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Analysis of the Budgetary Costs of the Supporting and Guarantee Agricultural and Forestry Fund

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1. Introduction

Government support of agriculture is currently one of the most discussed areas of economic policies of European Union (EU) and its member countries. A majority of the EU interventions and regulations of agriculture are present within the framework of the Common Agricultural Policy (CAP). In addition to CAP programs there are also National Aid programs in EU member countries. One of the most important National Aid programs in the Czech agricultural industry is for the support of commercially provided agricultural loans. This support is administered by a special fund called the Supporting and Guarantee Agricultural and Forestry Fund (SGAFF). In Czech it is known under the acronym PGRLF, which stands for *Podpůrný a garanční rolnický a lesnický fond*.

In this paper we first briefly describe the operations of this SGAFF fund and then we concentrate on the questions of its funding and its budgetary costs. Subsequently we complement this empirical analysis with a theoretical analysis of the budgetary costs of different government programs of agricultural credit support.

The problem of agricultural credit support is addressed by a number of papers in both academic and policy-oriented literature. A comprehensive overview of credit policies is provided by Barry (1995). He analyzes public credit programs in U.S. agriculture both from the empirical and the theoretical point of view. The credit provision in U.S. agriculture is also discussed by Doucha (1993). The credit guarantees are further described by Navajas (2001), who discusses credit-guarantee schemes used by farmers or small enterprises and by Gudger (1998), who concentrates on the use of credit guarantees in agriculture. In the context of the Czech Republic, the activities of SGAFF were empirically investigated by Janda, Sklenkova, and Vigner (1997) and by Janda and Cajka (2006). The agricultural policies relevant to transition countries in comparison to CAP are described by Pokrivcak and Ciacian (2004).

The theoretical model in this paper is written in the tradition of the asymmetric information approach to the explanation of credit-market imperfec-

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TABLE 1 Applications and Mediated Loans

Year	Number of applications	Of those approved	Approval ratio	Volume of loans mediated (CZK million)
1994	2 605	2 388	0.92	6 235
1995	2 945	2 739	0.93	10 129
1996	3 426	3 252	0.95	14 847
1997	2 540	2 340	0.92	14 622
1998	1 934	1 735	0.90	9 299
1999	1 746	1 493	0.86	7 695
2000	1 539	1 425	0.93	5 324
2001	1 723	1 671	0.97	6 369
2002	1 993	1 920	0.96	7 361
2003	1 802	1 723	0.96	6 088
2004	2 657	2 471	0.93	7 963
Total	24 910	23 157	0.93	95 932

Source: (PGRLF, 2005)

tions. This approach builds on earlier papers by Jaffee and Russell (1976), Stiglitz and Weiss (1981) and others to explain credit rationing and other imperfections as a rational, equilibrium-generating response to adverse selection problems attributable to asymmetric information between lenders and borrowers. Of the classic papers dealing with credit contracts under asymmetric information conditions those of Bester (1985) and Besanko and Thakor (1987) may be mentioned as relevant to the theoretical part of our paper. A comprehensive recent treatment of these theories is provided by Tirole (2006) and Bolton and Dewatripont (2005) on a general contract-theory level, by Freixas and Rochet (1997) and Bebczuk (2003) in the banking and finance environment context and by Cosci (1993) in a specialized setting of the credit-rationing problem. Gale (1990, 1991), Smith and Stutzer (1989) and more recently Janda (2003, 2005) use this contract-theory approach to analyze government interventions in credit markets. The general problems of dealing with firms in financial distress under asymmetric information conditions are addressed by Kolecek (2005) and Knot and Vychodil (2005).

2. Government Support of Agriculture through SGAFF

The SGAFF was set up on the basis of a Czech government resolution in 1993 as a joint-stock company whose sole shareholder is the Czech Ministry of Agriculture. The main activity of the SGAFF is the provision of interest--rate subsidies and loan guarantees. This provision is done through a number of specialized programs targeted either to a particular activity or to a particular type of recipients. More details about the creation and goals of credit support are provided in articles by Horcicova (1993) and Horcicova and Vaskova (1994). The evolution of the activities of SGAFF over the years of its operation is captured in the *Table 1*. The term "volume of mediated loans" used in this table means the total size of all loans supported by SGAFF.

The very high approval ratio in Table 1 is caused by the design of the SGAFF activities. SGAFF never intended to serve as a screening institution which would evaluate the quality of the submitted projects and which would subsequently make a decision on accepting or rejecting the project based on its economic viability. The SGAFF, as a matter of policy, leaves the economic analysis of the business projects entirely to commercial banks. In the event that the project is approved by the commercial bank for financing, the SGAFF essentially automatically provides support for the project as long as the project satisfies the generally stipulated conditions and rules of SGAFF programs. This means that the rejected applications for SGAFF support were those which somehow violated these SGAFF rules. This policy explains the low administrative burden, simplicity and transparency of SGAFF operations and the enthusiastic reception of SGAFF both by farmers and bankers.

There are currently two groups of SGAFF main programs: investment and non-investment loans programs, which are supplemented by the Youth program. This supplementary program, which may be used by young farmers only in conjunction with some of the main programs, increases the rates of support provided under the main programs. The non-investment loans support is currently represented only by the Interest Burden Compensation Program. The goal of this program is to compensate for the interest rate difference between agricultural loans and loans provided in other industries. The investment-loans group consists of five programs. Three of these are designed according to the production vertical line as the Farmer, Processor, and Distribution Organization Programs. The Hygiene Program is oriented toward the improvement of veterinary and hygienic conditions of processing animal and plant products according to EU and Czech regulations. The Land Investment Program supports land purchases for agricultural operations.

This description of SGAFF programs indicates that the term "Forestry" in the name of the SGAFF actually has no real meaning as far as the currently supported activities are concerned. SGAFF supports only agriculture and the activities currently related to agriculture. In the past SGAFF also operated some programs related to the non-production functions of agriculture, to multi-functionality and rural development, and to forestry.

3. The Budget Impact of SGAFF

3.1 SGAFF Funding

The funding for SGAFF is based on two main sources – the shares portfolio and the annual contribution from the state budget. At the time of its foundation SGAFF was endowed with portfolio shares of agricultural or agriculture-related enterprises. These shares were obtained in two tranches. In 1994 SGAFF obtained from the National Property Fund shares in the nominal value of CZK 3.8 billion in the first wave of voucher privatization. Janda (1996) estimates the market value of this initial portfolio of SGAFF to range from a minimum of CZK 1.6 billion to a maximum of

TABLE 2 Appropriations to SGAFF from the State Budget

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Appropriation (CZK bilion)	2.60	2.10	2.77	4.21	3.61	2.39	2.18	1.31	1.25	0.72	0.63	0.60
Change (%)	–	–19.2	31.9	52.0	–14.3	–33.8	–8.8	–39.9	–4.6	–42.4	–12.5	–4.8

Source: Zákon o státním rozpočtu (Czech State Budget Act) (1994–2005)

TABLE 3 Government Support to Agriculture

Type of expenditure	1994		1997		2000		2003	
	CZK mil.	%	CZK mil.	%	CZK mil.	%	CZK mil.	%
SGAFF	2 654	35.25	3 458	28.18	2 175	10.92	720	3.51
Market interventions	1 925	25.56	2 404	19.59	2 420	12.15	6 730	32.79
Direct subsidies	2 139	28.41	3 500	28.52	10 848	54.45	7 711	37.57
Research	448	5.95	418	3.41	441	2.21	586	2.85
Tax relief	264	3.51	1 664	13.56	822	4.13	1 597	7.78
Others	100	1.33	827	6.74	3 217	16.15	3 182	15.50
Total	7 530	100.00	12 271	100.00	19 923	100.00	20 526	100.00

Sources: (Ministerstvo zemědělství ČR, 1995, 1998, 2001, 2004)

CZK 2.5 billion at the time of SGAFF's creation. In 1995 SGAFF received from the National Property Fund shares in the nominal value of CZK 1.865 billion in the second wave of voucher privatization. At the time of their transfer to SGAFF, the market value of these shares was approximately one half of their nominal value. SGAFF did not obtain the shares completely free of charge. It had to pay one one-thousandth (1/1000) of their nominal value, i.e. CZK 5.665 million. The initial SGAFF portfolio is described in more detail by Janda (1994).

The most important source of SGAFF funding is the annual appropriations from the state budget. The time series of these appropriations is provided in *Table 2*. When evaluating the dynamics of this time series, it should be kept in mind that the sharp upswing in 1997 was partly caused by the special appropriation of CZK 750 million for the provision of flood relief for farmers in areas damaged by flooding in summer 1997. The steady decrease in annual government contributions, which has been especially pronounced since 2001, is partly connected with the decrease in the volume of support extended to farmers by SGAFF, caused in part by the argument that SGAFF has sufficient capital, and thus it does not need such large annual government contributions.

The comparison with Table 1 shows that the period of large annual contributions from the state budget from 1996 to 1998 corresponds to the period of the highest activity of the fund in terms of volume of loans supported by SGAFF. While the volume of supported loans in 2004 is approximately half that of the peak year of 1996, SGAFF's in the total support of Czech agriculture, shown in *Table 3*, decreased over the years much more significantly from 35 % in 1994 to 3.5 % in 2003.

TABLE 4 Supported Loans According to Their Duration

Loan duration	Number of applications	Of which approved	Loan amount (CZK million)	Guarantees amount (CZK million)	Subsidy in total (CZK million)	Subsidies paid out by December 31, 2004 (CZK million)
up to 1 yr.	7 037	6 989	32 097	5 476	2 032	2 028
up to 2 yrs.	2 844	2 825	9 533	3 399	1 179	1 101
up to 3 yrs.	1 554	1 536	3 900	1 168	682	678
up to 4 yrs.	4 362	4 327	13 594	4 201	3 183	3 108
up to 5 yrs.	1 931	1 898	6 461	2 056	1 394	1 176
up to 6 yrs.	3 121	3 064	13 563	4 816	3 648	3 127
up to 7 yrs.	1 169	1 165	6 941	4 032	2 609	2 319
up to 8 yrs.	656	642	5 044	2 851	2 022	1 758
up to 9 yrs.	119	117	1 265	584	503	390
up to 10 yrs.	144	140	1 855	899	800	559
up to 11 yrs.	16	16	257	173	164	124
up to 12 yrs.	6	6	64	43	57	42
up to 13 yrs.	3	3	22	0	12	10
up to 14 yrs.	6	6	23	4	11	2
up to 15 yrs.	18	18	107	18	49	12
up to 17 yrs.	1	1	20	0	14	4
up to 19 yrs.	5	5	7	0	4	0.02
up to 20 yrs.	18	18	43	0	22	0.38
unspecified	1 900	381	1 135	148	67	32
Total	24 910	23 157	95 932	29 869	18 453	16 469

Source: (PGRLF 2005)

3.2 The Main Budgetary Costs of SGAFF

From the point of view of the Czech government, the budgetary costs of SGAFF are equal to the annual contributions provided to SGAFF from the state budget through the Ministry of Agriculture, which are given in Table 2. From the economic point of view, these amounts are only transfers from the state budget to the SGAFF budget. SGAFF is not obliged to spend the funds provided by the government in a given year for credit support during that year. From the logic of guarantees it follows that the guarantee institution has to keep enough funds to be able to cover amounts due over the whole duration of the loan. Therefore SGAFF has to have sufficient reserve funds available. According to (PGRLF, 2005, p. 15), the value of SGAFF portfolio reached CZK 6.5 billion by December 31, 2004. The future liabilities of the SGAFF have to be compared against these assets. According to (PGRLF, 2005, p. 17), as of December 31, 2004 the contracted guarantees associated with outstanding loans were CZK 7,239 million. On the same date, the total volume of subsidies granted and associated with outstanding loans was CZK 5,586 million, of which approximately CZK 3,849 million had already been paid out. To answer the question about the quality of the match between the value of portfolio and future liabilities, the term structure of these liabilities and the expected rate of default must be known.

TABLE 5 Guarantees and Subsidies Contracted and Paid

Year	Guarantees contracted (CZK million)	Number of defaults	Guarantee payments by SGAFF (CZK million)	Subsidies contracted (CZK million)	Paid out from the subsidies contracted (CZK million)
1994	1 544	0	0	1 259	286
1995	4 436	9	28	2 417	722
1996	8 265	19	69	4 337	1 819
1997	4 788	61	170	2 964	2 702
1998	2 307	119	677	1 959	2 682
1999	1 138	191	811	1 394	2 208
2000	876	181	723	754	1 606
2001	1 129	99	308	992	1 333
2002	1 365	60	109	1 008	1 267
2003	1 714	36	131	606	964
2004	2 306	40	176	763	880
total	29 869	815	3 201	18 453	16 469

Source: (PGRLF, 2005)

Unfortunately we do not have available data about the current term structure of the future liabilities of SGAFF with respect to contracted future interest-rate subsidies and outstanding amounts of guarantees. However, we have available the aggregated historical data about the duration structure of all loans supported by SGAFF since its foundation until the end of 2004. This information is provided in *Table 4*. The duration data in this table show that the majority of the supported loans are for two years at most. When measured by loan amount, the one- and two-year loans account for 44 % of all loans supported. Only a very small share (5 %) of the loan amount belongs to long-term loans with the duration of nine or more years. Therefore, based on historical data we could say that the major expected cost and risk exposure of SGAFF is concentrated on a short-term horizon of up to two years with the rest essentially distributed in the medium term of three to eight years.

As we argued in previous paragraphs, the annual transfers from the state budget to SGAFF do not represent the actual costs of SGAFF. It would be quite a complex problem to calculate the true economic costs of SGAFF if we considered all direct and indirect costs. In this paper we will restrict our attention to only the direct costs. Nevertheless, even the quantification of all direct costs of SGAFF would not be an easy task even if we had available the internal accounting data of SGAFF. Since we do not have access to these proprietary data, we focus only on the direct cost of the main activities of SGAFF in this paper.

As we have already mentioned, the principal activity of SGAFF is the support of agricultural commercial loans through interest-rate subsidies and guarantees. Therefore the main budgetary costs of SGAFF are the payments of interest-rate subsidies and guarantee payments for defaulted loans. These payments are given in *Table 5* for the period 1994–2004.

It can be seen in Table 5 that both the total cost of guarantee payments and the number of defaulted guaranteed loans increased sharply during the period 1998–2000. The reaction to this trend was the steady decrease

in the size of contracted guarantees with the minimum achieved in 2000. By comparing the total guarantee payments with the total volume of guarantees contracted since the beginning of SGAFF until the end 2004, we find out that the average share of paid guarantees with respect to the guarantees provided in the contracts over the years of SGAFF's operation was slightly higher than 10 percent. As long as we take these historical data as a good prediction for the future, we may expect that the cost of CZK 7.239 billion in outstanding guarantees as of December 31, 2004 will be around CZK 0.7 billion in terms of expected actual guarantee payments by SGAFF. When we add the CZK 1.737 billion of outstanding contracted interest-rate subsidies, we see that the CZK 6.5 billion value of the SGAFF portfolio is sufficiently high to support the major mission of SGAFF regardless of the operational and institutional costs of running SGAFF operations and administration.

Our prediction of the expected guarantee payments could be taken as a reasonable estimate for the future. After the lesson with the increasing guarantee payments was learned by SGAFF during the 1990s, SGAFF is more careful and conservative in the provision of guarantees. SGAFF also contracted outside agencies to manage the defaulted loan payments so that the actual guarantee payments could be minimized.

Our comparison of the value of the portfolio and expected cost of core SGAFF activities explains the reasons of decreasing government budget contributions presented in Table 2. It also explains the insistence of the Czech Ministry of Agriculture on SGAFF taking part in additional supporting activities in addition to its main mission of providing credit guarantees and interest-rate subsidies. For 2006, SGAFF will not receive any government budget contribution. At the time of writing this paper there are no indications available whether this is only a one-year measure or whether this is the end of the government's budget support of SGAFF.

SGAFF obviously also has operational and administrative costs connected with its functioning as an institution and the financial costs of active management of its portfolio. It also incurs significant costs connected with a number of ad hoc activities imposed upon it by its sole shareholder – the Czech Ministry of Agriculture. These ad hoc activities range from the purchases of receivables to be received by primary agricultural producers from processing firms during 1994–1999 to the flood-relief loans in connection with the 1997 and 2002 floods. The most recent example is the involvement of SGAFF in agricultural insurance support since 2004. This support of agriculture insurance seems to be a lasting activity which could become one of the major SGAFF lines of business.

While the Czech Supreme Audit Office (Nejvyšší kontrolní úřad, 1997, 1999) and Silar (1996) mentioned and criticized a number of inefficiencies connected both with the main activities of SGAFF and all those supplementary activities, we have left all these legitimate concerns aside in this paper and restricted our attention to the interest-rate subsidies and guarantee payments summarized in Table 5. We will continue to maintain this focus on guarantees and interest-rate subsidies in the following sections, in which we will switch our focus from empirical investigation to the theoretical mode of analysis.

4. The Model of Credit Rationing under Asymmetric Information

In this section we incorporate the problem of budget costs of government intervention into the simplified version of the model of the credit market under asymmetric information developed by Janda (2003, 2005). This abridged model concentrates on inefficiencies caused by credit rationing and therefore does not deal with efficiency losses caused by collateralized debt contracts, which are analyzed by Janda (2003, 2005).

The focus on the credit-rationing aspect of the information asymmetry between lender and borrower is based on the Czech agricultural-policy makers' and agricultural economists' perception of the agricultural credit-market situation at the time the Czech SGAFF was created. The major concern leading to the establishment of SGAFF was the prevailing opinion that Czech farmers had been rationed out of the credit market. At the beginning of the 1990s commercial banks were not willing to lend to farmers since they were considered as a too-risky client group – see (Silar, 1996).

There are two types of risk-neutral borrowers in this model, indexed as Type 1 and Type 2. These two types are distinguished by their probability of successfully finishing their projects, 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 a lender is Type 1 is θ. The only informational asymmetry in the model is that ex ante lenders and the government do not know the borrower's type.

The borrower can either undertake one risky project, which yields y in the case of success and 0 in the case of failure, or he obtains the reservation utility b_i, $i \in \{1,2\}$. When the project is completed, the outcome of the project is freely observed by the borrower, lender, and government.

In order to undertake the project, the borrower has to borrow one unit of money from the lender. The unit cost of funds for risk-neutral lenders engaged in Bertrand competition is denoted as ρ. The contracts between the lender and borrower are standard debt contracts. This means that in the case of success of the project the lender receives a constant repayment R. Each lender offers two types of contract. Each contract is a pair (π_i, R_i), $i \in \{1,2\}$ where R_i is the required repayment and π_i is the credit-rationing probability, i.e. the probability that the application of the borrower who chooses this contract will be approved.

The expected utility of a borrower of type i who applies for a contract designed for a borrower of a type j is given as incremental expected utility:

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

which may be simplified as

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

This definition of utility function leads naturally to the participation constraint in the form

$$U_{ij} \geq 0$$

We assume that each project is socially efficient, that is $\delta_i y > b_i + \rho$. This assumption loosely corresponds to one important policy reason given as a justification for implementing the Czech SGAFF program. At the beginning of the 1990s the Czech agricultural policymakers and economists argued that direct provision of subsidies from the government to farmers may encourage inefficient projects. Therefore the policy response was to shift the responsibility for the choice of projects to be financed to commercial banks. In the framework of our model this means that we assume that the banks had already screened out and eliminated all the obviously bad projects. Therefore our model analysis corresponds to the second decision stage, when such a complete preliminary screening had already been accomplished by banks.

The government may attempt to reduce the inefficiencies created by credit rationing by three types of interventions, which were motivated by the programs used by the Czech SGAFF.

Under the proportional guarantees program, the government guarantees the payment of the fraction α_i of the contracted loan repayment in the case of zero return from a project. The expected profit to the lender is

$$B_i = \pi_i [\delta_i R_i + (1 - \delta_i)\, \alpha_i R_i - \rho] \tag{2}$$

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 a project. The expected profit to the lender is

$$B_i = \pi_i [\delta_i R_i + (1 - \delta_i)\, g_i - \rho] \tag{3}$$

The last considered type of intervention is an interest-rate subsidy s_i, which is paid only in the case of a project's success, as opposed to guarantees, which are paid in the case of failure. While the subsidy reduces the interest rate paid by the borrower, we can treat it analytically as an exogenous supplement to a repayment to the lender. Therefore the expected profit to the lender is

$$B_i = \pi_i [\delta_i (R_i + s_i) - \rho] \tag{4}$$

In accordance with the practice of SGAFF, these supports are provided by the government free of charge. This means that the borrower does not have to pay any guarantee (or subsidy) fee to the government, which in the Czech case is represented by SGAFF. This is in sharp contrast to the usual commercially provided guarantees.

5. The Optimization Problem and Its Solution

Since the focus of our attention in this paper is on the budgetary costs of government intervention, we only briefly state the solutions of the model under three different considered interventions here. The detailed solution

of the full unabridged model with the relevant proofs is provided by Janda (2003, 2005). Those papers consider our three types of government interventions but do not deal with their government budgetary impact, which is the point of interest in this article. In this paper we will analyze only the situation when the values of the reservation utilities and likelihood of success parameters are such that $\frac{b_2}{b_1} \geq \frac{\delta_2}{\delta_1}$. This situation corresponds to the transition-economy case in the terminology of Janda (2003, 2005).

The lender under asymmetric information does not know ex ante the risk class of a borrower. Due to competition from other lenders, each lender attempts to offer the best possible conditions to each type of borrower. If lump-sum guarantees are provided, the maximization problem of the lender is given by:

$$\max_{\binom{\pi_1,R_1}{\pi_2,R_2}} M = \theta U_{11} + (1-\theta)U_{22}$$

$$= \theta\pi_1[\delta_1(y-R_1)-b_1] + (1-\theta)\pi_2[\delta_2(y-R_2)-b_2]$$

s.t.

$$\begin{aligned} \pi_1[\delta_1(y-R_1)-b_1] &\geq \pi_2[\delta_1(y-R_2)-b_1] \quad \text{(IC1)} \\ \pi_2[\delta_2(y-R_2)-b_2] &\geq \pi_1[\delta_2(y-R_1)-b_2] \quad \text{(IC2)} \\ U_{ii} &\geq 0 \quad \text{(IRi)} \\ 0 \leq \pi_i &\leq 1 \end{aligned}$$

$$\delta_i R_i + (1-\delta_i)\, g_i - \rho = 0 \tag{5}$$

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

Equation (5) is a zero-profit condition for lenders, which explicitly prohibits cross-subsidization. This means that it is not possible for lenders to suffer a loss on a contract to one type of borrower and to enjoy a positive profit on a contract with another type of borrower. The zero-profit constraint restricts the ability of the lender to offer the most attractive contract to the borrower when the lender competes for the borrower with other lenders.

The solution of this problem is two different contracts (π_i^*, R_i^*) one offered to the high-risk borrower and one to the low-risk borrower. Therefore the initial ex-ante informational asymmetry disappears at the moment when the borrower reveals his type by accepting one of the offered contracts. Based on this ex-post revelation of the borrower type, the government is able to target its support by providing different subsidies or guarantees for different contracts offered by the lender.

When proportional guarantees are used, the lender's zero-profit condition (5) is replaced by

$$\delta_i R_i + (1-\delta_i)\alpha_i R_i - \rho = 0 \tag{6}$$

When interest-rate subsidies are used the lender's zero-profit condition (5) is replaced by

$$\delta_i(R_i + s_i) - \rho = 0 \tag{7}$$

By solving this optimization problem we determine the following characteristics of the optimum solution.

For government support implemented through lump-sum guarantees, the contracts for high-risk (indexed as borrower 1) and low-risk borrowers (indexed as borrower 2) are given by:

$$\pi_i^* = 1, R_i^* = \frac{\rho - (1 - \delta_i)g_i}{\delta_i}, \quad i \in \{1,2\} \tag{8}$$

$$\pi_2^* = \frac{\delta_1 y - \rho - b_1 + (1 - \delta_1)g_1}{\delta_1 y - \frac{\delta_1}{\delta_2}\rho - b_1 + \frac{\delta_1(1- \delta_2)}{\delta_2} g_2} \tag{9}$$

For government support implemented through proportional guarantees, the contracts for high-risk (indexed as borrower 1) and low-risk borrowers (indexed as borrower 2) are given by:

$$\pi_1^* = 1, R_i^* = \frac{\rho}{\delta_i + (1 - \delta_i)\alpha_i}, \quad i \in \{1,2\} \tag{10}$$

$$\pi_2^* = \frac{\delta_1 y - b_1 - \frac{\delta_1 \rho}{\delta_1 + (1 - \delta_1)\alpha_1}}{\delta_1 y - b_1 - \frac{\delta_1 \rho}{\delta_2 + (1 - \delta_2)\alpha_2}} \tag{11}$$

For government support implemented through interest-rate subsidies the contracts for high-risk (indexed as borrower 1) and low-risk borrowers (indexed as borrower 2) are given by:

$$\pi_1^* = 1, R_i^* = \frac{\rho}{\delta_i} - s_i, \quad i \in \{1,2\} \tag{12}$$

$$\pi_2^* = \frac{\delta_1 y - \rho - b_1 + \delta_1 s_1}{\delta_1 y - \frac{\delta_1}{\delta_2}\rho - b_1 + \delta_1 s_2} \tag{13}$$

In the next section we will use these equilibrium values of the required repayments R_i^* and credit-rationing probabilities π_i^*, $i \in \{1,2\}$ to evaluate the budget cost of different types of interventions. Our analysis will be purely theoretical and qualitative. We leave the possible calibration of the model and numerical estimations for future research.

6. Budget Cost of Interventions

From the welfare point of view the absolute volume of government money spent on the interventions really does not matter as long as we take it as

a pure transfer without any transaction cost. We do not include in this model any formal considerations of the cost of obtaining money for the government's budget, nor do we model the cost of transferring money from the government's budget to the hands of lenders and borrowers. This means that we do not answer the question of whether (taking into account the cost of obtaining and transferring money) it is socially efficient for the government to engage in credit-market interventions. In accordance with the situation of the Czech agricultural policies and government decision-making, we take it as a given fact that the government decides to undertake a credit-market intervention based on political reasons. Nevertheless, we assume that the government would like to achieve its goals in improving the efficiency of credit markets with as few government budget outlays as possible. (This is a very obvious assumption, but it is not trivial. It could be possible that for some political and economic reasons the government would pursue some additional goals besides improving the efficiency of credit markets and those goals would not be compatible with minimization of the government's budgetary cost.) Consequently, the government is very interested in the expected budget impact of its interventions, which is the subject of the following analysis. This means that we compare here only relative efficiency (from the budgetary cost perspective) of different credit market interventions.

The expected budgetary cost of different forms of government interventions G_m, $m \in \{\alpha, g, s\}$ are given by the following formulas:

Proportional guarantees:

$$G_\alpha = \theta\pi_1^* (1 - \delta_1)[\alpha_1 \frac{\rho}{\delta_1 + (1 - \delta_1)\alpha_1}] + (1 - \theta)\pi_2^* (1 - \delta_2)[\alpha_2 \frac{\rho}{\delta_2 + (1 - \delta_2)\alpha_2}] \tag{14}$$

Lump-sum guarantees:

$$G_g = \theta\pi_1^* (1 - \delta_1)g_1 + (1 - \theta)\pi_2^* (1 - \delta_2)g_2 \tag{15}$$

Interest-rate subsidies:

$$G_s = \theta\pi_1^*\delta_1 s_1 + (1 - \theta)\pi_2^*\delta_2)s_2 \tag{16}$$

Under the assumptions of our model in the first-best full information case all the projects would be implemented. This means that asymmetric information leading to equilibrium credit rationing generates welfare loss.

In the remainder of this section we consider the following scenario. We assume that the government determines the target level of credit rationing which the government would like to achieve. To reach this target level, the government is able to use different credit-support instruments.

Given a required target level of efficiency (determined by the level of π_2^*) denoted as π_h, we can determine the level of intervention $m_1(m_2, \pi_h)$, where $m \in \{\alpha, g, s\}$, is needed to achieve this required target.

We will compute these levels of intervention and subsequently we will use them to compare the budget impact of different types of interventions under the condition of the same achieved target level of efficiency.

For proportional guarantees we express in equation (11) the formula for a proportional guarantee to a high-risk borrower α_1 as a function of the target level of credit rationing π_h and the proportional guarantee to a low-risk borrower α_2:

$$\pi_h \left[\delta_1 y - b_1 - \frac{\delta_1 \rho}{\delta_2 + (1 - \delta_2)\alpha_2} \right] = \delta_1 y - b_1 - \frac{\delta_1 \rho}{\delta_1 + (1 - \delta_1)\alpha_1(\alpha_2,\ \pi_h)}$$

which leads to:

$$\alpha_1(\alpha_2,\ \pi_h) = \frac{\delta_1 \left\{ \rho - \left[\delta_1 y - b_1 - \pi_h [\delta_1 y - b_1 - \frac{\delta_1 \rho}{\delta_2 + (1 - \delta_2)\alpha_2}] \right] \right\}}{(1 - \delta_1) \left[\delta_1 y - b_1 - \pi_h [\delta_1 y - b_1 - \frac{\delta_1 \rho}{\delta_2 + (1 - \delta_2)\alpha_2}] \right]} \tag{17}$$

The size of a lump-sum guarantee for a high-risk borrower g_1, given as a function of the targeted level of credit rationing π_h and the lump-sum guarantee for a low-risk borrower g_2, is obtained from equation (9) as:

$$g_1(g_2, \pi_h) = \frac{\pi_h [\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 + \frac{\delta_1 (1 - \delta_2)}{\delta_2} g_2] - \delta_1 y + \rho + b_1}{1 - \delta_1} \tag{18}$$

Similarly, the interest-rate subsidy for a high-risk borrower, given as a function of π_h and s_2, is obtained from equation (13) as:

$$s_1(s_2, \pi_h) = \frac{\pi_h (\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 + \delta_1 s_2) - \delta_1 y + \rho + b_1}{\delta_1} \tag{19}$$

The budgetary cost of a lump-sum guarantee intervention, given as a function of π_h and g_2, is obtained by substituting $g_1(g_2,\ \pi_h)$ from (18) and $\pi_1^* = 1$ from (8), into (15):

$$\begin{aligned} G_g &= \theta \left\{ \pi_h \left[\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 + \frac{\delta_1 (1 - \delta_2)}{\delta_2} g_2 \right] - \delta_1 y + \rho + b_1 \right\} + \\ &+ (1 - \theta)\pi_h (1 - \delta_2) g_2 \\ &= \theta \left\{ \pi_h \left[\delta_1 y - \frac{\delta_1}{\delta_2} \rho - b_1 \right] - \delta_1 y + \rho + b_1 \right\} + \\ &+ \theta \pi_h \frac{\delta_1 (1 - \delta_2)}{\delta_2} g_2 + (1 - \theta)\pi_h (1 - \delta_2) g_2 \end{aligned}$$

The budgetary cost of an interest-rate subsidy, given as a function of π_h and s_2, are obtained by substituting $\pi_1^* = 1$ from (12) and $s_1(s_2,\ \pi_h)$ from (19), into (16):

$$G_s = \theta\left[\pi_h(\delta_1 y - \frac{\delta_1}{\delta_2}\rho - b_1 + \delta_1 s_2) - \delta_1 y + \rho + b_1\right] + (1-\theta)\pi_h \delta_2 s_2$$
$$= \theta\left\{\pi_h\left[\delta_1 y - \frac{\delta_1}{\delta_2}\rho - b_1\right] - \delta_1 y + \rho + b_1\right\} + \theta\pi_h \delta_1 s_2 + (1-\theta)\pi_h \delta_2 s_2$$

The comparison of the budgetary cost for the targeted lump-sum guarantees and for the targeted interest rate-subsidies shows that:

$$G_s - G_g = \pi_h\left\{s_2[\theta\delta_1 + (1-\theta)\delta_2] - g_2[\theta\,\frac{\delta_1(1-\delta_2)}{\delta_2} + (1-\theta)(1-\delta_2)]\right\} > 0$$
$$\Leftrightarrow s_2 > \frac{g_2(1-\delta_2)[\theta\,\frac{\delta_1}{\delta_2} + 1 - \theta]}{\theta\delta_1 + (1-\theta)\,\delta_2} = g_2\frac{1-\delta_2}{\delta_2}$$

So, it is intuitively plausible if s_2 is sufficiently high relative to g_2, then $G_s > G_g$. This means that if the government is targeting support both to low- and high-risk borrowers, the comparison of budget impacts of lump-sum guarantees and interest-rate subsidies depends on the extent of support provided directly to low-risk borrowers. The intervention with lower support targeted to low-risk borrowers will be cheaper for the government's budget.

For the optimal solution with $s_2 \to 0, g_2 \to 0$ we get $\lim_{s_2\to 0} G_s = \lim_{g_2\to 0} G_g$.

For $\alpha_2 \to 0$, the budgetary cost is given as:

$$\lim_{\alpha_2\to 0} G_\alpha = \theta\left[\pi_h(\delta_1 y - \frac{\delta_1}{\delta_2}\rho - b_1) - \delta_1 y + \rho + b_1\right] \Rightarrow \lim_{\alpha_2\to 0} G_\alpha = \lim_{s_2\to 0} G_s = \lim_{g_2\to 0} G_g$$

For the optimum interventions with negligible volume of support targeted to low-risk borrowers, the government is indifferent with regard to all three analyzed types of intervention as far as the impact of these interventions on the government's budget is concerned.

In the case of lump-sum guarantees and interest-rate subsidies we can also easily express $g = g_1 = g_2$ and $s = s_1 = s_2$:

$$g(\pi_h) = \frac{\delta_2[\pi_h(\delta_1 y - \frac{\delta_1}{\delta_2}\rho - b_1) - (\delta_1 y - \rho - b_1)]}{(1-\delta_1)\,\delta_2 - \pi_h\delta_1(1-\delta_2)}$$

$$s(\pi_h) = \frac{\pi_h(\delta_1 y - \frac{\delta_1}{\delta_2}\rho - b_1) - (\delta_1 y - \rho - b_1)}{\delta_1(1-\pi_h)}$$

The comparison of the cost of non-targeted lump-sum guarantees and non--targeted interest-rate subsidies shows that:

$$G_s - G_g = [\pi_h(\delta_1 y - \frac{\delta_1}{\delta_2}\rho - b_1) - (\delta_1 y - \rho - b_1)]$$

$$\frac{[\delta_2(1-\delta_1) - \pi_h\delta_1(1-\delta_2)][\theta\delta_1 + (1-\theta)\delta_2\pi_h] - \delta_1\delta_2(1-\pi_h)[\theta(1-\delta_1) + (1-\theta)\pi_h(1-\delta_2)]}{\delta_1(1-\pi_h)[\delta_2(1-\delta_1) - \pi_h\delta_1(1-\delta_2)]}$$

$$= [\pi_h(\delta_1 y - \frac{\delta_1}{\delta_2}\rho - b_1) - (\delta_1 y - \rho - b_1)] \frac{(\delta_2 - \delta_1)\pi_h[\delta_1\theta + \delta_2(1-\theta)]}{(1-\pi_h)[\delta_2(1-\delta_1) - \pi_h\delta_1(1-\delta_2)]}$$

Since the denominator term $(1-\pi_h)[\delta_2(1-\delta_1) - \pi_h\delta_1(1-\delta_2)]$ may be shown to be positive, the entire fraction is positive. The sign of the difference $(G_s - G_g)$ therefore depends on the leading term $[\pi_h(\delta_1 y - \text{rac}\delta_1\delta_2\rho - b_1)(\delta_1 y - \rho - b_1]$, which is positive if $\pi_h > \frac{\delta_1 y - \rho - b_1}{\delta_1 y - \frac{\delta_1}{\delta_2}\rho - b_1}$. This fraction is equal to the size of credit rationing in the absence of government intervention. Since in our model any meaningful intervention leads to the decrease in the credit ration (meaning the increase in the π_h), the leading term and the whole expression will be positive. Therefore $(G_s - G_g) > 0$. This argument also confirms that the formulas for uniform interventions $g(\pi_h)$ and $s(\pi_h)$ derived in this section take only positive values. The fact that the uniform interest rate subsidies are more expensive than the uniform lump-sum guarantees means that with the non-targeted supports, the government unambiguously prefers lump-sum guarantees to interest-rate subsidies in minimizing the budgetary cost.

7. Empirical Evidence

Our theoretical results may be compared with the empirical evidence of the loan support provided by the operations of the Czech SGAFF. SGAFF started with strong emphasis on guarantee provision (as witnessed by its name, which has remained unchanged since the creation of SGAFF), when the rate of guarantees was quite high, in some cases up to 100 % of the contracted loan repayment. All the initial programs of SGAFF provided either only guarantees or guarantees and subsidies. There was no program providing only interest-rates subsidies among the initial programs. The exception was only supplementary programs (Landscape, Youth, and Agro-region), which were designed as supplementary programs to be used by eligible farmers only in conjunction with some of the principal programs. These supplementary programs provided additional interest rate subsidies.

After the first few years, both the rate of guarantees and the volume of provided guarantees decreased relative to the provision of subsidies. This quantitative evidence of a shift of emphasis to interest-rates subsidies was quite consistent up to 2004. SGAFF's decision to decrease the provision of guarantees, which we discussed in Section 2, was caused primarily by the in-

crease in guarantee payments from the SGAFF budget since 1998. Through the combined effects of the decrease of guarantees and better active management of its portfolio of defaulted loans, SGAFF managed to avoid the danger of a massive wave of default connected with the huge guarantee payments. Since 2001 SGAFF's guarantee payments decreased to the level prevailing before 1998. This created a favorable environment for the revival of credit guarantees as a major part of SGAFF's operations. Therefore, 2004 saw the reversal of the trend of guarantees' decreasing role, with greater emphasis placed on guarantees, as measured by the volume of guarantees provided.

By 2004 and 2005 the guarantees provided by SGAFF were usually up to 30 % of the contracted loan repayments, in some programs up to 50 %. This means that they were still set more conservatively than in the first years of SGAFF's operations. Until 2004 non-investment loans were supported only by interest-rate subsidies; currently they are supported by both subsidies and guarantees. Among the investment-loan programs, three of them provide both interest-rate subsidies and guarantees, one provides only subsidies and one provides only subsidies in some investment areas and both subsidies and guarantees in other investment areas.

One interesting feature of the Czech SGAFF guarantees is that, as opposed to the guarantees provided by commercial banks, they do not require any guarantee fee. What is even more intriguing, the question of guarantee fees was never raised in any of the many discussions concerned with SGAFF. In the case of the 2006 termination of the government's budget contribution to SGAFF becoming permanent, the only possibility to continue operation of SGAFF guarantee activities will be to modify them along the lines used by commercial banks' guarantee programs. The inclusion of some simple guarantee fee into our model then may be relatively straightforward and our model may be used for the analysis of those modified guarantees too.

8. Conclusions

In our paper we have described the Czech SGAFF institution of agricultural credit support. We have shown the evolution of its activities, funding, and outlays over time. Our empirical analysis shows that while both its absolute volumes and its relative importance in total government support to agriculture decreased after 2000 as compared to second half of 1990s, it still remains an important institution of agricultural credit support. It is likely to remain active at the current level at least until the end of 2006.

We have shown that the value of the SGAFF portfolio is sufficiently high to cover the expected costs of credit guarantees and subsidies provided by SGAFF so far. In principle, our simple estimation of expected costs of credit guarantees could be done much more extensively using option-pricing techniques. The explicit theoretical analysis of the possibilities of using option pricing for valuation of SGAFF guarantees is provided by Janda and Levinsky (1996). But actual careful implementation of these techniques with the discussion of all relevant assumptions to the SGAFF data have not yet been carried out and it remains an interesting topic for future research.

In the second half of this paper we augmented the empirical analysis with a theoretical model. We started from the idea that the government's credit support may decrease the inefficiencies caused by credit rationing based on lender's incomplete information about the quality of the farmers. We introduced the government interventions – credit guarantees and interest--rate subsidies – modeled according to their Czech empirical counterparts. Our analysis was based on the comparison of direct budgetary costs required by different types of interventions for a given reduction of credit rationing.

Our analysis has shown that as long as the government is perfectly targeting its interventions to disadvantaged high-risk farmers with the goal of reducing credit rationing caused by asymmetric information, the considered types of interventions are perfectly equivalent from the point of view of direct government budgetary costs. If the government provides support both to low- and high-risk farmers, then the comparison of lump-sum guarantees and interest-rate subsidies depends on the extent of support provided to low-risk farmers. If the subsidy rates provided to these efficient farmers are sufficiently high relative to the lump-sum guarantees provided to these farmers, then the budgetary costs are higher for subsidies. As long as credit support is provided uniformly to all types of farmers, the government unambiguously prefers lump-sum guarantees to interest-rate subsidies in minimizing budgetary costs.

Our qualitative theoretical results have mixed empirical-evidence support. Since the currently used guarantees and subsidies are uniform, our model predicts that the most efficient way for the government to decrease credit rationing is to prefer guarantees over subsidies. This is what happened in the evolution of the Czech SGAFF fund during the first years of its operations and what seems to have been happening again recently. In the intervening years of the evolution of SGAFF, the fear of uncertainty connected with extended guarantees was stronger than our intuitively plausible theoretical argument and SGAFF curbed the provision of these guarantees. The successful management of guarantees and defaulted loans by the end of the 1990s and by the beginning of this century was probably the most important factor leading to the current renaissance of the SGAFF credit guarantees.

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SUMMARY

JEL classification: D82, G28, P31
Keywords: credit; guarantees; subsidies; transition

An Analysis of the Cost of the Supporting and Guarantee Agricultural and Forestry Fund (SGAFF) in the Czech Republic

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The paper analyzes the cost to the Czech state budget of the Supporting and Guarantee Agricultural and Forestry Fund (SGAFF). In the empirical part of the paper, the author shows that the SGAFF portfolio has sufficient value to cover the expected costs of the credit guarantees and subsidies offered by the fund. The theoretical model looks at government interventions designed to decrease the credit rationing of farmers with high probability of success. The theoretical model shows that, with uniform non-targeted supports, the Czech government unambiguously prefers lump-sum guarantees to interest-rate subsidies. With support targeted wholly to disadvantaged farmers, the cost of lump-sum guarantees, proportional guarantees, and interest-rates subsidies are all equal.