

## The Comparison of Credit Subsidies and Guarantees in Transition and Post-Transition Economies<sup>1</sup>

Karel JANDA\*

---

### Abstract

*We compare the welfare effects of government credit subsidies and guarantees in transition and post-transition economies in the conditions of asymmetric information. We show that the guarantees and subsidies targeted to low risk borrowers decrease efficiency while those targeted to high risk borrowers increase efficiency both in transition and post-transition economies. The uniform non-targeted guarantees improve welfare. The uniform subsidies may be used to improve welfare in the economy subjected to credit rationing, but they do not have any effect on the size of collateral required in post-transition economy.*

**Keywords:** *transition, credit, subsidies, guarantees*

**JEL Classification:** D82, G28, P31

---

### Introduction

One of the most important tasks of the economic transition was an establishment of a dynamic and efficient small and medium sized enterprise sector. For this purpose a provision of the start up loans for these enterprises was a crucial precondition. As opposed to large enterprises with a well known credit history, the provision of loans to new small enterprises was much more hindered by information asymmetry between lending agency and aspiring entrepreneur.

In order to entice the lending institutions to provide much needed capital for those entrepreneurs lacking established credit records and/or sufficient collateralizable wealth, the governments in transition countries established various credit supporting institutions. The examples are Slovak Guarantee and Development

---

\* doc. Ing. Karel JANDA, M. A., Dr., Ph.D., Department of Microeconomics and Mathematical Methods, Charles University, Opletalova 26, 110 00 Prague 1; Department of Banking and Insurance, University of Economics, W. Churchill Sq. 4, 130 67 Prague 3, Czech Republic; e-mail: Karel-Janda@seznam.cz

<sup>1</sup> The work on this paper was supported by Czech Science Foundation, grant number 402/05/2123.

Bank or Czech-Moravian Guarantee and Development Bank or Czech Support and Guarantee Agricultural and Forestry Fund. The major activities of these government agencies are provision of loan guarantees, direct loans, and interest rate subsidies.

In our paper we will concentrate on the efficiency effects of loan guarantees and interest rate subsidies in the situation characterized by private knowledge of entrepreneurs about their chances of success in the project for which they would like to obtain a credit from a lender. We will look at this problem from a historical perspective, comparing the situation during the initial phases of the economic transition in early nineties with post-transition situation in twenty first century.

In our analysis we will use the technical approach of the informational economy which is widely used in the analysis of credit markets under informational asymmetries since the Stiglitz and Weiss (1981) seminal paper. In particular we will utilize the screening role of collateral provision and credit rationing in overcoming the adverse selection effects of private information of the borrower. The basic idea of informational asymmetry and its alleviation through screening contracts in credit markets was empirically tested many times. For example Capra, Fernandez and Ramirez (2001) found out that separating role of collateral as predicted by screening models well fits the credit market both based on real data and on experimental simulations. The use of collateral and/or credit rationing as screening instruments in adverse selection models was recently analyzed by Janda (2002, 2003). The major contribution of this paper is the extension of Janda (2002, 2003) model and its original new application to the welfare analysis of the provision of government lump-sum guarantees and interest rate subsidies.

The Stiglitz and Weiss (1981) approach was recently discussed and empirically applied by Minelli and Modica (2003) to the regional policy in depressed regions of Italy, whose structural adjustment and poverty alleviation problems bear some resemblance to the problems faced by transition economies like Slovakia. The complex discussion of credit guarantees in the context of economic policy is provided by Gudger (1998) and Navajas (2001).

In our paper we will take the form of contract as given. We will consider so called standard debt contract as introduced by Townsend (1979) in the framework of costly state verification problem. The appropriateness of the standard debt contract in the adverse selection environment was investigated first by Innes (1993). Recently Vauhkonen (2003) proved that the standard debt contract is optimal as long as there is a competition between the lenders instead of there being only one monopoly financier in the model.

## 1. The Model

This model provides an extension to the model introduced by Janda (2002). There were two classes of economic agents in the original model – lenders, and borrowers. In the current paper we add the government as the third class of economic agent.

The introduction of government interventions in the form of interest rate subsidies and lump-sum guarantees constitutes an important innovation of our paper as compared to the Janda (2002) paper.

There are two types of risk neutral borrowers in this model, indexed as a type 1 and a type 2. The two types are distinguished by their probability of successfully finishing their project, denoted as  $0 < \delta_1 < \delta_2 < 1$ , and by their reservation utilities, denoted as  $b_1 < b_2$ . The probability that the random borrower facing lender is of a type 1 is  $\theta$ .

The borrower can either undertake one risky project, which yields  $y$  in the case of success and 0 in the case of a failure, or he obtains reservation utility  $b_i$ ,  $i \in \{1, 2\}$ .

When the project is completed, the outcome of the project is freely observed by both borrower and lender. This means that there is no costly state verification problem in this model.

In order to undertake the project the borrower has to borrow one unit of money from the lender. Each borrower is endowed with a non-stochastic endowment  $W < \rho$ , where  $\rho$  denotes the unit cost of funds for risk neutral lenders.

The provision of funds from lenders to borrowers and the repayment of these funds is governed by standard debt contracts. This means that in the case of the success of the project the lender receives a constant repayment  $R$ . In the case of failure the lender receives the collateral  $C$ . Each lender offers two types of contract. Each contract is three-tuple  $(\pi_i, C_i, R_i)$ ,  $i \in \{1, 2\}$ , where  $\pi_i$  is the probability that the application of the borrower who chooses this contract will be accepted;  $C_i$  is required collateral; and  $R_i$  is the required repayment. The expected utility of a borrower of type  $i$  who applies for a contract designed for a borrower of a type  $j$  is

$$U_{ij} = \pi_j[\delta_i(y - R_j) - (1 - \delta_i)C_j - b_i] \quad (1)$$

The lender's valuation of a collateral is given as  $\beta C_i$ , where  $\beta \in (0, 1)$ . We assume that each project is socially efficient, that is  $\delta_i y > b_i + \rho$ . The only informational asymmetry present in our model is that ex ante lenders and government do not know the type of borrower. Therefore our model belongs into the class of adverse selection models.

The expected profit to a lender on one loan provided to a borrower of a type  $i$  in the absence of the government intervention is under this asymmetric information given as:

$$B_i = \pi_i[\delta_i R_i + (1 - \delta_i)\beta C_i - \rho] \quad (2)$$

The government may attempt to reduce the inefficiencies created by the use of collateral and by credit rationing by two types of interventions.

Under the lump-sum guarantees program the government guarantees the payment of an exogenously determined lump-sum  $g_i$  in the case of zero return from project. The contracted collateral is passed to the government. The expected profit equation (2) is modified as:

$$B_i = \pi_i[\delta_i R_i + (1 - \delta_i)g_i - \rho] \quad (3)$$

The other considered type of an intervention is an interest rate subsidy  $s_i$ , which is paid only in the case of project's success, as opposed to guarantees, which are paid in the case of failure. While the subsidy reduces the interest rate paid by a borrower, we can treat it analytically just like an exogenous supplement to a repayment to a lender. The expected profit equation (2) is then modified as:

$$B_i = \pi_i[\delta_i(R_i + s_i) + (1 - \delta_i)\beta C_i - \rho] \quad (4)$$

The expected utility of a borrower, under both types of interventions, is still given by equation (1) since the interventions influence the borrower's utility only indirectly through their impact on the lender's profit.

The different assumptions about the relations of probabilities of successfully finishing the project in a given branch of a national economy and the opportunity costs of remaining in that branch of a national economy, which gave rise to our distinction of two market regimes of a transition economy and a post-transition, are formally expressed in a following way: if  $\frac{b_2}{b_1} \geq \frac{\delta_2}{\delta_1}$ , then the model is in a transition economy regime; otherwise, it is in a post-transition regime.

## 2. The Solution of the Model

In order to appreciate the effects of government interventions, first we briefly introduce the properties of the model's solution without government interventions, which are derived in detail by Janda (2002). We first mention the case when the lender has full information about the types of borrower, that is, the lender is able to say whether the borrower is of the high or low type *ex ante*.

Janda (2002) proves that the credit provision under full information is efficient in this case since the collateral is not used and no credit rationing is applied. Consequently there would be no need for government intervention.

In the case when the riskiness of the borrower is a private information of the credit applicant, Janda (2002) proves that asymmetric information leads to two kinds of inefficiency which call for government intervention. In a transition economy, it is credit rationing. In a stabilized economy, it is the use of collateral which is accompanied by a credit rationing if the collateralizable wealth of a borrower is lower than collateral required to provide credit to all applicants. In the case of a stabilized economy, this collateralizable wealth could be so low that the credit market breaks down and nobody is given a loan. In the following two sections we will extend the model by analyzing two types of government interventions aimed at alleviation of these inefficiencies.

## 2.1. Lump-sum Guarantees

The lender under asymmetric information does not know *ex ante* the risk class of a borrower. Because of the competition from other lenders, each lender attempts to offer to each type of the borrower as good conditions as possible. Therefor the maximization problem of a lender is given by:

$$\begin{aligned} \max_{\substack{(\pi_1, R_1, C_1) \\ (\pi_2, R_2, C_2)}} M &= \theta U_{11} + (1 - \theta) U_{22} \\ &= \theta \pi_1 [\delta_1 (y - R_1) - (1 - \delta_1) C_1 - b_1] + \\ &\quad + (1 - \theta) \pi_2 [\delta_2 (y - R_2) - (1 - \delta_2) C_2 - b_2] \end{aligned}$$

s.t.

$$\pi_1 [\delta_1 (y - R_1) - (1 - \delta_1) C_1 - b_1] \geq \pi_2 [\delta_1 (y - R_2) - (1 - \delta_1) C_2 - b_1], \quad (\text{IC1})$$

$$\pi_2 [\delta_2 (y - R_2) - (1 - \delta_2) C_2 - b_2] \geq \pi_1 [\delta_2 (y - R_1) - (1 - \delta_2) C_1 - b_2], \quad (\text{IC2})$$

$$U_{ii} \geq 0, \quad (\text{IRi})$$

$$0 \leq \pi_i \leq 1$$

$$0 \leq C_i \leq W$$

$$\delta_i R_i + (1 - \delta_i) g_i - \rho = 0 \quad (5)$$

$$i \in \{1, 2\}$$

Equation (5) is a zero profit condition for lenders, which explicitly prohibits a cross-subsidization. This means that it is not possible for lenders to suffer a loss on a contract to one type of a borrower and to enjoy a positive profit on

a contract to another type of a borrower. Zero profit constraint puts a bound on the ability of lender to offer the most attractive contract to the borrower when the lender competes for him with the other lenders.

Collateral is passed to the government. The government in turn guarantees the payment of an exogenously determined lump-sum  $g_i$  in the case of zero return from a project.

By solving this optimization problem we find out the following characteristics of the optimal solution:

The contract for a high-risk borrower both in the transition and the post-transition economies is given by:

$$C_1^* = 0, \pi_1^* = 1, R_i^* = \frac{\rho - (1 - \delta_i)g_i}{\delta_i} \quad (6)$$

While  $R_i^*$  for  $i = 2$  in (6) gives the interest factor part of an equilibrium contract for a low risk borrower, the remaining parts of contracts are different in the transition economy and in the post-transition economy with and without a binding collateral restriction.

If  $\frac{b_2}{b_1} \geq \frac{\delta_2}{\delta_1}$ , then:

$$C_2^* = 0 \quad (7)$$

$$\pi_2^* = \frac{\delta_1 y - \rho - b_1 + (1 - \delta_1)g_1}{\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 + \frac{\delta_1(1 - \delta_2)}{\delta_2} g_2} \quad (8)$$

If  $\frac{b_2}{b_1} < \frac{\delta_2}{\delta_1}$  and collateral is unconstrained, then:

$$C_2^* = \frac{\rho(\delta_2 - \delta_1) + \delta_1(1 - \delta_2)g_2}{\delta_2(1 - \delta_1)} - g_1 \quad (9)$$

$$\pi_2^* = 1 \quad (10)$$

If  $\frac{b_2}{b_1} < \frac{\delta_2}{\delta_1}$ , collateral is constrained, and collateralizable wealth  $W$  is such that (IC2) is satisfied, then:

$$C_2^* = W \quad (11)$$

$$\pi_2^* = \frac{\delta_1 y - \rho + (1 - \delta_1)g_1 - b_1}{\delta_1 y - \delta_1 \frac{\rho - (1 - \delta_2)g_2}{\delta_2} - b_1 - (1 - \delta_1)W} \quad (12)$$

As we mentioned previously, this solution of the model shows some inefficiencies, whose degree depends on the level of government intervention. In the cases of transition economy and the post-transition economy with low level of available collateral, the credit market is plagued by credit rationing of a low risk borrower. The extent of the credit rationing  $\pi_2^*$  may be influenced by government support since  $\pi_2^*$  depends on guarantees  $g_1$  and  $g_2$  both in equation (8) and (12). Similarly the extent of the other possible inefficiency – the required collateral in the post-transition economy – may be regulated by the government's choice of intervention parameters  $g_1$  and  $g_2$  which both enter the equation (9).

The optimal solution to the above given optimization problem exhibits the following welfare properties: The utility of a high risk borrower supported by a lump-sum guarantee is given-as:

$$U_{11} = \delta_1 y - \rho - b_1 + (1 - \delta_1)g_1$$

The utilities of low risk borrowers are given according to the following three cases:

1. Transition economy:

$$U_{22} = [\delta_2 y - \rho - b_2 + (1 - \delta_2)g_2] \frac{\delta_1 y - \rho - b_1 + (1 - \delta_1)g_1}{\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 + \frac{\delta_1(1 - \delta_2)}{\delta_2} g_2}$$

2. Post-transition economy with unconstrained collateral:

$$U_{22} = \delta_2 y - \rho - b_2 + (1 - \delta_2) \left[ \frac{(\delta_2 - \delta_1)}{\delta_2(1 - \delta_1)} g_2 + g_1 - \frac{\delta_2 - \delta_1}{\delta_2(1 - \delta_1)} \rho \right]$$

3. Post-transition economy with binding collateral restriction and with wealth  $W$  such that (IC2) is satisfied.

$$U_{22} = [\delta_2 y - \rho - b_2 + (1 - \delta_2)g_2 - (1 - \delta_2)W] \frac{\delta_1 y - \rho - b_1 + (1 - \delta_1)g_1}{\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 + \frac{\delta_1(1 - \delta_2)}{\delta_2} g_2 - (1 - \delta_1)W}$$

From the solution of the lender's optimization problem we are able to figure out the main general qualitative effects of the government guarantees. These are the following ones: The guarantees to low risk borrowers decrease efficiency.

The guarantees to high risk borrowers relax an incentive compatibility constraint and consequently increase an efficiency. The uniform non-targeted lump-sum guarantees are welfare improving. In the following part of this subsection we show these efficiency results formally according to all three cases outlined above. First we will deal with the transition economy situation.

If the economy is in „transition“ regime ( $\frac{b_2}{b_1} \geq \frac{\delta_2}{\delta_1}$ ), then:

$$\left. \frac{\partial \pi_2^*}{\partial g_1} \right|_{(g_2 = \text{const.})} = \frac{1 - \delta_1}{\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 + \frac{\delta_1(1 - \delta_2)}{\delta_2} g_2} > 0$$

This shows that lump-sum guarantees targeted to a high risk borrower decrease the credit rationing of a low risk borrower. This effect is caused by relaxing the incentive compatibility constraint for the high risk borrower. As long as the contract targeted to high risk borrower is made more attractive by provision of government support to him, the incentive for high risk borrower to pretend to be low risk borrower and to take low risk borrower's contract is decreased.

It means that instead of making low risk borrower's contract unattractive to high risk borrower by imposing credit rationing, we may achieve the incentive compatibility by improving the terms of high risk's contract through the use of government guarantee.

$$\left. \frac{\partial \pi_2^*}{\partial g_2} \right|_{(g_1 = \text{const.})} = [\delta_1 y - \rho - b_1 + (1 - \delta_1) g_1] \frac{-\frac{\delta_1(1 - \delta_2)}{\delta_2}}{[\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 + \frac{\delta_1(1 - \delta_2)}{\delta_2} g_2]^2} < 0$$

This means that lump-sum guarantees targeted to a low risk borrower increase the credit rationing of a low risk borrower. This is because the guarantees for low risk borrower make his contract more attractive. In order to satisfy the incentive constraint for high risk borrower, the low risk borrower's contract has to be made less desirable. This is achieved by increasing the credit rationing of a low risk borrower.

These results show that the targeting of guarantees to low risk borrower is counterproductive. But it remains to be shown what happens when both types of borrower obtain the same guarantee. We have to find out which of the two incentive effects described above will be stronger. The following expression shows that the positive effect of improving the contract for the high risk borrower is stronger than the negative effect of making the contract of the low risk borrower more attractive. Therefore we conclude that non-targeted credit guarantees increase a social efficiency since the credit rationing of a low risk borrower is decreased.



$$\begin{aligned}
\left. \frac{\partial \pi_2^*}{\partial g} \right|_{(g=g_1=g_2)} &= \frac{(1-\delta_1)[\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 + \frac{\delta_1(1-\delta_2)}{\delta_2} g]}{[\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 + \frac{\delta_1(1-\delta_2)}{\delta_2} g]^2} - \\
&\quad - \frac{[\delta_1 y - \rho - b_1 + (1-\delta_1)g](1-\delta_2) \frac{\delta_1}{\delta_2}}{[\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 + \frac{\delta_1(1-\delta_2)}{\delta_2} g]^2} = \\
&= \frac{(\delta_2 - \delta_1)(\delta_1 y - \delta_1 \rho - b_1)}{[\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 + \frac{\delta_1(1-\delta_2)}{\delta_2} g]^2 \delta_2} > 0
\end{aligned}$$

Next, we will deal with the targeted and uniform guarantees in the post-transition economies. If the economy is in „post-transition“ regime ( $\frac{b_2}{b_1} < \frac{\delta_2}{\delta_1}$ ) and collateral is unconstrained, then:

$$\left. \frac{\partial C_2^*}{\partial g_1} \right|_{(g_2=\text{const.})} = -1$$

This means that lump-sum guarantees provided to a high risk borrower decrease the collateral requirement for a low risk borrower and in this way increase the social efficiency.

$$\left. \frac{\partial C_2^*}{\partial g_2} \right|_{(g_1=\text{const.})} = \frac{\delta_1(1-\delta_2)}{\delta_2(1-\delta_1)} > 0$$

From this we see that the lump-sum guarantees provided to a low risk borrower increase the size of collateral required from him which leads to decrease in the social efficiency.

$$\left. \frac{\partial C_2^*}{\partial g} \right|_{(g=g_1=g_2)} = -1 + \frac{\delta_1(1-\delta_2)}{\delta_2(1-\delta_1)} = \frac{-(\delta_2 - \delta_1)}{\delta_2(1-\delta_1)} < 0$$

This implies that the uniform lump-sum guarantees have a positive social efficiency effect since they lead to a lower collateral requirement. From these results we see that the incentive effects on collateral requirements are qualitatively the same as the incentive effects connected with credit rationing requirements.

Finally we consider the case of post-transition economy with low level of collateral available. If the economy is in „post-transition“ regime ( $\frac{b_2}{b_1} < \frac{\delta_2}{\delta_1}$ ),

collateral is constrained, and collateralizable wealth  $W$  is such that (IC2) is satisfied, then:

$$\left. \frac{\partial \pi_2^*}{\partial g_1} \right|_{(g_2=\text{const.})} = \frac{1 - \delta_1}{\delta_1 y - \delta_1 \frac{\rho - (1 - \delta_2)g_2}{\delta_2} - b_1 - (1 - \delta_1)W} > 0$$

From this we see that lump-sum guarantees targeted to a high risk borrower decrease the credit rationing of a low risk borrower.

$$\left. \frac{\partial \pi_2^*}{\partial g_2} \right|_{(g_1=\text{const.})} = (\delta_1 y - \rho + (1 - \delta_1)g_1 - b_1) \frac{-\frac{(1 - \delta_2)\delta_1}{\delta_2}}{[\delta_1 y - \delta_1 \frac{\rho - (1 - \delta_2)g_2}{\delta_2} - b_1 - (1 - \delta_1)W]^2} < 0$$

Lump-sum guarantees targeted to a low risk borrower are counterproductive since they increase the credit rationing of a low risk borrower.

$$\begin{aligned} \left. \frac{\partial \pi_2^*}{\partial g} \right|_{(g=g_1=g_2)} &= \frac{(1 - \delta_1) \left[ \frac{(\delta_2 - \delta_1)(\delta_1 y - \delta_1 \rho - b_1)}{\delta_2(1 - \delta_1)} - (1 - \delta_1)W \right]}{\left[ \delta_1 y - \delta_1 \frac{\rho - (1 - \delta_2)g}{\delta_2} - b_1 - (1 - \delta_1)W \right]^2} > 0 \\ &\Leftrightarrow W < \frac{(\delta_2 - \delta_1)(\delta_1 y - \delta_1 \rho - b_1)}{\delta_2(1 - \delta_1)^2} \end{aligned} \quad (13)$$

Untargeted lump-sum guarantees decrease the volume of credit rationing of a low risk borrower provided that the available collateralizable wealth is low enough so that it satisfies condition (13). In the situation without government support it could happen in the post-transition economy that the available collateralizable wealth would be too low to satisfy condition (13). This would lead to the non-existence of equilibrium. This extremely inefficient case of credit market break-up may be precluded by sufficiently high government intervention since the properly designed guarantee leads to the decrease of required collateral.

## 2.2. Interest Rate Subsidies

We will keep the structure of this section as much as possible the same as the structure of the previous section, devoted to the credit guarantees, in order to enable the reader to make easy comparison of both types of government intervention.

The maximization problem is the same as in the case with lump-sum guarantees. The only change is in the zero profit condition for lenders, where equation (5) is replaced by

$$\delta_i(R_i + s_i) + (1 - \delta_i)\beta C_i - \rho = 0 \quad (14)$$

The subsidy is paid only in the case of the project's success, as opposed to guarantees which are paid in the case of failure. The subsidy is just an exogenous supplement to a repayment to a lender.

In all cases, a part of the equilibrium solution with interest rate subsidies is given by:

$$C_1^* = 0, \pi_1^* = 1, R_i^* = \frac{\rho - (1 - \delta_i)\beta C_i^*}{\delta_i} - s_i \quad (15)$$

The rest of the solution is given according to the following three cases.

If  $\frac{b_2}{b_1} \geq \frac{\delta_2}{\delta_1}$ , then:

$$C_2^* = 0 \quad (16)$$

$$\pi_2^* = \frac{\delta_1 y - \rho - b_1 + \delta_1 s_1}{\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 + \delta_1 s_2} \quad (17)$$

If  $\frac{b_2}{b_1} < \frac{\delta_2}{\delta_1}$  and collateral is unconstrained, then:

$$C_2^* = \frac{\rho(\delta_2 - \delta_1) - \delta_1 \delta_2 (s_1 - s_2)}{\delta_2(1 - \delta_1) - \delta_1(1 - \delta_2)\beta} \quad (18)$$

$$\pi_2^* = 1 \quad (19)$$

If  $\frac{b_2}{b_1} < \frac{\delta_2}{\delta_1}$ , collateral is constrained, and collateralizable wealth  $W$  is such that (IC2) is satisfied, then:

$$C_2^* = W \quad (20)$$

$$\pi_2^* = \frac{\delta_1 y - \rho - b_1 + \delta_1 s_1}{\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 - \frac{[\delta_2(1 - \delta_1) - \delta_1(1 - \delta_2)\beta]W}{\delta_2} + \delta_1 s_2} \quad (21)$$

The welfare properties of this optimal solution are given in the following paragraphs. The utility of a high risk borrower under the interest rate subsidies intervention is

$$U_{11} = \delta_1 y - \rho - b_1 + \delta_1 s_1$$

The utilities of low risk borrowers are given according to the following three cases:

1. Transition economy:

$$U_{22} = (\delta_2 y - \rho - b_2 + \delta_2 s_2) \frac{\delta_1 y - \rho - b_1 + \delta_1 s_1}{\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 + \delta_1 s_2}$$

2. Post-transition economy without collateral restriction:

$$U_{22} = \delta_2 y - b_2 - \frac{\rho [\delta_2 - \delta_1 + \delta_2 (1 - \beta)] - \delta_1 \delta_2 (1 - \delta_2) (1 + \beta) (s_1 - s_2)}{\delta_2 (1 - \delta_1) - \delta_1 (1 - \delta_2) \beta} + \delta_2 s_2$$

3. Post-transition economy with constrained collateral and with wealth  $W$  such that (IC2) is satisfied:

$$U_{22} = [\delta_2 y - \rho - b_2 + \delta_2 s_2 - (1 - \delta_2) (1 - \beta) W] \frac{\delta_1 y - \rho - b_1 + \delta_1 s_1}{\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 + \delta_1 s_2 - (1 - \delta_2) (1 - \frac{\delta_1}{\delta_2} \beta) W}$$

The qualitative nature of the targeted interest rate subsidies to low risk or high risk borrowers is similar to the case of guarantees.

The main qualitative features of the optimal solution of the optimization problem are the following: The uniform subsidies in the transition economy case and in the post-transition economy with a binding collateral decrease credit rationing. As opposed to guarantees, the uniform subsidies do not have any effect on the size of collateral required in a stabilized economy.

The formal comparative statics, on which these welfare results are based, are presented in the reminder of this subsection. First we will consider the transition economy, then we will move to the post-transition economy.

If the economy is in „transition“ regime ( $\frac{b_2}{b_1} \geq \frac{\delta_2}{\delta_1}$ ), then:

$$\left. \frac{\partial \pi_2^*}{\partial s_1} \right|_{(s_2 = \text{const.})} = \frac{\delta_1}{\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 + \delta_1 s_2} > 0$$

This means that interest rate subsidies targeted to a high risk borrower decrease the size of credit rationing of a low risk borrower.

$$\left. \frac{\partial \pi_2^*}{\partial s_2} \right|_{(s_1=\text{const.})} = [\delta_1 y - \rho - b_1 + \delta_1 s_1] \frac{-\delta_1}{[\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 + \delta_1 s_2]^2} < 0$$

Therefore we see that interest rate subsidies to a low risk borrower increase the credit rationing of a low risk borrower.

$$\left. \frac{\partial \pi_2^*}{\partial s} \right|_{(s=s_1=s_2)} = \frac{\frac{\delta_1}{\delta_2} (\delta_2 - \delta_1) \rho}{[\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 + \delta_1 s_2]^2} > 0$$

If the government decides to implement untargeted subsidies, then this policy leads to the decrease in credit rationing of a low risk borrower.

If the economy is in „post-transition“ regime ( $\frac{b_2}{b_1} < \frac{\delta_2}{\delta_1}$ ) and collateral is unconstrained, then:

$$\left. \frac{\partial C_2^*}{\partial s_1} \right|_{(s_2=\text{const.})} = \frac{-\delta_1 \delta_2}{\delta_2 (1 - \delta_1) - \delta_1 (1 - \delta_2) \beta} < 0$$

which says that interest rate subsidies to high risk borrower decrease the collateral required from the low risk borrower.

$$\left. \frac{\partial C_2^*}{\partial s_2} \right|_{(s_1=\text{const.})} = \frac{\delta_1 \delta_2}{\delta_2 (1 - \delta_1) - \delta_1 (1 - \delta_2) \beta} > 0$$

On the other hand, the subsidies provided to low risk borrower increase the collateral required from him.

Now we will consider the case when government decides to provide untargeted interest rate subsidies of the same size for all borrowers. This situation leads to the following conclusion:

$$\left. \frac{\partial C_2^*}{\partial s} \right|_{(s=s_1=s_2)} = 0$$

As opposed to all other cases analyzed in this section, under this government policy we get the surprising result that the untargeted interest rate subsidies are totally powerless since the uniform increase in subsidies has no effect on the collateral requirement.

As the last part of this section we will consider situation when the economy is in „post-transition“ regime ( $\frac{b_2}{b_1} < \frac{\delta_2}{\delta_1}$ ), collateral is constrained, and collateralizable wealth  $W$  is such that (IC2) is satisfied. Under these conditions the three approaches to the targeting of subsidies considered in this paper generate the following results:

$$\left. \frac{\partial \pi_2^*}{\partial s_1} \right|_{(s_2=\text{const.})} = \frac{\delta_1}{\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 - \frac{[\delta_2(1-\delta_1) - \delta_1(1-\delta_2)\beta]W}{\delta_2} + \delta_1 s_2} > 0$$

Interest rate subsidy targeted to a high risk borrower decreases the credit rationing of a low risk borrower.

$$\left. \frac{\partial \pi_2^*}{\partial s_2} \right|_{(s_1=\text{const.})} = \frac{(\delta_1 y - \rho - b_1 + \delta_1 s_1)(-\delta_1)}{[\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 - \frac{[\delta_2(1-\delta_1) - \delta_1(1-\delta_2)\beta]W}{\delta_2} + \delta_1 s_2]^2} < 0$$

Subsidy targeted to a low risk borrower increases the credit rationing of the targeted borrower and consequently it is not a desirable policy option.

Finally,

$$\begin{aligned} \left. \frac{\partial \pi_2^*}{\partial s} \right|_{(s=s_1=s_2)} &= \frac{\delta_1 \left\{ [\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 - \frac{[\delta_2(1-\delta_1) - \delta_1(1-\delta_2)\beta]W}{\delta_2} + \delta_1 s] \right\}}{[\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 - \frac{[\delta_2(1-\delta_1) - \delta_1(1-\delta_2)\beta]W}{\delta_2} + \delta_1 s]^2} - \\ &\quad - \frac{\delta_1 [(\delta_1 y - \rho - b_1 + \delta_1 s)(-\delta_1)]}{[\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 - \frac{[\delta_2(1-\delta_1) - \delta_1(1-\delta_2)\beta]W}{\delta_2} + \delta_1 s]^2} = \\ &= \frac{\delta_1 \left\{ -\frac{\delta_1 \rho}{\delta_2} - \frac{[\delta_2(1-\delta_1) - \delta_1(1-\delta_2)\beta]W}{\delta_2} + \rho \right\}}{[\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 - \frac{[\delta_2(1-\delta_1) - \delta_1(1-\delta_2)\beta]W}{\delta_2} + \delta_1 s]^2} = \\ &= \frac{\frac{\delta_1}{\delta_2} \{ \rho(\delta_2 - \delta_1) - [\delta_2(1-\delta_1) - \delta_1(1-\delta_2)\beta]W \}}{[\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 - \frac{[\delta_2(1-\delta_1) - \delta_1(1-\delta_2)\beta]W}{\delta_2} + \delta_1 s]^2} > 0 \\ &\Leftrightarrow W < \frac{\rho(\delta_2 - \delta_1)}{\delta_2(1-\delta_1) - \delta_1(1-\delta_2)\beta} \end{aligned}$$

which is the restriction on collateral, leading to this case  $\Rightarrow \frac{\partial \pi_2^*}{\partial s} \Big|_{(s=s_1=s_2)} > 0$ .

Therefore we conclude that uniform subsidies lead to a decrease in a credit rationing of a low risk borrower in this case.

## Conclusions

In our paper we introduced government interventions into the model of credit provision under asymmetric information. The aim of these interventions was to alleviate the inefficiencies in credit markets caused by private information of borrowers. In accordance with empirically observed types of interventions we concentrated on two kinds of government intervention – credit guarantees and interest rate subsidies.

We compared these two intervention mechanisms in the framework of two possible historically evolving regimes relevant for transition economies. First we considered transition environment of early nineties, when the big structural changes happened both in the structure of economy and in the welfare of people. It was a time when some people with good entrepreneurial abilities became relatively quickly quite well off while other people without these abilities were due to structural changes forced outside of their old employments and moved down along the social ladder. Then we considered the post-transition environment of the years before the accession to the European Union, when the situation in the economy became more stable and the alternative opportunities for people were not so widely different as at the start of the transition.

Both for subsidies and guarantees we considered two possible ways of providing them. One possibility is to provide uniform subsidies for all borrowers. This is a very attractive specification since it minimizes the discretion of the government and simplifies the provision of the government support. We also considered the government support targeted to different types of entrepreneurs, as revealed by their choice of contract offered to them by the lenders.

Based on all these distinctions we showed that the guarantees and subsidies targeted to low risk borrowers decrease efficiency while those targeted to high risk borrowers increase efficiency both in transition and post-transition economies. Further we proved that the uniform non-targeted guarantees improve welfare. We also proved that the uniform subsidies may be used to improve welfare in the economy subjected to credit rationing too, but we obtained quite interesting result that they do not have any effect on the size of collateral required in post-transition economy. Therefore we conclude that guarantees and subsidies

have in majority of cases qualitatively similar effects. Nevertheless guarantees are more robust instrument in the situation when the policymakers are not sure whether the economic environment corresponds more to the transition or post-transition economy.

## References

- [1] CAPRA, M. C. – FERNANDEZ, M. O. – RAMIREZ, I.: The Separating Role of Collateral Requirements in Credit Markets with Asymmetric Information. [Working paper 23. LINEEX.] Valencia: University of Valencia 2001.
- [2] GUDGER, M.: Credit Guarantees: An Assessment of the State of Knowledge and New Avenues of Research. [Agricultural Services Bulletin, No. 129.] Rome: FAO 1998.
- [3] INNES, R.: Financial Contracting under Risk Neutrality, Limited Liability and ex ante Asymmetric Information. *Economica*, 60 (237) : 27 – 40 February 1993.
- [4] JANDA, K.: A Model of a Competitive Credit Market in the Conditions of Imperfect Information [In Czech: Model konkurenčního úvěrového trhu v podmínkách nedokonalých informací.] *Politická ekonomie*, 50 (4) : 551 – 566 August 2002.
- [5] JANDA, K.: Credit Guarantees in a Credit Market with Adverse Selection. *Prague Economic Papers*, 12 (4) December 2003.
- [6] MINELLI, E. – MODICA, S.: Credit Market Failures and Policy. [Discussion paper, 2003/93.] UCL-CORE December 2003.
- [7] NAVAJAS, A. R.: Credit Guarantee Schemes: Conceptual Frame. [Mimeo.] FONDESIF, November 2001.
- [8] STIGLITZ, J. E. – WEISS, A.: Credit Rationing in Markets with Imperfect Information. *American Economic Review*, 71 (3) : 393 – 410 June 1981.
- [9] TOWNSEND, R. M.: Optimal Contracts and Competitive Markets with Costly State Verification. *Journal of Economic Theory*, 21 (2) : 265 – 293 October 1979.
- [10] VAUHKONEN, J.: Are Adverse Selection Models of Debt Robust to Changes in Market Structure? [Discussion paper 28.] Helsinki: Bank of Finland November 2003.