The Roles of Commercial Credit and Direct Subsidies in Czech Agriculture During Early Transition

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Abstract: This paper provides an econometric estimation of the influence of individual social-economic, natural, and technological determinants of the credit provision for the agriculture in the case of the Czech Republic. The regression model is based on the microeconomic model of the maximization of the bank's profit. The results of this paper show that the support of agricultural credit provided by Guarantee Fund goes primarily to the areas with a good conditions for the development of agricultural production. On the other hand, the direct government subsidies are targeted primarily to the areas with non-favourable natural conditions.

Keywords: Subsidies, Guarantees, Rural Development

JEL classification: Q14, R51.

1 The Financial Situation of the Czech Agriculture in Early Transition

The government supported finances have a very import part in the financing of the agriculture in transition economies. Up to the end of the 80's, the government support of agriculture in all transition economies had a very different nature and forms as compared to the situation in the 90's. In the pre-reform period, agriculture in all transition countries was administratively isolated from the world market, so the export and import interventions had very different forms from those used in market economies. In the internal markets, the support for agriculture was primarily channelled indirectly through subsidies connected with prices of agricultural inputs and outputs. Significant support to agriculture also went through general social programs designed to improve the quality of life of the population as a whole and to equalize the standards of living between rural and urban populations.

From the beginning of the 90's, the Czech government abolished the previous interventions in pricing goods and it also rejected the idea of the "welfare state." In 1991-1993, the main tools of government intervention in Czech agriculture were the State Fund for Market Regulation and the subsidies provided under the subsidy programs of the Ministry of Agriculture.

The State Fund for Market Regulation (SFMR) was a government run agency, which buys certain agricultural products under certain conditions, stores them (or arranges for their storage by contract with some commercial enterprises) and again sells these products in domestic or foreign markets. In this way, SFMR was engaged in the creation and implementation of both domestic and foreign agricultural trade policies of the Czech government.

SFMR was designed to work both as a market stabilizer and a farmers' support program. During the first years of its existence, its programs involved many agricultural commodities. The gradual tendency was to narrow its focus, so that in 1995 it was only engaged in

the trade of cereals and milk products. For farmers the forward buying of agricultural commodities by SFMR served as a very important source of money paid in advance under favourable conditions.

The subsidies provided under the subsidy programs of the Czech Ministry of Agriculture were always targeting some special goals. Under these programs, in the majority of cases, the farmers had to formally apply for a given program and the Ministry of Agriculture had no obligation to accept the application. The support included a very wide array of subsidized activities ranging from the support of beef pastures to the creation of information systems for agriculture. The methods of support were also varied from direct monetary payments to direct loans or subsidies for interest payments on ordinary commercial loans.

From the beginning of 1994, this system was supplemented by the Support and Guarantee Fund for Farmers and Forestry (further abbreviated as the Guarantee Fund), which came to be viewed as the single most important instrument of government support for agriculture, as emphasized by the Czech Vice-Prime Minister and Minister of Agriculture [Zásady (1996)]. The importance of the Guarantee Fund is obvious from the comparison of the government budget money budgeted in 1996 for agriculture through the Guarantee Fund, which was 3.1 billion Czech Crowns [Zásady (1996)], with the money budgeted for the subsidies programs of the Ministry of Agriculture, which was 2.4 billion Czech Crowns, and with the money budgeted for SFMR, which amounted to 1.5 billion Czech Crowns (Doucha, 1996).

2 The Model

My approach to the analysis of the provision of the agricultural credit in the Czech Republic is based on the standard neoclassical individual profit maximization.

The maximizing agent in my model is the bank. This modelling choice is done according to the empirical situation in the Czech agriculture, where the decision about the provision

Tabulka 1: The Expenditures from Government Budget to Agriculture (in milions of Czech crowns in current prices)

	1991	1992	1993	1994	1995
Fund of Market Regulation	5564	3539	1575	1925	850
Guarantee Fund	0	0	0	2654	2299
Direct subsidies	7152	5596	5087	2112	2648
Expenditure from sources outside of Ministry of Agriculture	NA	NA	70	52	200
Specific tax allowances	6000	4000	100	100	177
Total	18716	13135	6832	6843	6174

Source: Zpráva o stavu českého zemědělství (1996, p.30).

of loan and about the size of loan is in the hands of bank. The bank evaluates projects presented by farmers. The projects approved by a bank almost automatically receive a government support through the Guarantee Fund.

The bank maximizes its profit π:

$$\max \pi = R - C, \tag{1}$$

where

R is the return to the bank,

C is the cost to the bank.

The cost C is composed from variable cost and fixed cost. Variable cost is given as a product of the volume of extended credit y and a price ρ which the bank has to pay for its sources. Fixed cost F does not depend on the volume of extended credit.

$$C = \rho y + F. \tag{2}$$

The return to the bank is defined as a function

$$R = rf(y, x_1, \ldots, x_n), \tag{3}$$

where

r is an interest factor (1+interest rate),

$x_1, \ldots, x_n$ are factors influencing the probability of the loan repayment.

For the econometrical estimation I specify the function $f(y, x_1, \ldots, x_n)$ in the form:

$$f = y^{a_0} \prod_{i=1}^{n} x_i^{a_i} e, \tag{4}$$

where

e is a residual term.

After a substitution from the equations (2), (3), and (4) into a maximization problem (1), I obtain a problem in the form:

$$\max \pi = r y^{a_0} \prod_{i=1}^{n} x_i^{a_i} e - \rho y - F. \tag{5}$$

Under the assumption that the right hand side of the equation (5) is a concave function of the volume of credit y, the solution of the bank's profit maximization problem is given by the first order condition

$$\frac{d\pi}{dy} = r a_0 y^{a_0 - 1} \prod_{i=1}^{n} x_i^{a_i} e - \rho = 0. \tag{6}$$

From the equation (6) I express the volume of credit y which maximizes the profit of the bank:

$$y = \left(\frac{\rho}{r a_0 \prod_{i=1}^{n} x_i^{a_i} e} \right)^{\frac{1}{a_0 - 1}}. \tag{7}$$

After a taking of logarithms of the equation (7), I get

$$\log y = \frac{1}{a_0 - 1} \log \frac{\rho}{r a_0} - \sum_{i=1}^{n} \frac{a_i}{a_0 - 1} \log x_i - \frac{1}{a_0 - 1} \log e. \tag{8}$$

Under an assumption that both the market for lending sources and the market for agricultural credit are competitive, the variables r and ρ are constant for all banks and all

loans. The equation (8) then can be reparametrized into the form (9) using substitutions $\beta_0 = \frac{1}{a_0-1} \log \frac{\rho}{ra_0}$, $\beta_i = -\frac{a_i}{a_0-1}$, and $\epsilon = -\frac{1}{a_0-1} \log e$.

$$\log y = \beta_0 + \sum_{i=1}^{n} \beta_i \log x_i + \epsilon. \tag{9}$$

The parameters $\beta_1, \ldots, \beta_n$ are direct elasticities of the volume of credit supported by the Guarantee Fund with respect to the individual factors $x_i, i \in \{1, \ldots, n\}$.

3 The Data

The influence of the factors determining the provision of the agricultural credit in the Czech Republic is analysed on the cross-section of the county data. Out of 76 Czech counties I have used 63 counties in my analyses. The removed 13 counties correspond to large town agglomerations and to the counties with missing or unreliable data.

As a dependent variable in my regressions I use the volume of credit supported by Guarantee Fund per hectare of agricultural land in a given county. The data on supported credit for 1996 include only the period from the beginning of the year up to the September 10, 1996. Besides the three regression equations with the supported credit in the years 1994–6 as a dependent variable I also estimate two equations with the value of direct subsidies per hectare in 1994–95 as a dependent variable.

As independent variables $x_1, \ldots x_n$ I consider:

- x_1 the natural conditions,
- x_2 the degree of rurality,
- x_3 the intensity of agricultural production,
- x_4 the social-economic environment.

These theoretical independent variables are not observable and quantifiable. For the econometric estimation I had to find proxies for them. I have identified a group of possible proxies for each of my four theoretical variables.

The natural conditions in a given county (variable x_1) could be characterized by the following indicators: the elevation over the sea level, the average slope of land, official price of land, production ability of land, share of cheap land on the total area of agricultural land, share of expensive land on the total area of agricultural land, the share of permanent grass land on the total area of cheap land, the share of permanent grass land on the total area of expensive land. The degree of rurality (variable x_2) is described by the following indicators: the share of agricultural land on the total area of county, the population density, the share of town population on the total population, the share of farm labor force on the total labor force.

The intensity of agricultural production (variable x_3) is described by: the use of calcium fertilizers, the use of industrial fertilizers, the use of manure, the gross agricultural production, the gross crop agricultural production, the gross livestock agricultural production. All these characteristics are considered per hectare of agricultural land. The social-economic environment is characterized by: the production potential of non-agricultural sectors, the average wage, the average wage in agriculture, the rate of unemployment.

My choice of suitable proxy for my theoretical independent variables $x_1, \ldots, x_4$ was based on the correlation between dependent variables and the possible proxies for each independent variable. I have chosen as a proxy for the independent variable always the indicator, which has the highest absolute value of correlation with a given dependent variable. By this procedure I have got the following independent variables. For the equation explaining the provision of direct subsidies in 1994: x_1 is the share of cheap land on the total area of agricultural land, x_3 is the use of manure, x_4 is the average wage. For the equation explaining the provision of direct subsidies in 1995: x_1 is the share of cheap land on the total area of agricultural land, x_3 is the use of industrial fertilizers, x_4 is the production potential of non-agricultural sectors. For the equation explaining the credit in 1994: x_1 is the elevation over the sea level, x_3 is the gross crop agricultural production, x_4 is the production potential of non-agricultural sectors. For the equation explaining the credit in

1995: x_1 is share of cheap land on the total area of agricultural land, x_3 is the gross crop agricultural production, x_4 is the average wage. For the equation explaining the credit in 1996: x_1 is the share of permanent grass land on the total area of cheap land, x_3 is the gross crop agricultural production, x_4 is the rate of unemployment. The variable x_2 is taken as the share of agricultural land on the total area of county in all five regression equations.

The correlations coefficients for the indicators serving as proxies for the social-economic environment were much lower than the correlation coefficients for other groups of indicators. Therefore in order to achieve parsimony I did not include the variable x_4 into the final estimation.

In order to improve the efficiency of estimation, I have estimated all five regressions together. I have used the multivariate regression, which is an improvement on the conventionally used seemingly unrelated regressions (SUR). I have minimized the function:

$$Q(\boldsymbol{\beta}) = \mathbf{e}(\boldsymbol{\beta})'(\mathbf{S}^{-1} \otimes \mathbf{I}_T)\mathbf{e}(\boldsymbol{\beta}), \tag{10}$$

where

$\mathbf{e}(\boldsymbol{\beta})$	is a vector of stacked residuals (the function of the vector of $\boldsymbol{\beta}$)(for the system of K equations $\mathbf{e}' = (\mathbf{e}_1, \ldots, \mathbf{e}_K)$),
$\mathbf{S}$	is an estimated covariance matrix of disturbances of the size $(K \times K)$,
$\mathbf{I}_T$	is unit matrix of the size $(T \times T)$, where T is a number of observations.

The regression coefficients obtained by my estimation are given together with their t-statistics and with the values of the R^2 in table 2. The results of my regressions show the important differences in the directions of influence of the factors determining provision of agricultural credit and provision of direct subsidies. In all observed years the provision of credit increases with the improvement of natural conditions and with the increase in intensity of agricultural production. For the direct subsidies, the opposite is true - the worse the natural conditions for agricultural production and the lower the intensity of agricultural production, the more direct subsidies is provided. This finding is in full agreement with

economic intuition according to which the commercial banks will prefer to provide the credit to the areas, where the probability of successful repayment will be higher. The government is not restricted by a requirement of the profit maximization. One of the roles of the government is to correct market externalities and to take care of the development of the areas which would be underserved by market forces.

It is not so easy to explain the influence of the degree of rurality on the provision of money to farmers. The economic intuition presented above would suggest, that with an increase of rural character of a given area, the volume of credit allocated by the commercial banks will decrease and the volume of direct subsidies will increase. But my results show a different picture. In both analysed years the direct subsidies decreased with the growth of rural character and in the years 1994 and 1996 the increase in rurality led to increase in the volume of credit. These results show that in the conditions of the Czech Republic as a relatively developed, densely populated and a small and homogeneous country with a good transportation infrastructure the often used equivalences between agricultural and rural population, between agricultural and rural issues, between agricultural and rural policies do not hold. The results of my econometric analysis suggest that in the formulation of policies for the development of the financing of the Czech agriculture we have to differentiate explicitly between the agricultural and rural policies.

From the econometric point of view I have to note that the statistical significance of my credit and subsidy elasticities with respect to the degree of rurality is generally lower than is the case for elasticities with respect to the natural conditions and the intensity of agricultural production.

Generally the same signs of elasticities with respect to any given factor in the equations explaining one dependent variable (credit or direct subsidy) in different years indicate the time consistency. This time consistency is shown both on the level of microeconomic agents (the provision of commercial credit) and on the government policies level (the provision of direct subsidies). From the institutional point of view the consistency of government

policies is shown both by very stable stable rules for the support of agricultural credit [Pokyny (1996)] and by a relatively stable rules for the provision of direct subsidies [Zásady (1995), Zásady (1996)].

4 Conclusions

This paper provides an econometric estimation of the influence of individual social-economic, natural, and technological determinants of the credit provision for the agriculture in the case of the Czech Republic. The regression model is based on the microeconomic model of the maximization of the bank's profit. This approach corresponds to the empirical realities of the Czech agricultural credit market where the decisions about the provision of credit to agriculture is done by commercial banks. This is true even for the credit supported by the Czech Guarantee Fund.

The theoretically based model of credit provision is supplemented by an ad hoc specified regression model which relates the volume of direct subsidies for agriculture with the same independent variables as were those used in the explanation of credit provision.

The results of this paper show that the support of agricultural credit provided by Guarantee Fund goes primarily to the areas with a good conditions for the development of agricultural production. On the other hand, the direct government subsidies are targeted primarily to the areas with non-favourable natural conditions.

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Tabulka 2: The Results of Regression

Independent variable	Natural conditions (x_1)	Rurality (x_2)	Intensity of agriculture (x_3)	R^2
Subsidies 94	0.073	-0.543	-0.445	0.298
(t-stat.)	(1.916)	(-0.987)	(-2.265)	
Subsidies 95	0.079	-0.918	-0.114	0.413
(t-stat.)	(1.379)	(-1.972)	(-1.172)	
Credit 94	-0.635	0.127	0.111	0.157
(t-stat.)	(-3.274)	(0.261)	(0.503)	
Credit 95	-0.022	-0.549	1.156	0.108
(t-stat.)	(-.0831)	(-0.533)	(2.379)	
Credit 96	-0.079	0.272	0.518	0.434
(t-stat.)	(-4.759)	(0.783)	(3.223)	

Note: The t-statistics are computed from the heteroskedasticity robust standard errors. [White (1980)].