Bezlepkina, I.V., and N.M. Svetlov Approaching the level of losses caused by a lack of finance: The case of Russian farms // European rural policy at the crossroads: Conference papers / The Arkleton Centre for Rural Development Research, University of Aberdeen, Scotland, UK, 29 June - 1 July 2000.

International Conference:
European Rural Policy at the Crossroads
Thursday 29 June – Saturday 1 July 2000

The Arkleton Centre for Rural Development Research
King's College, University of Aberdeen
Scotland

Approaching the level of losses caused by a lack of finance: the case of Russian farms

Irina V. Bezlepkina*
Wageningen University (the Netherlands)
Moscow Agricultural Timiryazev Academy (Russia)
Nikolai M. Svetlov**
Moscow Agricultural Timiryazev Academy (Russia)

Abstract
Low financial discipline and an inefficient credit system in Russia result in insufficient financing of agricultural production. This study investigates whether a lack of finance causes essential losses for Russian agricultural production and what is their approximation? The modified Bayesian formalism allows us to employ scarce data to approximate losses. This formalism is incorporated into the objective function of optimisation model expressing the empirical dependence of profit on cash flow and debts. The model seeks for the optimal quarterly cash distribution within a year allowing for taking credit and making deposit (specification I and II) and for variability in debt receivable (specification II). We derived losses by comparing the values of optimal profit to capital ratio and the modelled profit to capital ratio under actual cash flow distribution. Empirical application employs the data from 60 quarterly reports of six agricultural enterprises from the Moscow Region in 1995-1998. The results from two scenarios representing efficiently working and imperfect economies with different discount rates are obtained for each model specification. The losses amount to 42.6% of a farm's total expenses. The resources to improve farm financial performance can be revealed from individual changes in the quarterly cash flow distribution. The efficiency of working capital on average is improved by 0.10 (specification I) and by 0.15 (specification II). These results give the first insight to evaluation of consequences of insufficient financing. Further investigations are necessary for a greater number of farms in order to analyse how these losses can be reduced by changes at the policy level.

*Irina V. Bezlepkina is a PhD student at Wageningen University (the Netherlands) and Moscow Agricultural Timiryazev Academy (Russia). Address in Russia: Department of Economic Theory, Timiryazevskaya 49, 127550 Moscow, Russia. Address in the Netherlands: Agricultural Economics and Rural Policy Group, Hollandseweg, 1, 6701 KN Wageningen, the Netherlands.
E-mail: Irina_Bezlepkina@hotmail.com
**Dr. Nikolai M. Svetlov is an associate professor at the department of economic cybernetics at Moscow Agricultural Timiryazev Academy (Russia). Address: Dept. of economic cybernetics, Moscow Agricultural Academy n.a. K.A. Timiryazev, Listvennichnaia alleia 4, 127550 Moscow, Russia.E-mail:svetlov@mnts.msk.su

1. Introduction

The majority of agricultural enterprises in Russia are in a dire state. Instability in financial markets brings a lot of uncertainty to producers and affects their production decisions. Operating in unfavourable economic environment has already resulted in agricultural production decline over 40% between 1991-1998 and in a large share of unprofitable agricultural enterprises (84% in 1998, Goskomstat (1999)). The financing of the agrarian production remains unstable and uncertain. Facts of postponed and incomplete payments for the agricultural products are widely observed in Russia. Debt payable exceeded debt receivable 3-4 times in 1998, whereas the share of the delayed part in total debt receivable was 91.7%, Goskomstat (1999). The ratio of credits and loans to gross output is 16 times higher in industry than in agriculture in 1998 (6 times in 1996). Limited access to credit sources, low financial discipline among the participants of the agrarian production and money devaluation caused by high inflation result in a lack of finance. The latter in turn leads to production decline and stipulates the losses. In order to make these losses less hampering, it is necessary to determine their essential factors and draw the strategies to their overcoming.

Actuate problem of agricultural production decline has recently drawn the attention of agrarian economists in Eastern Europe countries. Gow & Swinnen (1998), Macours & Swinnen (1999) admit that one of the essential reasons for output decline is the financing problems due to reduced supply of agricultural credit, market uncertainty and high inflation. Russian agricultural enterprises prefer the barter transactions, which in turn stipulate increasing transaction costs compared to the regular monetary transactions and negatively affect the efficiency of financing. According to the survey conducted by Goskomstat in 1998, 78% of Russian agricultural enterprises reported that the most reasonable limiting factor of agrarian development was lack of finance; 55% mentioned high credit rates; 48% named the consumers' insolvency[1].

Among the major factors that were identified as reasons for low economic performance of Russian agricultural enterprises Pederson *et al.* (1998) pointed low profitability, debt problem and low rate of return on assets. Van Empel (1999) and Von Pischke (1999) fairly admit that inefficiency of agricultural credit system to a certain extent causes the decline of agricultural production. As a consequence of rural credit system underdevelopment, agricultural farms cannot improve their financing through the banking

[1] Also the respondents mentioned insufficient support from the state, aggravated condition of the fixed assets, high taxes and inefficient management.

system due to risky nature of agricultural production and demanding requirements of the banks (Van Empel, (1999); Hardaker *et al.*, (1997)).

This paper attempts to answer the question: what is the approximate level of losses caused by a lack of finance? We underline the following **research hypothesis**: insufficient financing is one of the essential causes of losses incurred at the agricultural enterprises. The aim of this study was to evaluate the upper boundary of losses for a set of Russian agricultural enterprises. We presume that the study of a typical feasible structure of a farm's cash flow and the distribution of debt receivable within a year will allow us to identify the reserves that could lower the financial losses.

The contribution of this research is that it explicitly quantifies the costs of imperfect financing, mainly considered here as the limited access to credit sources and the deferred agricultural products payments. The relevance of these results for an enterprise is that the farm management exploits the internal sources to soften the damage caused by financial constraints; for policy makers level the calculated losses express how costly the mentioned financial imperfections are and thus indicate the direction of future policies. The data limitation problem in Russia, recently stressed by Moers (1999), remains in this study. 26% of the data used in this study were missing. We deal with the data scarcity problem by employing the Bayesian approach.

The current analysis of farming in Russia is different from previous research (see e.g Pederson et al., 1998; Epstein & Tillack, 1999) in several ways. First, it introduces new data that have a quarterly basis, thus allowing the modelling of cash flow distribution. Second, it applies some modifications to the standard Bayesian approach to avoid the problem of missing data. Third, it provides the estimation of the upper boundary of losses associated with imperfect financing. Fourth, it permits the preliminary identification of the reserves to soften the damage caused by a lack of finance.

To answer the stated above questions the theoretical concept was developed which relates to modelling of agricultural production financing. This concept will be further explained in section 2. In that section we also describe the modifications that have been applied to a standard Bayesian formalism. The modifications were necessary to run optimisation model that is presented in section 3. We focus on two specifications of this model aimed to account for losses and perform the simulations. The losses are derived by comparing the values of optimal profit to capital ratio and the profit to capital ratio modelled under actual cash flow distribution. The data description and results are given in section 4. Later in this paper we focus on possibilities to improve the economic performance of

agricultural farms. Discussion of the applied model and the outline of its further improvements finalise the paper.

2. Profit on cash flow dependence model: a modified Bayesian approach

The mathematical programming approach forms the base of this study. The theory is presented in (Kantorovich, 1962; Hazell & Norton, 1986) and many others. This section concentrates on the Bayesian approach in economics. Most of the Bayesian inference problems can be expressed as the evaluation of the expectation of a function of interest under the posterior. Approaches to this problem are nowhere near as systematic or methodical and carried out routinely (Geweke, 1989). We introduce its modification which makes it possible to incorporate the Bayesian inference into the mathematical programming problem. Here the main issues of the modified Bayesian formalism are presented. They are fully described in (Svetlov, 2000). Like the classical Bayesian formalism, its modified version is useful to derive the distribution of the variable considering the known factors influencing it (Judge *et al.*, 1988) but in addition it allows us to use differential analyses of variables of interest when the number of observations is insufficient.

To employ the Bayesian inference, input data require special preparations to extract all necessary information. The dependent (objective) variable and independent (factor) variables need to be converted into the discrete form. Insofar as the traditional Bayesian formalism operates with discrete data, the small (within one quantile) alternation of a factor variable will not result in changes of the dependent variable. Therefore, the optimisation methods based on differential calculus will not work. The Bayesian formalism is modified in order to enable the realisation of traditional numerical methods of optimisation. Thus, in the modified Bayesian formalism the value of a variable is considered as reliably belonging to a particular quantile only in case if it matches with quantile mean[2]. Otherwise the variable can be attached to both adjacent quantiles with a certain probability.

The rate of convergence of the function of interest depends critically on the choice of the probability distribution function (Geweke, 1989). In this study the decision on probability distribution function is justified regarding to the actual data: for the variables with both negative and positive values the normal distribution is preferred and for the non-negative variables the gamma distribution is chosen. Theoretically the number of quantiles should be chosen so to ensure that the share of the entropy removed by a factor variable in the overall

[2] Quantile is a compact subset of values realising with a given probability (in our study either 1/3 or 1/4).

entropy of the objective variable is the greatest. Empirically the number of quantiles is conditioned by the number of missing values. The upper boundaries b_k of each quartile are defined from the equation

$$\int_{-\infty}^{b_k} G(x)dx = \frac{k}{N},\ k = 1\ldots N-1$$

for normal distribution or

$$\int_{0}^{b_k} \Gamma(x)dx = \frac{k}{N},\ k = 1\ldots N-1$$

for gamma distribution where $G(x)$ is the normal distribution function, $\Gamma(x)$ is the gamma distribution function, k is a number of quantile, N is a number of quantiles for a given variable.

In this study the modified Bayesian formalism is embodied in a function $\pi = f(\mathbf{x})$, where π is a profit per working capital and $\mathbf{x} = (x_n)$ is a vector consisting of 9 independent variables describing cash flow and debt status. The mathematical expression for this function is as follows:

$$f(\mathbf{x}) = \sum_{i=1}^{4} p_i({}^{9}\mathbf{x})\pi_i$$

where

$$p_i({}^{n}\mathbf{x}) = \begin{cases} p_i({}^{n-1}\mathbf{x}) \quad if\ n>0\ and\ x_n \text{ is missing;} \\ \dfrac{p(B_{n,k(n)}/A_i)\,p_i({}^{n-1}\mathbf{x})}{\sum_{h=1}^{4} p(B_{n,k(n)}/A_h)\,p_h({}^{n-1}\mathbf{x})}\cdot(1-z_n+k(n)) + \dfrac{p(B_{n,k(n)+1}/A_i)\,p_i({}^{n-1}\mathbf{x})}{\sum_{h=1}^{4} p(B_{n,k(n)+1}/A_h)\,p_h({}^{n-1}\mathbf{x})}\cdot(z_n-k(n)) \\ \quad if\ n>0\ and\ x_n \in]m_{n,1};m_{n,q}[; \\ \dfrac{p(B_{n,k(n)}/A_i)\,p_i({}^{n-1}\mathbf{x})}{\sum_{h=1}^{4} p(B_{n,k(n)}/A_h)\,p_h({}^{n-1}\mathbf{x})} \quad if\ n>0\ and\ x_n \notin]m_{n,1};m_{n,q}[; \\ 0.25 \quad if\ n=0; \end{cases} \qquad (1)$$

$$z_n = k(n) + \frac{x_n - m_{n,k}}{m_{n,k+1} - m_{n,k}}.$$

Here ${}^{n}\mathbf{x}$ is a vector consisting of the first n elements of **x**, $p_i({}^{n}\mathbf{x})$ is a probability that the profit per working capital belongs to a quantile i considering the values of the first n factor variables, π_i is a mean value of the profit per working capital in the i-th quantile, $m_{n,k}$ is a mean of the k-th quantile of x_n, $m_{n,q}$ is a mean of the last quantile of x_n, $k(n)$ is either the greatest number of the n-th variable's quantile for which $x_n \geq m_{n,k(n)}$ or 1 if such quantile does

not exist, A_i denotes the event that the profit per working capital belongs to the quantile i, $p(B_{n,k(n)}/A_i)$ is an average probability of the event $B_{n,k(n)}$ that the value of the n-th variable belongs to the quantile $k(n)$ in case of the event A_i, z_n is a real number representing x_n in a form required by the modified Bayesian formalism.

According to (1) the probabilities can be calculated with which the value of variable π can be attached to quantile i considering the available information on values of the vector **x**. Their computation includes the realisation of the modified Bayesian formalism. *A priory* these probabilities are 0.25 by construction of quantiles. If the values x_n do not belong to the interval $]m_{n,1}; m_{n,q}[$ then there is no difference between the standard and the modified Bayesian procedures to compute the probability. If there is no available information on **x** at all then $p_i(\mathbf{x})$ remains equal 0.25. The realisation of the modified Bayesian formalism distributes the value of π among the quantiles proportionally. The means of these quantiles taken in this proportion give the mean value of π.

3. Models of accounting for level of losses due to a lack of finance

To derive the upper boundary of losses caused by financial imperfections we compare two modelled values. The first (E^*) is the optimal profit to working capital ratio that has been modelled with incorporated financial constraints. The second (E) is derived by substituting the actual values into (1), no optimisation is involved. We do not compare actual and modelled values because then it is rather difficult to capture the difference caused by the error term.

Two specifications of the optimisation model to account for the level of losses are developed. In both specifications described below the vector **x** of dependent variables consists of the following 9 components: $x_1 \ldots x_4$ are profit to total costs ratios for quarters I…IV respectively; $x_5 \ldots x_8$ are debt receivable to working capital ratios at the end of quarters I…IV respectively; x_9 is debt payable to working capital ratio at the end of quarter IV[3]. The Bayesian inference requires $x_1 \ldots x_8$ to be virtually independent. To avoid the existing dependencies that are induced by the variance of enterprises' size we use the relative measures in the analysis. In addition, the chosen measures also give the possibility to examine the

[3] The applied formalism requires the independence of factor variables. It does not hold for quarterly debts payable per working capital. Hence, we cannot introduce the debts payable for more than one quarter in the model. The disadvantage of this approach resulting from this restriction is that the model does not allow for the influence of debt payable distribution within a year on profit.

potential efficiency of working capital that is expressed as balance profit per unit of working capital.

Specification I aims at defining the best quarterly distribution of money flow and allows for taking credit and making deposit when needed. The function $\pi = f(\mathbf{x})$ of yearly balance profit to working capital is maximised. In this specification only $x_1 \dots x_4$ vary while optimisation, whereas variables $x_5 \dots x_9$ are fixed at their actual levels. The modified Bayesian formalism is introduced into the objective function. It ensures that the values of $\partial\pi / \partial x_n$ for $n = 1 \dots 9$ are, as a rule, non-zero. It is necessary in order to engage the Newton's method of solving for optimum[4]. The mathematical expression of this maximisation model is as follows:

$$\max_{x_1 \dots x_4} f(x_1 \dots x_9)$$

subject to

$$\sum_{i=1}^{4} \frac{x_i c_i}{(1+\delta)^{i-1}} \le \sum_{i=1}^{4} \frac{x_{0i} c_i}{(1+\delta)^{i-1}}$$

Here $f(x)$ is a function of profit to working capital described earlier, δ is a quarterly discount rate, c_i are farm expenses for the quarter i, x_{0i} is the observed value of x_i. The constraint ensures that the total available yearly financing stays constant so that there is no overestimation in the modelled values of cash flow. In other words, constant value of financing is allowed to be optimally distributed among the quarters.

Specification II in addition to specification I optimises the quarterly distribution of debt receivable. Thus, the variables $x_1 \dots x_8$ are involved in optimisation. As in specification I, the model is constrained keeping the sum of the compounded financial resources constant:

$$\max_{x_1 \dots x_8} f(x_1 \dots x_9)$$

subject to

$$\sum_{i=1}^{4} \frac{x_i c_i}{(1+\delta)^{i-1}} - \sum_{i=5}^{8} \frac{\omega(x_i - x_{0i})}{(1+\delta)^{i-5}} \le \sum_{i=1}^{4} \frac{x_{0i} c_i}{(1+\delta)^{i-1}}$$

Here ω is the amount of working capital at the end of the year. The interest rates on credit and deposit are assumed the same for both specifications for simplicity.

The level of losses defined as (E^*-E) represents the approximate reserve of cash flow improvement assuming that input and output allocations are in optimal (regarding to available knowledge) accordance with the cash flow that induces E^*. It approximates the **upper boundary** of the reserves to improve the cash flow distribution without the assumption that the input and output allocation is optimal.

[4] The Newton's method is incorporated in Excel as a standard solver procedure.

4. Data and results

The data on production and financial activities over six agricultural enterprises located in the Moscow Region are used in this study. The agricultural enterprises in our data set are the former kolkhozes and sovkhozes with 1000-3000 hectares of arable land and 200-650 employees. Most of the farms combine the crop and livestock production activities (table A.1 in Appendix). Four enterprises produce vegetables, three of them specialise in this product. This set is not a typical representation of the farming sector in the Moscow Region, so the conclusions are valid only within the given set of enterprises.

The approach requires the quarterly or, as desirable, monthly data, which are hardly accessible. We used 60 quarterly reports of the enterprises for the period 1995-1998[5]. There are 22 observations in this data set. An observation is a farm in a specific year. The values for different quarters form different variables within the observation. To give a reader a clear picture how the unbalanced panel was formed and which reports are missing we refer to table A.2 in Appendix. As it follows, for some observations we do not have complete records throughout a year. All variables, as it was mentioned before, are taken relatively to the value of working capital or to total costs to avoid the correlation conditioned by the size effect. The measurement unit for all variables is mln roubles to mln roubles.

The necessary data conversion into the discrete form is performed as described in section 3. The results can be reviewed in tables A.3 and A.4 of Appendix. The number of quantiles is 3 or 4 depending on the number of non-missing values. Data transformation was based on either normal or gamma distribution regarding to their better conformance with the data. In Table A.4 the real number z_n usually has fractional part. This denotes that with the probability represented by the fractional part of z_n the value x_n can be attached to the quantile which number is an integer part of z_n. With the probability (1 – fractional part of z_n) this value can be attached to the quantile which number is an integer part of z_n + 1. For example, z=2.84 (farm №1, year 1995 in Table A.4) implies that value x_3=0.2624 can be attached to quantile 2 with probability 0.16 and to quantile 3 with probability 0.84.

Both model specifications are executed in Microsoft Excel. The software processes one observation at a time. The optimisation model operates with the transformed data, which are presented in Table A.3. Two scenarios for each model specification are obtained applying different discount rates. These two scenarios allows us to compare the level of losses under

[5] The agricultural farms are obliged to fill in the balance sheets quarterly and to provide them to the regional departments of agriculture.

the assumption that the discount rate is 25% (typical for efficiently working economy, scenario 1) and 100% (the case of the economy with financial imperfections, scenario 2). The real situation in Russian economy in 1996-1998 when the credit rates were around 100% is likely reflected in scenario 2.

Though the calculations are performed at the farm level, the conclusions are drawn over the whole sample in order to be robust. The structure of the model does not take into account the farm specific characteristics, thus we cannot make a conclusion at the level of individual farm about the reserves to reduce the losses. The optimisation model was run with the data from the years 1997 and 1998 which form 10 observations. Among them 1 observation was omitted because it did not provide the minimal amount of data which is absolutely necessary to run the optimisation model. Optimisation was not applied to the data from 1995-1996 because the study was aimed at the analysis of losses incurred during the latest period. The graph with actual profit per working capital and that modelled under actual conditions is presented in Appendix. The difference between these values is attached to the influence of the factors that are not reflected in the model.

Table 1 presents the share of the calculated losses in the farm’s expenses. The upper boundary of losses identifies the approximate potential farm’s economic effect determined by perfectly functioning credit system and demonstrates the existence of such losses under current economic conditions.

Table 1. Share of calculated losses in total expenses, %

Farm number, year	Specification I		Specification II	
	efficient economy (scenario 1)	imperfect economy (scenario 2)	efficient economy (scenario 1)	imperfect economy (scenario 2)
№1, 1997	9.6	9.6	29.1	29.1
№2, 1997	27.1	27.1	33.3	33.3
№3, 1997	1.8	9.8	2.2	14.9
№4, 1997	5.9	3.8	6.0	4.3
№5, 1997	19.2	21.5	19.2	21.5
№6, 1997	2.8	2.8	4.0	5.6
№3, 1998	0.4	0.8	0.4	2.2
№5, 1998	33.8	40.2	39.2	42.6
№6, 1998	5.5	5.5	10.2	9.9

Loss magnitude for some observations in our data set is as large as 42.6% of total farm's expenses. Derived losses are not always higher for the scenario 2 of imperfect economy because farms are adapted to existing imperfections. Model specification II

performs wider possibilities in optimisation of cash flows, i.e. optimisation of debt receivable, therefore the losses derived from specification II are 5-65% higher. These additional losses can be attributed to the negative externalities received from the debtors.

Table 2. Net cash flow distribution, mln roubles

Farm number, year	Number of a quarter	Under actual conditions	After optimisation			
			Specification I		Specification II	
			efficient economy (scenario 1)	imperfect economy (scenario 2)	efficient economy (scenario 1)	imperfect economy (scenario 2)
№1, 1997	I	-1443	-1009	-1009	**-1009**	**-1009**
	II	-1142	-1220	-1220	-49	-49
	III	**-2130**	**-2934**	**-2934**	-2	-2
	IV	2277	1999	300	1136	1136
№2, 1997	I	**-162**	**-302**	**-302**	**-302**	**-302**
	II	555	265	265	265	265
	III	n.a.*	n.a.	n.a.	n.a.	n.a.
	IV	n.a.	n.a.	n.a.	n.a.	n.a.
№3, 1997	I	31	31	-291	-1072	**-1072**
	II	**-1144**	**-1144**	**-1261**	**-1206**	-430
	III	-394	-394	-282	-561	-234
	IV	1877	1877	1777	1761	271
№4, 1997	I	**83**	373	274	**-442**	373
	II	48	**-100**	**-100**	-306	**-100**
	III	422	210	323	-79	567
	IV	580	627	587	54	750
№5, 1997	I	**-231**	258	**-564**	**-454**	-892
	II	-62	76	98	328	-895
	III	511	**-209**	-209	-209	**-2255**
	IV	538	567	834	834	1108
№6, 1997	I	-1226	-892	-892	-892	-892
	II	-685	-895	-895	-888	-895
	III	**-1970**	**-2255**	**-2255**	**-2137**	**-2255**
	IV	-544	-796	-796	-672	1108
№3, 1998	I	248	403	-187	296	734
	II	-97	-713	137	-164	-881
	III	144	-850	-850	75	-417
	IV	-47	215	118	-81	0
№5, 1998	I	68	**-242**	**-359**	**-242**	**-364**
	II	512	-165	-25	-165	-25
	III	**-537**	161	122	161	113
	IV	-8	55	55	55	55
№6, 1998	I	-398	-454	-454	-454	208
	II	**-610**	**-991**	**-991**	**-812**	-76
	III	-329	-513	-513	-486	**-90**
	IV	1800	1978	1978	1827	1410

* n.a. = not available from the quarterly reports

In table 2 the quarterly net cash flow under actual and modelled conditions are presented. The outflows of the quarters-recipients are in bold. The quarter-recipient is a quarter that has the largest outflow. It tends to attract the money from other periods and requires the credit. There is no significant difference at the discount factor 25% or 100% in the shifts of cash flow in model specification I. For specification II the cash flow allocation is different for two scenarios: in some cases receivables shift to adjacent quarters. Under Russian conditions, farms are constrained in their capabilities to control receivables because the debtors usually have no money on their accounts. The possible interpretation of this scenario is that farms may use the service of some non-profit intermediate who concentrates the debts and supplies the money to the farms instead.

We presented the quarterly values of debt receivable for actual situation and for two scenarios of the second specification in Appendix, table A.5. The changes in quarterly values of debt receivable for the specification II vary from 1% to 37% between two scenarios. The modelled and actual quarterly values of debt receivable differ a lot for some observations underlying the debt structure optimisation possibilities. The greater differences are observed for the second scenario of imperfect economy when the discount rate is higher. For most of the observations the difference in debt receivable allocation is within 1-40%.

Efficiency of the working capital that is defined as balance profit to working capital ratio is always positive after optimisation (table 3). On average it is improved by 0.10 according to the model specification I and by 0.15 according to the results of specification II.

Table 3. Efficiency of the working capital before and after optimisation (in roubles of balance profit to roubles of working capital)

Farm number, year	Before optimisation	After optimisation			
		Specification I		Specification II	
		efficient economy (scenario 1)	imperfect economy (scenario 2)	efficient economy (scenario 1)	imperfect economy (scenario 2)
№1, 1997	-0.059	0.049	0.049	0.268	0.268
№2, 1997	-0.032	0.087	0.087	0.115	0.115
№3, 1997	0.206	0.226	0.313	0.230	0.369
№4, 1997	0.151	0.212	0.191	0.214	0.196
№5, 1997	0.091	0.242	0.260	0.242	0.260
№6, 1997	0.102	0.141	0.141	0.158	0.181
№3, 1998	0.297	0.303	0.308	0.303	0.327
№5, 1998	-0.160	0.106	0.157	0.149	0.177
№6, 1998	0.111	0.176	0.176	0.233	0.230

Currently we have very limited results to give a comprehensive explanation to the observed differences between scenarios. It is possible that many enterprises have adjusted their activities so that their expected profits are higher under high discount rates which reflect prevailing short-term preferences. For instance, in our case those enterprises, as a rule, can have higher results under the economic imperfections which have greater debt payable. In

case of successful agrarian policy such enterprises can suffer. So they could potentially form an opposition to this policy thus playing a negative role in the reformation process. However, this question needs deeper study to make certain conclusions.

5. Conclusion and Discussion

This paper has presented a framework for explicit evaluation of the upper boundary of losses that agricultural enterprises face due to a lack of finance. The possibility to solve the problem of preliminary evaluation of losses given scarce data by means of the Bayesian approach is demonstrated. This study provides the evidence of the possible existence of significant losses accumulated due to imperfect financing by the farms in the Moscow Region. The level of losses derived for two scenarios (with different discount rates) and for two specifications of optimisation model (allowing for different optimisation possibilities) showed that for some observations it is as large as 42.6% of farm's expenses. So the initial research hypothesis that insufficient financing is one of the essential cause of losses accumulated at the agricultural enterprises in Russia is not rejected.

The study has shown that the influence of discount rate on optimal cash flow is low. There was no significant differences at the discount factor 25% or 100% in the shifts of cash flow in model specification I. The influence of discount rate on optimal structure of debts receivable is considerable: in some cases the change of the discount rate in specification II leads to the shifts of quarters-recipients to adjacent quarters. The arguments are obtained in favour of the hypothesis that the farms in the Moscow Region are to a certain extent have adapted to the existing level of interest rate. Deeper adaptation is constrained by the obstacles to borrowing. After optimisation the efficiency of the working capital on average is improved.

These conclusions are valid only for the set of six farms. In order to obtain more comprehensive evidence the similar study operating with the representative subset of the enterprises located in the Moscow Region is desired. However, it is problematic to access the necessary data.

In order to measure the losses rather than to approach their upper boundaries, a more advanced and detailed model is required that may be applied to a complete detailed data set. It would allow to thoroughly study the factors of the losses in order to propose a policy aimed at their reduction.

Apart from the actuate detailed research of the losses caused by imperfect financing, the outline of improvements of the model oriented on the preliminary study is developed. It includes simulation of various scenarios by: a) choosing other values of the discount factor to model different possibilities of economic development, b) introducing the possibility to optimise debt payable for each quarter so that it will be also involved into optimisation; c) fixing inflows for the particular period in order to measure the effect of severe financial constraints applied for particular periods and d) allowing for additional amounts of inflows or outflows. Thus, wider scope of resources to improve the financial performance of agricultural enterprises under different conditions can be identified. Another angle of improvement is introducing the variables (possibly qualitative) into the specification of $f(x)$ which would reflect the farm technological specifics and therefore reduce the error term of the model.

6. References

1. Epstein, D. & P. Tillack 1999, '*How Russian Enterprises are surviving (financial status of large agricultural enterprises, the case of enterprises in the St. Petersburg region)'*, The economics in transition (forthcoming).
2. Geweke, J. 1989, '*Bayesian Inference in Econometrics Models Using Monte Carlo Integration'*, Econometrica, vol. 57, pp.1317-1339.
3. Goskomstat 1999, '*Rossiiskyi Statisticheskyi Ezhegodnik*' [Russian Statistical Yearbook, *in Russain*]. Moscow.
4. Gow, H.R. & J.F.M. Swinnen 1998, '*Agribusiness Restructuring, Foreign Direct Investment, and Hold-Up Problems in Agricultural Transition'*, European Review of Agricultural Economics, vol. 25, no. 3, pp.331-350.
5. Hardaker, J.B., R.B.M. Huirne & J.R. Anderson 1997, *Coping with risk in agriculture,* CAB, Wallingford.
6. Hazell, R.B.R. & R.D. Norton 1986, *Mathematical programming for economic analysis in agriculture*, Macmillian Publishing Company, New York.
7. Judge, G.G., R.C. Hill, W. Griffiths, H. Lutkepohl & T.-C. Lee 1988, *Introduction to the theory and practice of econometrics,* John Wiley & Sons.
8. Kantorovich, L.V. 1960, *Ekonomicheskii raschet nailuchshego ispol'zovaniia resursov* [Economic calculation for the best utilisation of resources]. Moscow, Izdatel'stvo AN SSSR.
9. Macours, K. & J.Swinnen 1999, '*Causes for output decline in economic transition: The case of central and Eastern European agriculture'*. Paper presented at the IX EAAE Congress 1999, Warsaw, Poland.
10. Moers, L. 1999, '*What determines Enterprise Performance in Russia? A Survey of the Evidence'*, Tinbergen Institute, discussion paper #1999-077/2.
11. Pederson, G. D., K. M. Brooks & O.P. Lekhtman 1998, '*Russian Farm Enterprise Performance and restructuring: a debt or profitability problem?*' Working Paper WP98-5, University of Minnesota.
12. Svetlov, N.M. 2000, '*Metodika predvaritel'noi otcenki poter', obuslovlennyh neratcional'nym finansirovaniem sel'skohozyaistvennyh predpriyatii'* [Methodology of preliminary evaluation of losses caused by irrational financing of agricultural enterprises, in Russian]. Working paper published at RePEc file archive. RePEc serial: nos:ecomon:747321.
13. Van Empel, G. 1999, '*Preferential credits in countries in transition from the perspective of a commercial bank'*. Rabobank. Paper presented at the Experts in credit system Meeting, Moscow, January 12-13th, Russia.
14. Von Pischke, J.D. 1999, '*Predposylki sozdaniya ystoichivyh sistem selskohozyaistvennogo finansirovaniya i kreditovaniya*' [Development of stable systems of agricultural finance and credit, i*n Russian*]. Paper presented at the Experts in credit system Meeting, Moscow, January 12-13th, Russia.

Bezlepkina, I.V., and N.M. Svetlov Approaching the level of losses caused by a lack of finance: The case of Russian farms // European rural policy at the crossroads: Conference papers / The Arkleton Centre for Rural Development Research, University of Aberdeen, Scotland, UK, 29 June - 1 July 2000.

Appendix

Table A.1. Average in 1995-1998 shares of farm production, %

Farm number	Milk	Cattle meat	Other livestock production	Potato and cereals	Vegetables	Other crop production	Total
№1	43.6	4.9	3.4	8.0	30.6	9.5	100.0
№2	0.0	92.0	7.7	0.2	0.0	0.1	100.0
№3	21.2	2.9	0.4	9.2	64.2	2.1	100.0
№4	16.5	4.9	0.1	13.4	64.0	1.0	100.0
№5	36.0	12.5	0.2	45.1	4.1	2.1	100.0
№6	20.9	3.7	0.3	8.5	64.7	1.8	100.0

Table A.2. Model data (blank cells represent missing data)

Farm number, year	Variables of the model									
	π	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9
№1, 1995	-0.0576			0.2624	-0.1877				0.2028	0.4009
№2, 1995									0.1418	0.3143
№3, 1995	0.5753			0.1738	0.5006				0.3365	0.9405
№4, 1995	0.3879			0.5119	0.2505				0.2984	0.2686
№5, 1995	0.1833				0.2140				0.2821	0.1432
№6, 1995	0.8498								0.4574	1.2651
№1, 1996	-0.3126			-1.0854		0.0981			0.2502	0.8182
№2, 1996	-0.0907			-0.3218	-0.2525		0.0415	0.0797	0.0639	0.4852
№3, 1996	0.0396			0.2186	0.1295	0.1974	0.1930	0.2610	0.2167	1.0455
№4, 1996	0.0846	0.0114	-0.0735	0.1490	0.0336	0.2679	0.1430	0.2776	0.2458	0.4687
№5, 1996	-0.0805	0.0387			-0.0260	0.1531	0.1558	0.0947	0.1258	0.3366
№6, 1996	-0.0894	0.2282	-0.4546	-0.7051	3.4477	0.2680	0.1628	0.1841	0.1648	0.4215
№1, 1997	-0.2366	-0.4406	-0.3612	-0.4142			0.1754	0.1973	0.1966	1.0219
№2, 1997	-0.7228	-0.1653	0.5311			0.0870	0.1095		0.1047	0.8831
№3, 1997	0.0216	0.0089	-0.1335	-0.1964	0.4059	0.2574	0.2218	0.2849	0.2349	1.4125
№4, 1997	0.0784	0.0313	0.0317	0.0477	0.2965	0.1657	0.1716	0.2125	0.1495	0.4988
№5, 1997	0.0797	-0.1263	-0.0378	0.2855	0.2478	0.0846	0.0858	0.0465	0.0236	0.4133
№6, 1997	-0.4605	-0.4238	-0.2954	-0.4985	-0.1259	0.1665	0.1525	0.2118	0.2392	0.6883
№3, 1998	0.0101	0.0476	-0.0392	0.0198	-0.0026	0.1879	0.2090	0.2843	0.2276	1.3344
№4, 1998	0.1242					0.1318	0.1626	0.4567	0.3329	0.4775
№5, 1998	0.0040	0.0560	0.3407	-0.2401	-0.0040	0.0299	0.0905	0.1757	0.1067	0.7437
№6, 1998	0.0408	-0.27	-0.2375	-0.0749	0.3496	0.1042	0.1321	0.2435	0.0048	0.9607
Number of missing values	1	10	11	6	6	8	7	8	0	0

Table A.3 Descriptive statistics of the model variables and quantiles

	Variables of the model									
	π	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9
Distribution*	N	N	N	N	N	Γ	Γ	Γ	Γ	Γ
Number of quantiles	4	3	3	3	4	3	3	3	4	4
Mean	0.020	-0.084	-0.066	-0.117	0.100	0.157	0.147	0.215	0.200	0.697
Variance	0.109	0.042	0.086	0.173	0.050	0.005	0.002	0.011	0.012	0.135
Mean of quantile 1, m_n	-0.399	-0.308	-0.386	-0.571	-0.184	0.084	0.097	0.113	0.084	0.300
Mean of quantile 2, m_n	-0.087	-0.084	-0.066	-0.117	0.027	0.146	0.142	0.200	0.151	0.530
Mean of quantile 3, m_n	0.128	0.141	0.253	0.337	0.173	0.241	0.205	0.324	0.217	0.756
Mean of quantile 4, m_n	0.440				0.384				0.327	1.209

*N denotes Normal distribution, Γ denotes Gamma distribution.

Table A.4 Results of data conversion (the values of z_n for each x_n)

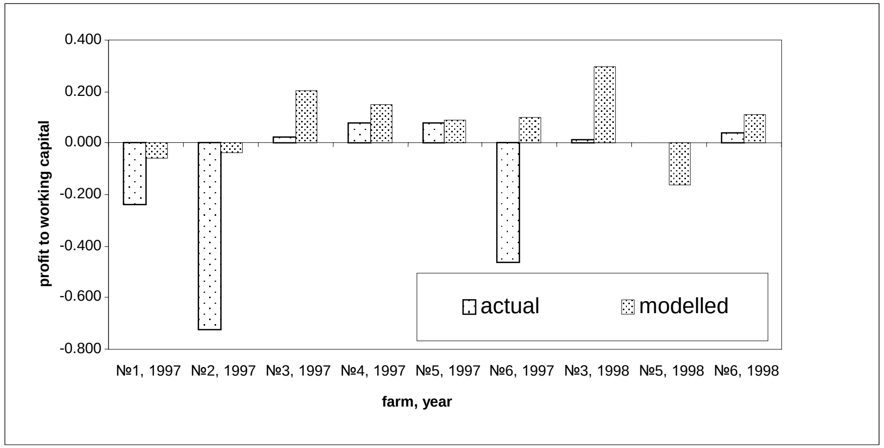
Farm number, year	Variables of the model									
	π	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9
№1, 1995	2.14			2.84	1.00				2.78	1.44
№2, 1995									1.86	1.06
№3, 1995	4.00			2.64	4.00				4.00	3.41
№4, 1995	3.83			3.00	3.37				3.74	1.00
№5, 1995	3.18				3.20				3.59	1.00
№6, 1995	4.00								4.00	4.00
№1, 1996	1.28			1.00		1.22			3.30	3.14
№2, 1996	1.99			1.55	1.00		1.00	1.00	1.00	1.81
№3, 1996	2.59			2.74	2.70	2.54	2.80	2.49	2.99	3.64
№4, 1996	2.80	2.42	1.98	2.59	2.04	3.00	2.01	2.62	3.26	1.73
№5, 1996	2.03	2.55			1.75	2.07	2.22	1.00	1.62	1.16
№6, 1996	1.99	3.00	1.00	1.00	4.00	3.00	2.33	1.82	2.21	1.53
№1, 1997	1.52	1.00	1.08	1.34			2.53	1.97	2.69	3.59
№2, 1997	1.00	1.64	3.00			1.04	1.27		1.31	3.28
№3, 1997	2.51	2.41	1.79	1.82	4.00	3.00	3.00	2.68	3.16	4.00
№4, 1997	2.77	2.51	2.31	2.36	3.59	2.20	2.47	2.10	1.98	1.86
№5, 1997	2.78	1.81	2.09	2.89	3.36	1.00	1.00	1.00	1.00	1.49
№6, 1997	1.00	1.00	1.28	1.16	1.28	2.21	2.17	2.10	3.20	2.70
№3, 1998	2.45	2.58	2.08	2.30	1.86	2.44	3.00	2.68	3.10	4.00
№4, 1998	2.98					1.76	2.32	3.00	4.00	1.77
№5, 1998	2.42	2.62	3.00	1.73	1.85	1.00	1.00	1.72	1.34	2.95
№6, 1998	2.59	1.17	1.46	2.09	3.84	1.32	1.78	2.35	1.00	3.45

Table A.5 Quarterly values of debt receivable, mln roubles

Farm number, year	*Actual*				*Scenario 1*				*Scenario 2*			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
№1, 1997	n.a.*	1807	2033	2026	1454	1916	2782	2237	1454	1916	2782	2237
№2, 1997	399	502	n.a.	480	387	652	0	386	387	652	0	386
№3, 1997	4403	3794	4874	4018	3690	3375	4827	3714	3664	3416	4605	3854
№4, 1997	2395	2480	3071	2161	2142	2599	2576	3048	2531	2555	3082	2433
№5, 1997	802	814	441	224	800	1009	1385	798	800	1397	1894	798
№6, 1997	1600	1466	2035	2299	1659	1519	1986	2087	2007	1866	2491	2087
№3, 1998	4615	5134	6983	5590	4648	5029	7001	5525	5478	4861	5536	5333
№5, 1998	263	796	1546	939	742	855	1600	830	747	901	1553	934
№6, 1998	1183	1500	2765	54	1057	1614	2596	955	1663	1621	2185	1433

*n.a. = not available from the quarterly reports

Chart 1. Values of profit to working capital ratios: actual and modelled under actual cash flow and debt state.



[Back to The Arkleton Centre Crossroads Conference]

