrow (n + 2)(\beta n(n + 2) + 2(n + 1) - \gamma n) \text{ VS } n(n + 2)(\beta(n + 2) - \gamma + 2) \Rightarrow$$

$$\Rightarrow 2n + 2 \text{ VS } 2n \Rightarrow$$

$$\frac{dL}{d\gamma} > 0$$

The volume of loans given out on particular period depends positively on the share owned by government in the price leader, which is in line with intuition. So, we have verified that we can continue with the model and derive other important parameters of the equilibrium.

$$\sum_{i=1}^n \pi_i^p = \frac{ni^2}{4} = n \left(\frac{A(\beta(n + 2) - \gamma + 1)}{(n + 2)(\beta(n + 2) - \gamma + 2)} \right)^2$$

$$V_g = A - i - \frac{n \times i}{2} = \frac{A}{\beta(2 + n) - \gamma + 2}$$

The result regarding the volume of loans supplied by the price leader is rather intuitive: the more there are the banks in the competitive fringe, the lower volume is supplied by the price leader, and the greater is the competitive advantage of the price leader over the participants of the competitive fringe (i.e. the lower is β), the higher is the volume of loans supplied by the

price leader. These results are just the same as in the previous case, where the price leader was interested only in his own profits. The main difference is that the greater is the fraction of the government ownership in the capital structure of the price leader, the greater volume of loans is supplied by the price leader.

The point to discuss here is that when the price leader is increasing the volume of loans provided on his own, he, on the one hand, is increasing the consumers' surplus, but on the other hand he is decreasing the profits of the competitive fringe. As we see, here the first effect in terms of total welfare dominates the second effect. As far as I understand, this is due to the difference in the cost functions of the competitive fringe banks and price leader: if the price leader will allow the competitive fringe to provide greater quantity of loans, for each individual small private bank it will be done at greater cost than the price leader could do.

Let's see what is going on with the profits of the price leader, consumer's surplus and welfare.

$$\begin{aligned}
 i_f^g &= \beta \times V_g = \frac{\beta A}{\beta(2+n) - \gamma + 2} \\
 \pi_g &= TR_g - TC_g = (i - i_f^g) \times V_g = \frac{A(\beta(2+n) - 2\gamma + 2)}{(n+2)(\beta(2+n) - \gamma + 2)} \times \frac{A}{\beta(2+n) - \gamma + 2} \\
 &= \frac{A^2(\beta(2+n) - 2\gamma + 2)}{(n+2)(\beta(2+n) - \gamma + 2)^2} \\
 CS(i) &= \frac{1}{2} \times (A - i)^2 = \frac{A^2(\beta n(n+2) + 2(n+1) - \gamma n)^2}{2(n+2)^2(\beta(n+2) - \gamma + 2)^2} \\
 W &= \sum_{i=1}^{n+1} \pi_i + CS(i) = n \left(\frac{A(\beta(n+2) - \gamma + 1)}{(n+2)(\beta(n+2) - \gamma + 2)} \right)^2 + \frac{A^2(\beta(2+n) - 2\gamma + 2)}{(n+2)(\beta(2+n) - \gamma + 2)^2} \\
 &\quad + \frac{A^2(\beta n(n+2) + 2(n+1) - \gamma n)^2}{2(n+2)^2(\beta(n+2) - \gamma + 2)^2} \\
 &= \frac{A^2(2n(\beta(n+2) - \gamma + 1)^2 + 2(\beta(n+2) - 2\gamma + 2) + (\beta n(n+2) + 2(n+1) - \gamma n)^2)}{2(n+2)^2(\beta(n+2) - \gamma + 2)^2}
 \end{aligned}$$

So, we have derived equilibriums in three cases: perfect competition, price leadership of private bank and price leadership of partially owned by the government bank. Now we can proceed to policy implications, derived with the help of equilibriums above.

Policy implications.

Now, let's try to derive some policy implications with the help of the dangerous equations given above.

Participation of the government in capital of any bank is not possible.

Firstly, let's see what are the optimal actions of the regulatory authorities, if the authorities due to some exogenous reasons cannot participate directly in the capital structure of any bank. For example, imagine that the country faces uncomfortable amount of budget deficit, and thus has to sell its shares in various firms from various industries, including banking industry. But, nevertheless, the government cares about the society and thinks what it can do in order to maximize the welfare.

I assume that government has two possible instruments to control the market in this case (I mean specific, or unusual methods, i.e. I will not focus on quotas or taxes now):

1. It can control the number of participants in the banking industry, at least in the short run.

As I outlined above, the banking industry has rather "high" barriers for prospective entrant. Firstly, there are the so-called capital requirements. And when the Central bank raises the capital requirements, the number of the banks in the industry is likely to decrease, because it becomes more difficult for the banks to satisfy these requirements. So, by changing the level of capital requirements in the banking industry the regulatory authorities can control the number of banks participating in the industry, although not directly.

Another way for the regulatory authorities to control the number of banks participating in the industry is a direct method: by licensing, which is used in Russia. Obviously, the number of licenses given out by the Central bank directly determines the number of participants in the banking industry.

So, the first way for the government to influence the situation in the loan market when the government cannot enter the capital of any bank is to control the number of participants in the loan market.

2. The second specific method is to try to give some privileges to one particular bank. These privileges can be in the form of, for example, state guarantees of the borrowing of the bank from the market.

The obvious question that arises in the mind of the reader now is why cannot the government provide the guarantees to all the participants of the market. To me it seems reasonable to suppose that if the government decides to guarantee the borrowing of all the participants of the market, then these guarantees should lose their

power: The resources of the government are not enough to cover the liabilities of all of the banks. So, in this case the default risk connected with the liabilities of the banks can in some case transfer to the government fully. In this case, the guarantees of the government will not have any power any more.

I suppose an extreme case when the government can provide support to one bank only. When the government decides to support some bank, there are two opposite effects for the total welfare: on the one hand, the society benefits from the lowered total costs of one of the banks, while on the other hand the society loses due to the market power, gained by the supported bank, which the bank can use in order to extract abnormal profits at the expense of the society. Deadweight loss occurs.

To me it seems reasonable to examine at the first stage the optimal decisions of the government when it can choose only one parameter of the market: either support of one of the banks, or the number of the firms participating in the industry.

Government controls the number of the banks

Firstly, let's examine the case where the presence or absence of privately owned price leader is given exogenously, while the government can make a decision regarding the number of banks participating in the industry.

There is no price leader in the market.

Sequence of the game:

- Government decides about the number of the firms in the competitive fringe ($n+1$)
- Firms from the competitive fringe decide about their volumes of loans and funding.

We solve the optimal number of the firms participating in the market by backward induction:

For the derivation of the expressions, see the case concerning perfect competition for derivation of parameters of equilibrium.

Above, we have seen the reaction function of the firms from the competitive fringe

$$\sum_{i=1}^{n+1} v_i^p = \frac{i(n+1)}{2}$$

So, the welfare of the society in the equilibrium was determined in the following way:

$$W = \sum_{i=1}^{n+1} \pi_i + CS(i) = \frac{(n+1)A^2}{(n+3)^2} + \frac{A^2(n+1)^2}{2(n+3)^2} = \frac{1,5A^2(n+1)^2}{(n+3)^2}$$

To see the optimal number of firms, we again can differentiate the welfare with respect to the number of the banks.

$$\frac{\partial W}{\partial n} = \frac{6A^2(n+1)}{(n+3)^3}$$

Again, as in the previous case, the welfare is strictly increasing with the number of banks participating in the industry. Again, as far as I understand this is due to the increasing funding interest rate for each of the banks.

Moreover, as in the previous case, I would like to outline that if there are some constant costs associated with monitoring of an additional bank, which the Central Bank faces, there is an optimal number of banks, given as

$$\frac{dW}{dn} - c = 0$$

Where c are the costs associated with monitoring of one particular bank. The optimal number exists, as, o

There is price leader in the market

Sequence of the game:

- Government decides about the number of the firms in the competitive fringe (n)
- Price leader decides about the interest rate
- Firms from the competitive fringe decide about their volumes of loans and funding.

We solve the optimal number of the firms participating in the market by backward induction:

For the derivation of the expressions, see the case 2 above.

Above, we have seen the reaction function of the firms from the competitive fringe:

$$\sum_{i=1}^n v_i^p = \frac{n \times i}{2}$$

And the optimal interest rate, set by the price leader.

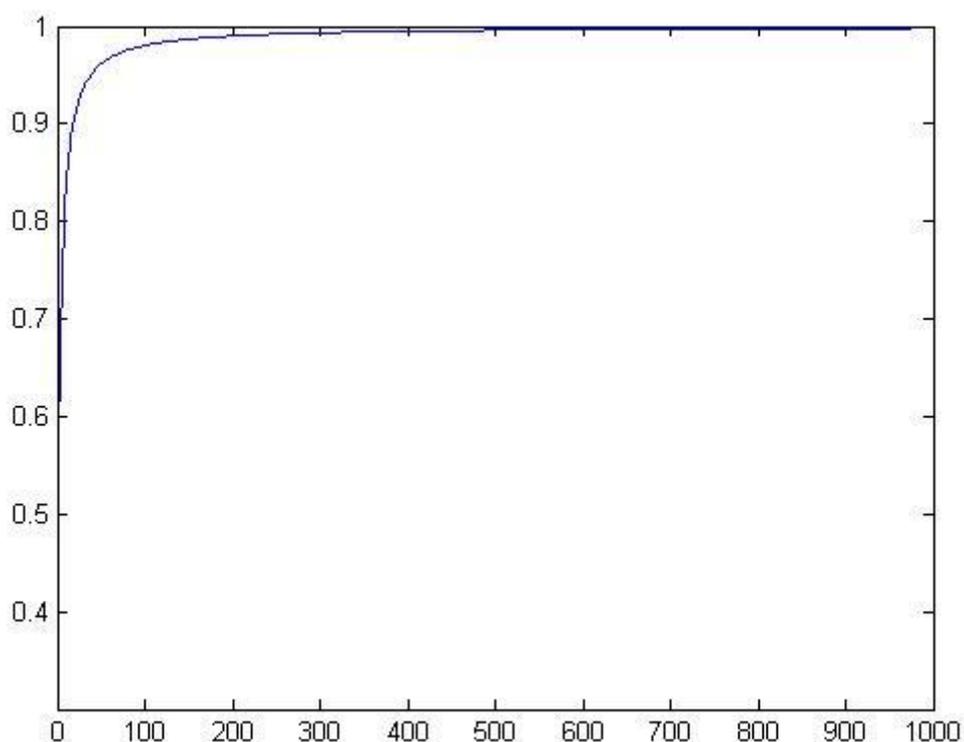
$$i = \frac{2A(\beta(n+2) + 1)}{(n+2)(\beta(n+2) + 2)}$$

So, the welfare of the society in the equilibrium was determined in the following way:

$$W = \sum_{i=1}^{n+1} \pi_i + CS(i) = \frac{A^2 \left((n+2) \left(2\beta(2n+1) + \beta^2 n(n+2) \right) + (n+3)2 \right)}{(n+2)(\beta(2+n) + 2)^2}$$

The aim of the government is to maximize the total welfare of the society. To see the optimal decision of the government regarding the number of banks in the industry (i.e. regarding the number of licenses given) we can simply differentiate the welfare expression by n and equate the derivative to zero. Unfortunately, the resulting value of n is not suitable for interpretation (too large, see Appendix 1). So, we will use graphs of the function of welfare depending on n to give some interpretation of the optimal policy of the government. In the corresponding Appendix 1, you can see several graphs for different parameter values. For example, for

parameter values $A=1$, $\beta=0,7$ the graph of dependence of welfare on the number of firms participating in the market looks in the following way:



The graphs look more or less the same for different parameter values (see corresponding appendix).

As we see, the welfare of the society is increasing in the number of firms in the market without achieving any maximum point. To my mind, we can extrapolate the result for any reasonable parameter values ($A > 0$, $0 < \beta < 1$). So, it is optimal for the government in presence of a price leader in the industry to increase the number of firms in the industry as much as it can. As far as I understand, this is due to increasing with the volume of loans given out by particular bank funding interest rate for that bank. In reality, however, the desire of the Central Bank to develop the financial system of the country is bounded by the necessity to control and monitor the financial intermediaries. Obviously, there is some maximum number of banks the Central Bank can control and monitor in a proper way, and the fraud is likely to occur in different banks if the Central Bank cannot pay a necessary sum of attention to each of the banks in the system.

To conclude the discussion about the optimal number of banks in presence of price leader, introduced exogenously, I would like to outline the decreasing marginal effect of each additional license given out by the central bank.

This decreasing marginal effect suggests that if there are some fixed costs, associated with monitoring of each additional bank, there definitely exists the optimal number of banks,

which is defined as n , such that

$$\frac{dW_1}{dn} - c = 0$$

Where c are the costs associated with monitoring of one particular bank.

Government controls the entrance of price leader.

Now, let's examine the case where the Central bank cannot control the number of participants in the industry, but can make a decision whether to support one of the banks or not.

There are $(n+1)$ competitive firms. The Central Bank has an opportunity to decide to support one of the banks. The degree of the competitive advantage that the supported bank will get is given exogenously. The Central Bank can only decide whether to "give" the competitive advantage or not.

If the Central Bank does not give the competitive advantage, the welfare of the society will be given as

$$W_{\text{perfect competition}} = \frac{1,5A^2(n+1)^2}{(n+3)^2}$$

If the Central Bank decides to give the competitive advantage, then the social welfare will be given as

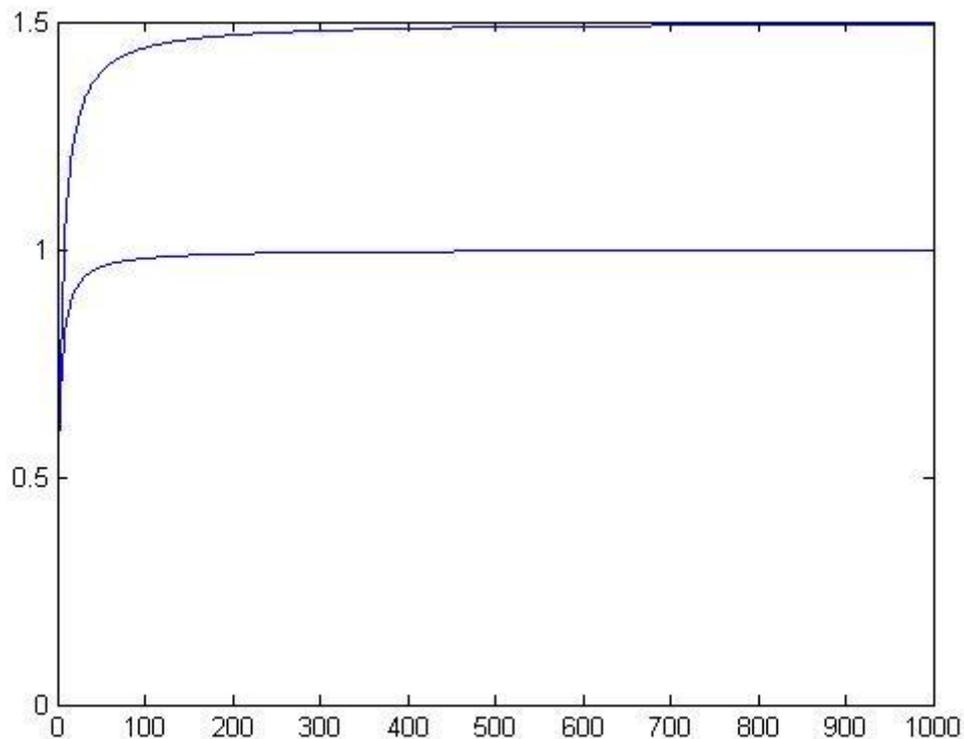
$$W_{\text{private price leader}} = \frac{A^2 \left((n+2) \left(2\beta(2n+1) + \beta^2 n(n+2) \right) + (n+3)2 \right)}{(n+2)(\beta(2+n)+2)^2}$$

Let's try to compare the two welfare functions for different values of n . In Appendix 2, you can see the pared graphs for several different values of parameter β . As you see, in several cases of reasonable values of parameter β , the amount of the social welfare in the case of no supported bank is greater for any number of banks participating in the industry.

So, if the Central Bank cannot decide about the number of the firms in the industry, but can decide whether to give one of the banks a competitive advantage in terms of lower funding interest rate, the Central bank will decide not to give such an advantage.

Upper line – no support. Lower line – one is supported.

$\beta=0,7, A=1$. Horizontal axes represents number of the firms in the industry, vertical axes represents social welfare.



Government controls both number of banks and entrance of the private price leader.

Let's examine the last case where government cannot participate in the capital structure of the bank. The case is where the government can make both decisions mentioned above: about the number of the firms, and about the support of the one of the banks. As we saw above, for any number of the firms participating in the industry, the welfare (both taking into account additional welfare from possibility of increase of productive facilities in the next period and not taking into account) is greater under perfect competition than under price leadership of one of the banks. So, if the government has a right to choose, it will choose the following market structure: no price leader in the market, as many banks as possible according to the budget constraint of the Central banks regarding the costs of monitoring of the banks.

Government can participate in the capital of the price leader.

Now, let's proceed to the case where the government can participate in the capital structure of the price leader of the industry.

Suppose that the number of the banks is given exogenously, or determined by the budget constraint concerning monitoring of the banks by the Central Bank.

So, the sequence of the game is the following:

- The government decides about the proportion it owns in the price leader
- Price leader decides about the interest rate set at the market
- Banks from competitive fringe decide about the volume of loans they are going to provide

Let's examine the optimal level of government ownership in the price leader.

$$W_1 = \frac{A^2(2n(\beta(n+2) - \gamma + 1)^2 + 2(\beta(n+2) - 2\gamma + 2) + (\beta n(n+2) + 2(n+1) - \gamma n)^2)}{2(n+2)^2(\beta(n+2) - \gamma + 2)^2}$$

To find the optimal degree of ownership, we simply maximize W by γ .

As the function is rather complicated, MATLAB is used.

The output is the following:

$$\gamma = n + 2$$

As we see, the optimal degree of ownership in the price leader does not depend on the volume of the loan market (A). Moreover, it does not depend on the competitive advantage of the price leader. Finally, it is really rather strange, though pretty simple (unexpectedly from the complicated equations). So, the key point here is to try to understand what we see. First of all, the easiest interpretation is to say that it is always optimal for the price leader to be fully owned by the government.

Secondly, we can claim that the more firms are participating in the industry, the more it is important for the Central Bank to control the price leader.

As we know from above, perfect competition is always better in our framework than price leadership of privately owned leader. Besides, as we know that the optimal share of ownership is always greater than zero, it means that welfare under partial ownership of the price leader by the government is greater than under fully private price leader. So, to give the complete view of which market structures are better for society and what are the optimal policy actions it is enough to compare the welfare under perfect competition and under partial ownership of the price leader by the government.

I would like to pay your attention to the fact that we will compare the two welfares for the same n , so we should decide which share of state ownership we will use. To me it seems reasonable to use the optimal share derived above. Here we have two options: either to use $\gamma = n + 2$ or to use $\gamma = 1$.

Let's examine the first case, $\gamma = n + 2$.

So, we are comparing two welfare functions:

$$W_{competition} = \frac{(n+1)A^2}{(n+3)^2} + \frac{A^2(n+1)^2}{2(n+3)^2} = \frac{1,5A^2(n+1)^2}{(n+3)^2}$$

and

$W_{state\ owned\ leader}$

$$= \frac{A^2(2n(\beta(n+2) - \gamma + 1)^2 + 2(\beta(n+2) - 2\gamma + 2) + (\beta n(n+2) + 2(n+1) - \gamma n)^2)}{2(n+2)^2(\beta(n+2) - \gamma + 2)^2}$$

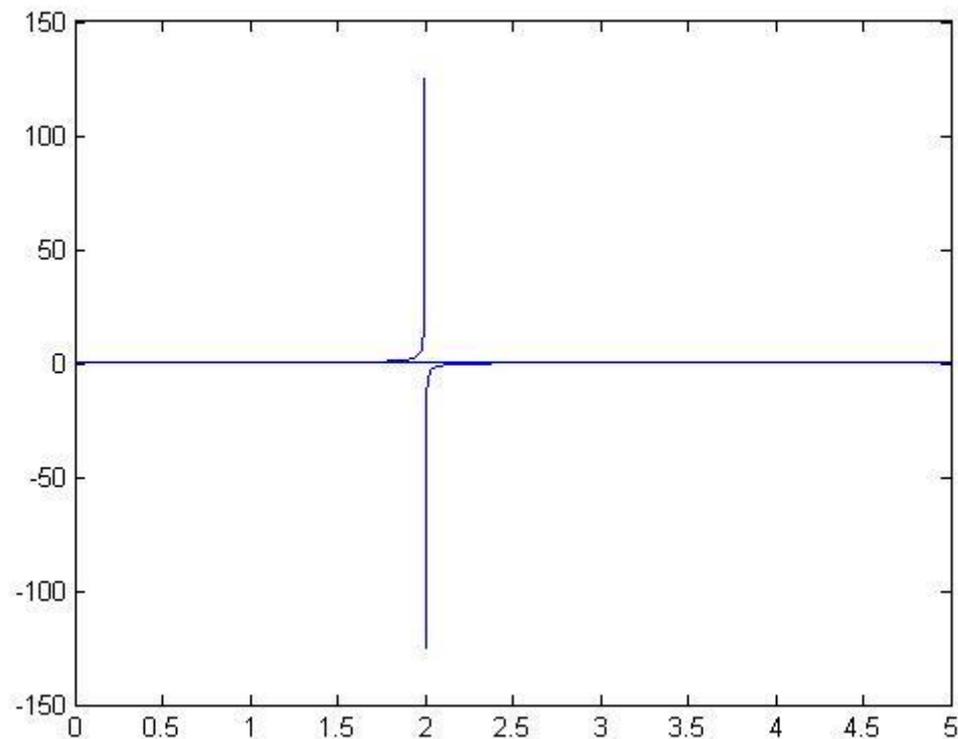
Where

$$\gamma = n + 2$$

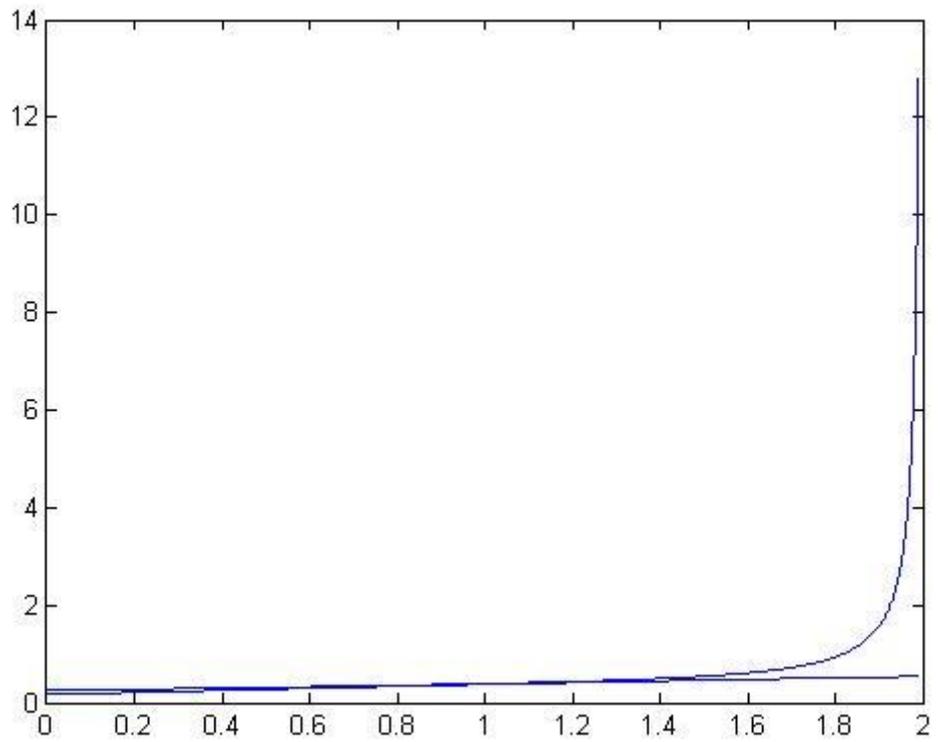
Let's compare them by drawing graphs:

From a big perspective, there are no differences, the only difference is the gap in the function of the welfare in the case of government intervention in $n=2$. In all other points, the two functions look like they coincide.

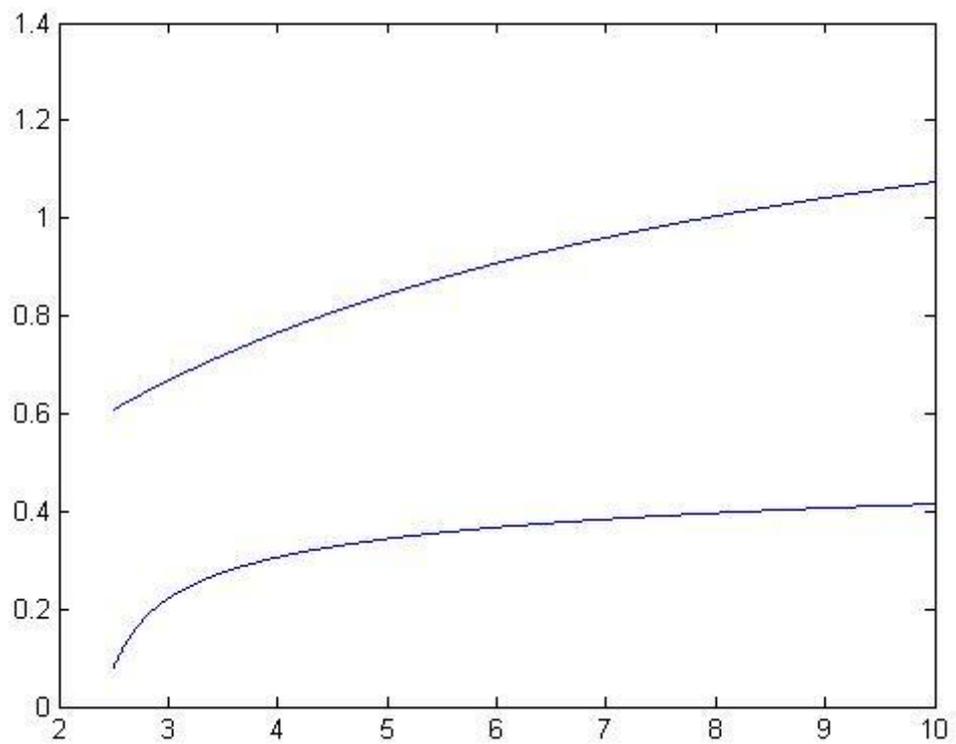
On the horizontal axes the number of firms, on vertical axes the welfare.



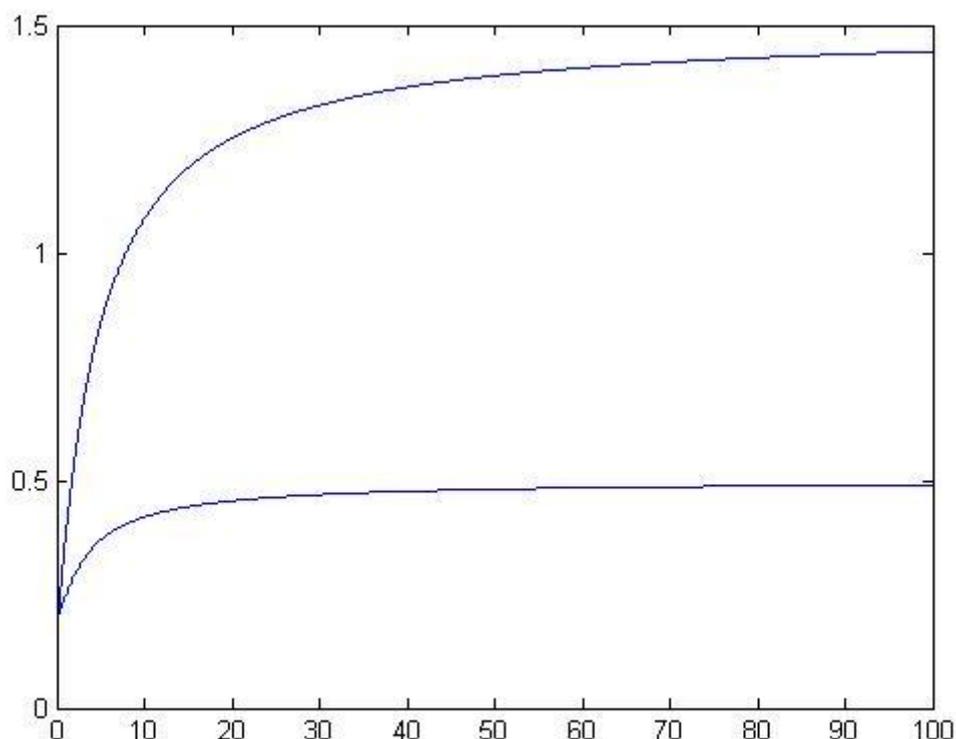
If we look closer for n smaller than 2, again, no big differences except the gap will be found. On the graph below, the function with the gap at 2 it that which corresponds to total welfare in case of price leader owned by government.



But if we look at n greater than two, we will see that perfect competition (upper graph) is superior to price leadership of firm with government in its capital structure (lower graph) in terms of total welfare:



Let's see how the analysis changes if we replace $\gamma = n + 2$ by $\gamma = 1$. The graph of two welfare functions against the number of firms in the industry now look in the following way:



Here, the upper graph is the graph for perfect competition, while the lower graph is the graph for the government ownership of price leader by fraction $\gamma = 1$.

So, as we see, in terms of social welfare perfect competition is better than the ownership by the government of the price leader of the market by optimal fraction $\gamma = 1$. The graph looks much better than for the case where we used $\gamma = n + 2$. So, probably, the interpretation that is there price leader in the banking industry it is optimal for the government to control its decisions fully.

Summary of policy implications.

Now, let's sum up the policy implications derived above.

- 1) In any case, due to increasing funding interest rate it is optimal got the Central Bank to try to increase the number of the banks in the industry as much as possible (taking into account the costs of monitoring of the banks).
- 2) Perfect competition is the best market structure in terms of total welfare.
- 3) Price leadership of private bank is the worst market structure of discussed above.

- 4) Price leadership of the bank, fully controlled by the government is better than price leadership of private bank, but worse than perfect competition, for any number of participants of the industry.

So, the conclusion regarding policy implications is the following:

The Central Bank should try to increase the number of banks in the country whatever is the market structure. If the market structure is perfect competition, it is not reasonable to introduce the price leader owned by the government. But if the market structure is the price leadership of some private bank, and the Central Bank cannot eliminate the competitive advantage of the bank, it is optimal for the government to try to control the decisions of the price leader fully through participation in its capital structure.

Evaluation of policy in Russia.

Regarding the current policy concerning the banking industry in Russia, I have a several point to outline.

- 1) The policy of participation in capital structures of several leading banks and giving them competitive advantage in terms of cheaper funding can be regarded as optimal only if without the government support and participation the banks would still have the competitive advantage. In other words, if the price leadership occurred before the government participation, then the government participation is optimal, otherwise it is not. As far as I know, in Russia government participation and price leadership occurred simultaneously, so the optimality of the policy is questionable. Thus, the objectives of the Russian government regarding maximization of total welfare are questionable. Probably, this can be interpreted as an indirect support for "Politics" view of government participation in the banking sector, which supposes that in case of government's control (or partial control) over the banking sector the banks will be used for political interests of the government and thus lead to inefficient allocation of resources in the economy and decrease of welfare.
- 2) Currently, privatization of the partially owned by the government banks is discussed. If the banks after privatization will still have competitive advantage in terms of funding and thus will behave as price leaders the privatization is not an optimal policy. If the banks will lose their competitive advantage and the market will become more similar to perfect competition then the discussed privatization of banks is optimal. But, probably, if the government, controlling the banks, is not interested in the total welfare, and its objective function is concerned with some political variables,

then the change of ownership structure of the banks in Russia towards greater extent of private ownership will have an ambiguous effect on total welfare.

- 3) Recently, the capital requirements in the banking industry were raised. Trying to evaluate this decision in the framework of presented model leads to a conclusion that the decision is not optimal in terms of total welfare unless the budget constraint of the Central Bank regarding the costs of monitoring of participants of the industry has not decreased.

Summary.

To sum up, in the paper I have presented empirical and theoretical background for the model derived, then derived several equilibriums for different market structures of the banking industry and developed with the help of these equilibriums a couple of policy implications. Moreover, in the context of the policy implications derived, I discussed the recent or proposed changes in the Russian regulation of the banking industry.

The main feature of the paper is that I developed an equilibrium and found an optimal degree of government ownership in case of model concerned with price leadership, while most earlier papers on markets with mixed capital structure are concerned with oligopolies with very limited number of participants (usually, two).

For further research of the subject, I propose the following topics:

- 1) Investigation of the question about the possibility that if the government does not hold 50%+1 shares in a firm, then the objective function of the firm can fail to include the objectives of the government (and thus, society). This question is discussed with more details in the section devoted to model specification.
- 2) It may be interesting to try to see how parameters of the equilibriums may change if the society derives additional utility from the volume of loans given out in the current period. That is, additional term in the welfare function of the society, which partly determines the objective function of the partially state-owned bank, may be included. This term can refer to the fact that the investment projects started in the current period are likely to generate additional production facilities in the economy for all the future periods (subtracting depreciation). So, they are likely to increase GDP of the country in the future. And naturally, government, and society, should be interested in increasing GDP of the economy. And the more funds are borrowed in the current period, the more investment projects are started in the current period. So, apart from the producers' surplus and the consumers' surplus, the government can be interested in the volume of loans given out in each period.

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$$\begin{aligned}
& \frac{(6*b^3 + 4*b^2 + 2*b)^2/(9*b^6)}{(((8*b^3 + 16*b^2 + 2*b - 2)/(2*b^3) + (6*b^3 + 4*b^2 + 2*b)^3/(27*b^9) - ((6*b^3 + 4*b^2 + 2*b)*(12*b^3 + 16*b^2 + 5*b))/(6*b^6))^2 + ((12*b^3 + 16*b^2 + 5*b)/(3*b^3) - (6*b^3 + 4*b^2 + 2*b)^2/(9*b^6))^3)^{1/2} - (6*b^3 + 4*b^2 + 2*b)^3/(27*b^9) - (8*b^3 + 16*b^2 + 2*b - 2)/(2*b^3) + ((6*b^3 + 4*b^2 + 2*b)*(12*b^3 + 16*b^2 + 5*b))/(6*b^6)^{1/3} + (((8*b^3 + 16*b^2 + 2*b - 2)/(2*b^3) + (6*b^3 + 4*b^2 + 2*b)^3/(27*b^9) - ((6*b^3 + 4*b^2 + 2*b)*(12*b^3 + 16*b^2 + 5*b))/(6*b^6))^2 + ((12*b^3 + 16*b^2 + 5*b)/(3*b^3) - (6*b^3 + 4*b^2 + 2*b)^2/(9*b^6))^3)^{1/2} - (6*b^3 + 4*b^2 + 2*b)^3/(27*b^9) - (8*b^3 + 16*b^2 + 2*b - 2)/(2*b^3) + ((6*b^3 + 4*b^2 + 2*b)*(12*b^3 + 16*b^2 + 5*b))/(6*b^6)^{1/3}}*j/2
\end{aligned}$$

Obviously, it is quite impossible to use it for interpretation of an optimal number of firms in the industry in this case.

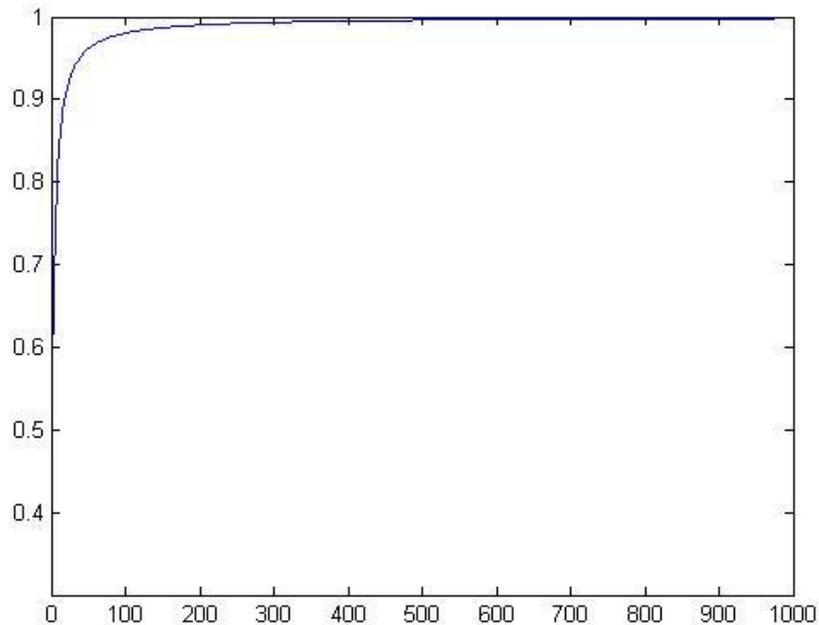
So, let's try to use graphs depicting welfare as a function of n to give some intuition regarding an optimal number of firms in the industry.

The graph of welfare

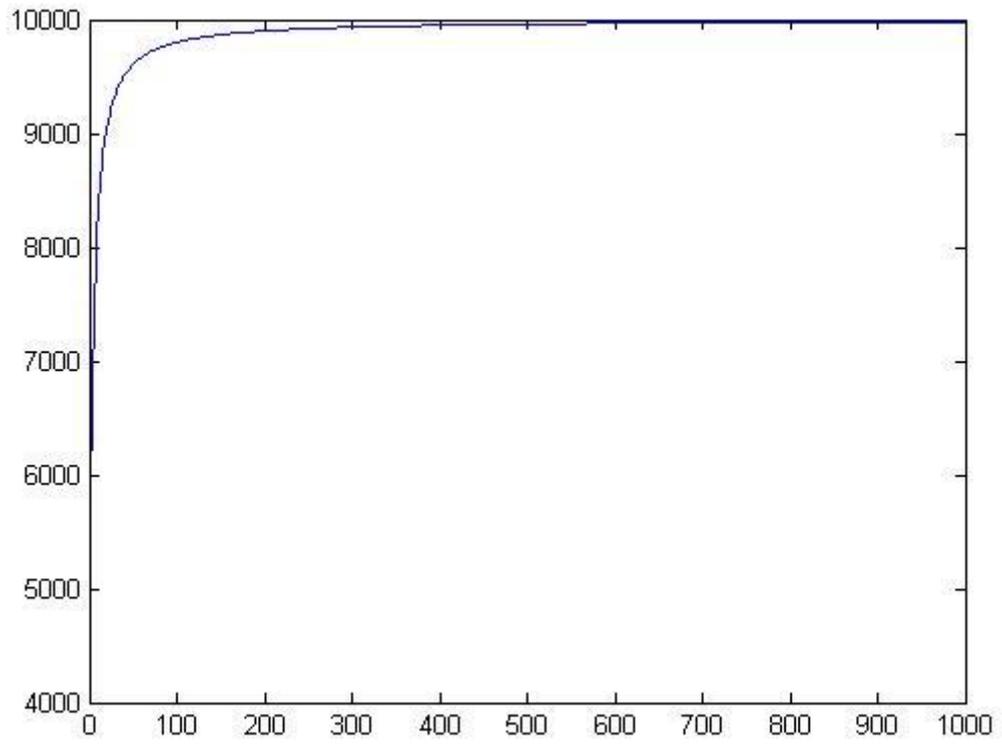
$$W_1 = \sum_{i=1}^{n+1} \pi_i + CS(i) = \frac{A^2 \left((n+2) \left(2\beta(2n+1) + \beta^2 n(n+2) \right) + (n+3)2 \right)}{(n+2)(\beta(2+n)+2)^2}$$

On all the graphs below, horizontal axes represents number of firms in the industry, vertical axes represents welfare.

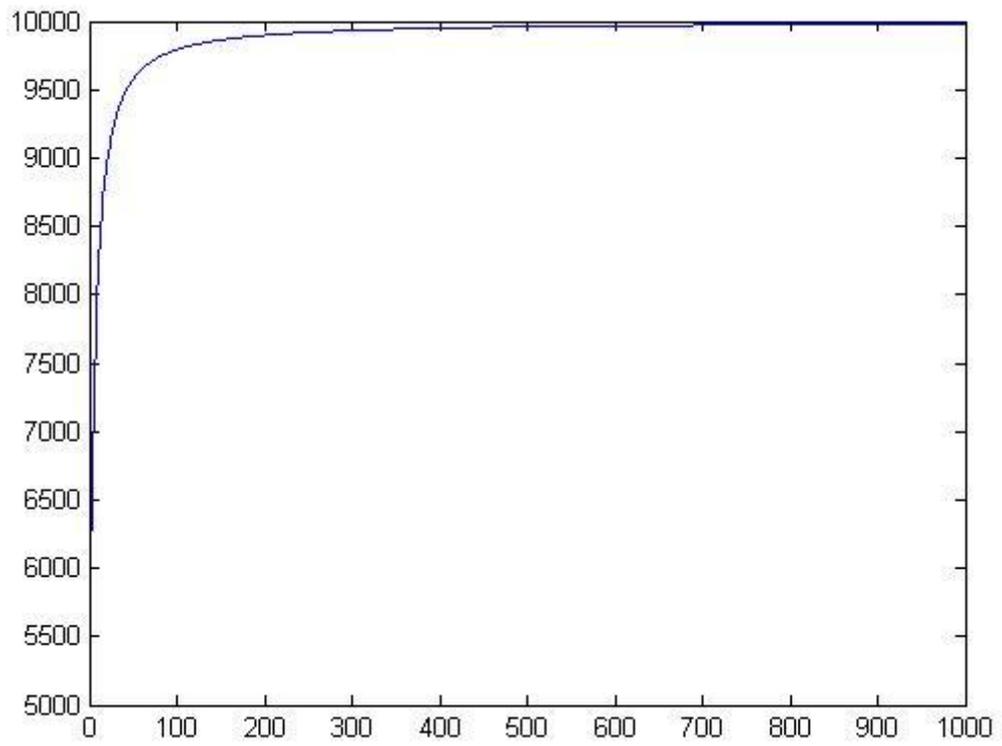
For parameter values A=1, $\beta=0,7$:



For parameter values $A=100$, $\beta=0,5$:



For parameter values $A=100$, $\beta=0,3$:



Appendix 2.

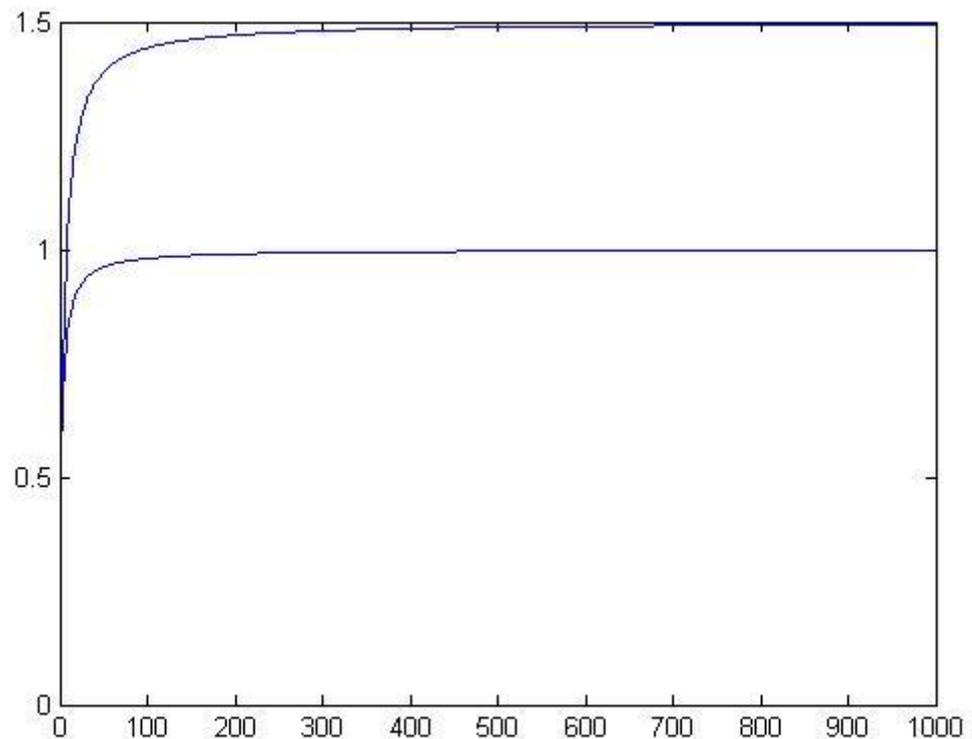
Path: Policy implications: Participation of the government in capital structure of any bank is not possible: Government controls the entrance of price leader.

Graphs comparing the welfare when the Central Bank decides whether to support one of the banks or not. Government cannot participate in capital structure of the bank.

On all the graphs below, horizontal axes represents number of firms in the industry, vertical axes represents welfare.

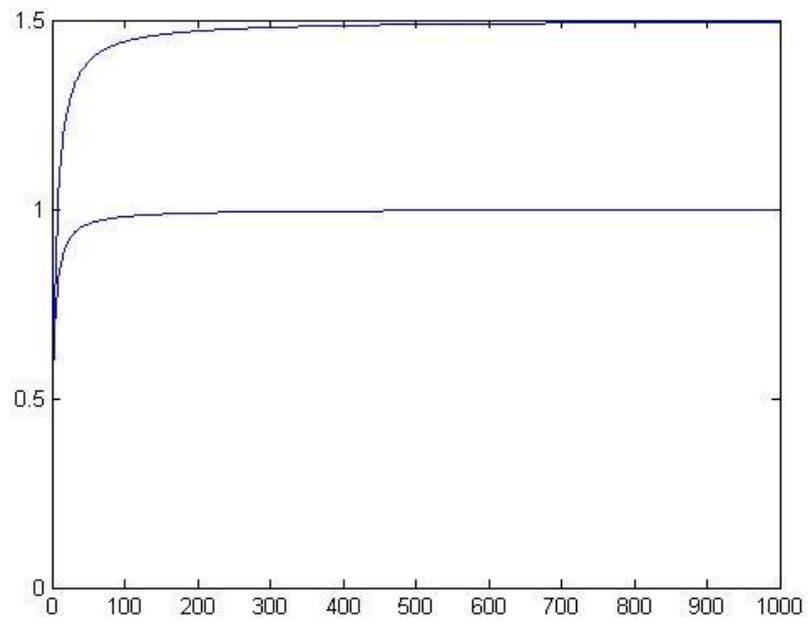
1) Upper line – no support. Lower line – one is supported.

$\beta=0,7$, $A=1$.



2) Upper line – no support. Lower line – one is supported.

$\beta=0,5$, $A=1$.



3) Upper line – no support. Lower line – one is supported.
 $\beta=0,2, A=1$.

