

Factors of farms' access to credit in Russia

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1. Problem definition and research methodology

The study examines the problem of bank credit rationing in agriculture. An attempt is made to empirically analyze factors of Russian farms' access to credit by means of regression analysis (LOGIT model).

The essence of credit rationing¹ problem is that a farm cannot get credit at all or cannot get credit of the required size even in case it's ready to pay higher interest (a fair price considering associated risks), i.e. has no access to credit resources. Credit rationing is the result of credit market models with asymmetric information due to negative selection, moral risk and (or) positive *ex-post* borrower monitoring costs.

The study of credit rationing has a high practical value. First, credit rationing has a negative impact on agriculture's economic performance (e.g. as shown in Jappelli, 1990 and Diagne, Zeller, 2001). According to Foltz, 2003 losses are entailed by the fact that a farm is unable to optimally allocate resources in a short term (the profit-liquidity effect) and has to refrain from long-term investments in land and equipment since it cannot spread its expenditures over time (*investment demand effect*). Second, as shown by Eswaran and Kotwal, 1986 credit market imperfections may result in greater differentiation of farm commodity producers. The cause of this phenomenon is positive correlation between available farm assets and access to credit. Third, the study of credit access factors allows estimating relative efficiency of policy tools targeted at better financing of agriculture.

The empirical analysis of credit rationing implies answering two questions: is a farm credit rationed (i.e. does it have problems in accessing credit) and if yes, what are the factors influencing access to credit. The first question is difficult to answer since farms that did not get credits in fact could have had no need therein (no demand therefor). As shown by Koshar, 1997 on the basis of Indian data, the "limited customer" supposition may not be true due to two reasons. First, farms may not have demand for credit since they are unable to achieve profitability sufficient for servicing and paying it back, i.e. are actually not ready to pay an equilibrium price for the credit. Second, farms may have access to less costly or more available non-bank credit.

Some authors (e.g. Boucher and Carter, 2002) call the first of the above limitations connected with farm profitability *price rationing*. In case of such type of rationing the shortage of circulating capital does not influence the farm's decision on resource allocation. The classical non-price rationing as we have defined it above supposes that the possibility of credit transaction for a farm first of all depends on its endowment and other factors but not on investment opportunities.

The case of non-price credit rationing is obvious only when two conditions take place: the farm has not received a credit and the farm is ready to take credit at the interest rate that is much higher than the average market one. (The second condition is to guarantee that the

¹ We base upon definition of credit rationing suggested in the study of Stiglitz and Weiss, 1981.

farm is ready to pay a fair price for the credit). The respective questions are often included into survey questionnaires (e.g. see Diagne and Zeller, 2001; Foltz, 2003). Then regression analysis of credit access factors is made for selected farms that got credits and that had no access to credit.

Unfortunately, we didn't have an opportunity to participate in working out of questionnaire that served for gathering data used in further empirical studies. Therefore we do not have a direct answer to the question at what interest and how much funds farms wanted to get through bank credit. This imposes certain limitations on the study – we cannot differentiate farms experiencing price or non-price rationing as it was done in Foltz, 2003. In this situation the dependent variable that we can investigate is not the getting of credit by a farm in case of its readiness to take it at market interest but the possibility of credit transaction for a farm. Examining factors that influence this indicator we can come to the conclusion what type of rationing prevails on the bank credit market. In case the probability of getting credit is well described by factors directly connected with farm profitability, the price rationing prevails. In case factors of endowment and transaction costs are also significant, non-price rationing plays an important role as well.

Taking into account the set study objectives, we can differentiate five basic groups of factors determining access to credit. The first three of them are directly connected with the borrower's performance: availability of sources for settling the debt; sustainability reserve enabling to offset unfavourable performance trends ("endowment"); factors reflecting borrower's trustworthiness, its credit history. In addition to factors connected with the borrower's performance, access to credit depends on external conditions connected with the market functioning: possibility to get a soft credit, situation in the region, etc. (the fourth group of factors). At last, the fifth factor is transaction costs born by a bank when crediting the borrower.

The *first group* of factors regards sufficiency of a normal source of debt settling meaning that a farm has all grounds to expect receipts from marketing that less taxes enable it to pay the principal debt and interest.

The *second group* of factors includes, first, foundations enabling a farm to remain sustainable even in unfavourable situation (factors averting risk of insufficient normal source of settling debt), and, second, security in case the normal source of settling debt is not sufficient. First of all, larger farms are *ceteris paribus* more sustainable. Also they usually have bigger collateral potential. A farm with worn out fixed assets having no property to be used as a collateral has small chances to get credit. In this group of factors we also include farm specialization since specifics of a certain agricultural sub-sector determine the risk of income fluctuations due to price situation, seasonal variations, etc. We suggest that *ceteris paribus* livestock farms should have easier access to credit since, first, performance of this sub-sector is less season-dependent and, second, livestock can be used as a collateral.

The *third group* of factors includes, first, the borrower's credit history and, second, multiple specific factors of subjective nature that influence the lending of credit. Credit history is the information about how the farm settled its debts earlier. In case it once failed to pay back, cooperation with the bank may be blocked for many years.

Access to credit is obviously influenced by federal and regional policies. Thus, the possibility to get soft-term funding in some regions is the *fourth group* of factors that we

consider. Besides, various non-formal ties between farm producers, regional authorities and banks also matter since in some cases they make access to credit easier. Such factors are very difficult to detect and take into account when modeling.

Finally, the last *fifth group* of factors is transaction costs associated with credit lending. As mentioned above, for a “large” client these costs per ruble of lent funds are much lower than for a “small” one. Besides, we can suppose that for a farm situated near an economic center or bank monitoring and control costs will also be lower than for a farm in remote area. Carling and Lundberg, 2002 showed that there is a negative correlation between possibility to get credit and remoteness. As an indicator of transaction costs we use variables reflecting the remoteness of areas where farms are situated from the nearest administrative and economic center.

It should be noted that the fourth and the fifth groups of factors have intersections – regional institutional differences and non-formal ties (or their lack) with administrations can be examined in terms of transaction costs.

2. Econometric study of credit access factors

For analysis we used the database resulting from pole conducted by the Analytical Center of Agrifood Economics in 2002-2003. The study’s objective was to define production functions for agricultural production.

The information was collected for 142 corporate farms and 425 individual farms. In 2001 credit was received by 26% of large farms and only by 6% of individual farmers. When examining the data for individual farms we found out that 21 of the 24 farms that took credit are situated in remote areas of Rostov oblast. This concentration is presumably due to some specific factors. Probably, there is a bank in these areas that actively works with farmers. In any case the information on individual farms is of small interest for analysis. We have to admit that crediting of farmers in Russia (at least in the three surveyed regions) is actually non-developed. Hereinafter we examine data for only 105 corporate farms (30 of which have got credits and 75 have not) with available basic economic and technical indicators.

Prior to designing the credit access econometric model, it’s worth to make a general analysis of the sample and to examine its homogeneity by regions. Table 1 presents comparative economic indicators for two groups of farms – those who got credits and those who did not. We’ve done a *t*-test for checking equality of averages for the two groups of farms. Differences by the available land area and engine capacities proved statistically non-significant. It’s noteworthy that land ownership does not play an important role. Apparently, in case of seasonal crediting land has no value as a collateral since the land market has not yet developed. It’s worth noting that the share of loss-making farms among the ones who haven’t got credit is much higher while their profitability is much lower. Though illustrating general trends, indicators presented in Table 1 do not allow making substantiated conclusions about credit access factors.

Table 1. Comparison of selected economic indicators of farms that got credit with the ones that did not

Indicator	All farms (N=105)	Farms that got credit (N=30)	Farms that didn’t get credit (N=75)	t-value	P-value (double-sided)
Average available land area, ha	3 844	3 339	4 046	-0.861	0.391

Average area of owned land, ha	4 015	3 453	4 240	-0.777	0.439
Engine capacity, h.p.	5 608	6 005	5 549	2.012	0.620
Receipts from marketing, thousand rubles	9 385	11 871	8 391	0.781	0.438
Share of livestock production	48.12	46.63	48.72	-0.258	0.798
Share of farms with positive gross income	78.10	73.33	90.00	-	0.029*
Share of gross income in receipts from marketing	27.23	41.52	21.51	2.848	0.006
Overdue debts to enterprises and banks, thousand rubles	1 308	707	1 548	-1.931	0.056
Possibility to get soft credits	41.90	60.00	34.67	-	0.035*
Location in remote areas	34.29	23.33	38.67	-	0.149*

Table 2 presents data showing regional differences in access to credit. In the three surveyed oblasts the share of farms that got credits in 2001 is not the same. In Nijegorodskaya and Rostovskaya oblasts the situation is relatively identical – bank credits were received by 34% and 29% of farms, respectively. In Ivanovskaya oblast this indicator is much lower – only 11%.

Table 2. Crediting of agriculture by oblasts and areas

	Rostovskaya oblast (N=69)	Nijegorodskaya oblast (N=38)	Ivanovskaya oblast (N=35)	All oblasts (N=142)
Share of farms that got credit, %	29	34	11	26
Suburb areas: share of farms that got credit, %	38	67	15	41
Relatively distant areas: share of farms that got credit, %	31	29	0	24
Remote areas: share of farms that got credit, %	21	6	18	16

The access to credit also correlates with a farm’s remoteness from the economic center. This conforms to our supposition about significance of transaction costs’ factor since it’s much more difficult for a bank to work with a farm in remote area. Still, there are probably other factors as well behind this correlation. For instance, farms in remote areas are situated farer from markets and thus bear additional costs making them less efficient and less attractive for creditors. Finally, it’s a common notion that the farer from the economic center – the lower quality of labour and management (beginning from the Soviet times it was more prestigious to get “an assignment” to farms located closer to a city). This can also affect farms’ economic performance.

What are the causes of regional differences? The mere “geographic” fact of farm location in a certain oblast can hardly influence access to credit. On the one hand, regional variations may be due to differences in general economic performance, development of agriculture and bank sector, policies of regional administrations. As we have already noted, these factors cannot be empirically estimated. On the other hand, divergences in access to credit can be explained by differences in “estimable” indicators of farms’ performance. If

we managed to make quantitative estimates of all significant indicators, our model wouldn't require a variable of farm location in a specific region or at a certain distance from the economic center. Unfortunately, it's actually not possible.

Above we have distinguished five groups of factors that to our mind have the strongest impact on access to credit. When starting the empirical analysis we have to define quantitative variables with the help of which we can estimate the impact of named factors. In Table 3 we describe variables that analysis proved to be most adequate. The last column contains our hypotheses as to the impact of respective variable on access to credit. The “+” sign means that according to the above formulated suppositions the probability of getting credit grows in line with the variable's increase. If a variable can equal either 1 or 0, the “+” sign in the last column means that we expect higher probability of getting credit in case of its equaling 1.

Table 3. Description of variables

№	Group of factors	Variable	Description of variable	Method of calculation	Unit of measurement	Hypothetic influence on the variable
1	Explaining variable	credit	Getting of credit	Dummy-variable equaling 1 for farms that got credit and 0 for farms that did not	-	
2	First	revenue	Receipts from marketing	Receipts from marketing all types of products	Million rubles	+
3	First	pr_marg	Profit rate	Ratio of gross income (according to report form No.6 – Agrifood sector) to receipts from marketing	%	+
4	Second	land	Land area	Available land area of a farm	Thousand hectares	+
5	Second	machin	Engine capacity	Engine capacity of available machinery (according to line 090 of report form No.6). This variable reflects collateral potential of a farm without livestock (although it's not fully correct since the actual wearing of machinery is not taken into account).	Horse powers	+
6	Second	rev_str	Share of receipts from marketing livestock products	Ratio of receipts from marketing beef, veal, pork, milk, poultry meat, eggs to the total receipts from marketing.	%	+
7	Third	od_priv	Overdue debt	Overdue debt to suppliers (including suppliers of electricity and gas) and to banks	Thousand rubles	-
8	Fourth	privil	Access to credit with compensated interest	Dummy-variable formed from answers to the question: “Did you have an access to credit with interest partially	-	+

				compensated from the budget in the last two years?" If the respondent said "yes" for federal or regional soft credits, the variable was considered to equal 1.		
9	Fourth	ivanovo	Location in Ivanovskaya oblast	Variable equaling 1 if the farm is situated in Ivanovskaya oblast and 0 in all other cases	-	
10	Fourth	nijegor	Location in Nijegorodskaya oblast	Variable equaling 1 if the farm is situated in Nijegorodskaya oblast and 0 in all other cases	-	
11	Fifth	far	Location in an area remote from the economic center	Variable equaling 1 if the farm is located far from the regional center and 0 in all other cases	-	-

For designing the econometric model of access to credit we apply the logistical regression. It allows forecasting whether an object will succeed or fail in acquiring the examined parameter (in this case – getting of credit) given its indicators. In general the model is similar to linear regression but the regression variable here is dichotomic – it equals 1 if a farm got credit and 0 if it did not.

The most illustrative and precise was model whose coefficients are shown in Table 4. The regression was based on 105 observations (30 farms that got credit and 75 farms that did not). Other observations were not taken into account since one or more indicators were lacking.

Table 4. Coefficients of the LOGIT regression model, Nagelkerke $R^2=0,417$

№	Group of factors	VAR	B	S.E.	Wald	P-value	Exp(B)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	First	revenue	0,028	0,014	4,139	0,042	1,028
2	First	pr_marg	0,027	0,010	6,629	0,010	1,027
3	Second	land	-0,239	0,144	2,766	0,096	0,788
4	Second	machin	0,022	0,080	0,076	0,783	1,022
5	Second	rev_str	0,060	0,025	5,611	0,018	1,061
6	Third	od_priv	-0,030	0,135	0,050	0,824	0,970
7	Fourth	privil	0,598	0,552	1,175	0,278	1,818
8	Fourth	ivanovo	-3,123	1,068	8,550	0,003	0,044
10	Fourth	Rostov	3,846	1,826	4,435	0,035	46,786
11	Fifth	far	-0,437	0,624	0,490	0,484	0,646
12		const	-5,443	1,983	7,533	0,006	0,004

The third column of Table 4 enumerates variables that were included in this model. The fourth column contains coefficients of LOGIT model. For interpreting factors' impact it's more convenient to use potential (column 8) rather than actual values of coefficients. For instance, potential value 0.646 of dummy variable *far* coefficient means that *ceteris paribus* the ratio between chances for getting or not getting credit reduces 0.646 fold for farms remote from the economic center. The ratio of chances here is the ratio of probabilities: if the probability to get credit is 0.2 and the probability to fail is respectively 0.8, the ratio is 0.25. Potential value 1.027 of variable *pr_marg* coefficient means that *ceteris paribus* the increase of marginal income rate by one percent point results in 1.027-

fold growth of ratio between chances to get and not to get credit. However, to estimate the impact of a certain factor on the probability to get credit one needs to take into account its statistical significance rather than its value. For each coefficient Wald statistics is calculated that is asymptotically distributed according to normal law. The probability of zero value of Wald statistics (indicating probability of zero actual value of a coefficient, i.e. lack of its impact) is shown in column 6.

So, most important for us are coefficients' signs showing the direction of a factor's impact and statistical significance of coefficients proving authenticity of an observed correlation.

Regression coefficients of regional dummy variables do not fully reflect differentiation of regions' economic development. They merely show differences that are not reflected in farms' indicators. Significance of these coefficients means that the model does not include important factors describing differences by farms and markets or that used proxy-variables do not allow full accounting of factors analyzed in the model. It's important that these factors are *non-price* by their nature. According to Valdivia, 1996 differences in access to credit by regions that are not explained by economic variables evidence market imperfections and existence of non-price rationing.

As can be seen in Table 4, signs of almost all coefficients are predictable. Profitability is a factor having quite a strong impact on access to credit. We can assert that efficiency of a farm economic performance (that in our case is described by profit rate) is a significant factor. It means that in principle crediting bases upon market mechanism. The analysis results prove that during the Soviet period profitability indicators had no importance of their own – all the useful information could be derived from current indicators.

It's noteworthy that in our model a farm's specialization on livestock production is significant. Farms with larger share of receipts from marketing livestock products have more chances to get credit. The first cause thereof is that livestock farms are less dependent on the seasonal factor. While grain growing farms have an apparent annual production (and financial) cycle, most livestock farms produce output all the year round. Accordingly they can take shorter-term credit and thus diminish risks for creditors. The second cause may be that livestock farms have collateral potential – productive livestock. Why then the share of receipts from marketing livestock products in Table 1 illustrating different economic performance of farms that got and didn't get credit is not significant? The matter is that the impact of this share can be clearly observed “inside” each oblast but not in a sample as a whole. Therefore in a multi-factor regression including regional dummy variables, profitability, etc. this factor becomes evident.

The factor of privileges that we tried to use for interpreting regional variations proved relatively insignificant although its coefficient is positive. The availability of privileges was determined by questionnaire: the respondents answered whether to their mind they had a theoretical opportunity to get a credit at lower interest (i.e. they didn't actually get it but thought that in principle they could benefit from this mechanism). The study results show that in fact not only farms that admitted access to federal and regional privileges actually received credit.

Despite the significance of price rationing proved by positive correlation between getting of credit and profitability, the theoretical opportunity to get a credit at lower rate doesn't make it available for most farms. Farms that have access to credit often can pay for it at market rate. It means that just the opportunity to get soft credits is not a sufficient tool for ensuring access to credit. Measures improving borrowers' financial performance (e.g.

through lowering of risks by means of insurance, development of marketing infrastructure, etc.) could apparently be much more efficient.

So, the factor of benefiting from interest rate compensation is not the crucial one for access to credit. This conclusion is supported by data of the conducted pole where farm administrators listed basic barriers to getting credit. Only one fifth of potential borrowers mentioned a too high interest on credit. The principal named hindrances were: poor financial performance of a farm (large debts, bad credit history), shortage of collateral, high risks associated with long terms of credits, complexity of application for credit, i.e. *non-price factors*. Compensating of interest rate by no means can solve these problems.

Why do then access to privileges and access to credit correlate on the aggregate level? Analysis of individual data showed that the causal relationship here is more complicated. Access to soft credit is apparently a variable well describing the general condition of agriculture's infrastructure in a region and the overall economic situation therein. In relatively well-to-do regions there are more solvable farms that get access to financial resources (not always thanks to lower interest mechanism).

Among variables describing a farm credit history the best is the amount of overdue debts to private creditors (suppliers, banks). However, its coefficient is not statistically significant. The amount of debts to budgets and non-budget funds turned out to be even less relevant. Probably, the problem here is due to incorrect questioning: most farm debts are not actually overdue because of prolongation. Even a heavily indebted farm can have relatively small overdue debt.

It's curious that the coefficient of variable describing the owned land area is negative and significant at $\alpha=10\%$. Probably, it's due to the fact that relatively small farms more easily adjust to market situation and have higher economic efficiency. Available land area is to some extent an "extensive" parameter of a farm size. Receipts from marketing are also a size parameter but of a somewhat different nature. It determines the "economic" size of a farm. Its coefficient is positive although as different from the efficiency indicator (profit rate) the correlation here is not statistically significant.

Of particular interest are variables describing collateral potential of a farm. The regression shows that creditors are not interested in land as a collateral. This is most probably due to underdevelopment of land market in Russia. However, machinery stock does not significantly influence access to credit either. The model variable reflecting a farm's engine capacity may seem inadequate for describing the collateral potential – it ignores, first, wear of machinery and, second, its heterogeneity. That's why we attempted to apply more exact (at first glance) indicators. We designed wear-adjusted variables separately for tractors, grain and forage harvesters and cargo cars. The quality of machinery (its actual overall wear) was estimated using the pole data. Farm engineers appraised machinery on the 5-point scale. 5 stands for zero wear, i.e. engine capacity for such machinery was not adjusted. 1 stands for 80% wear, i.e. coefficient of engine capacity for such machinery was 0.2.

However, this model gave results that were even worse than in the described above model, both in case of separating types of machinery and of wear adjustment. The supposition that the wear estimation method is inadequate proved wrong as well: we designed variables describing only availability of machinery in very good condition and they turned out to be insignificant. At the same time the inclusion of four additional variables resulted in multicollinearity in the model – e.g. most grain harvesters are concentrated in Rostov oblast farms where receipts from marketing livestock products are small, etc. So the significance

of other coefficients in the model became lower. Still, on the whole one cannot attribute the lack of apparent impact of machinery variables in all the designed models to multicollinearity or other statistical phenomena.

To all appearances, the correct interpretation of this result is that farm machinery is a “bad”, low-liquid collateral. In the years when farms are in distress there is no demand for agricultural machinery and its price lowers. For a bank the sale of such a collateral is associated with high transaction costs. So, for a creditor the availability of collateral is a minor factor as compared with availability of a normal source of settling debt.

3. Conclusion

Our analysis resulted in several important findings. *First*, most significant are factors reflecting farms’ economic performance. Highly profitable farms have more chances for getting credit. The conclusion can be made that crediting of agriculture is at least to some extent market regulated. *Second*, the availability of land and machinery only slightly influences farms’ access to credit. This is due to the fact that economic performance of large farms is in general worse than that of relatively small farms. Besides, it proves the supposition that farm machinery has low value as a collateral.

The analysis results show that one has to be careful when trying to apply conclusions widely spread in economic publications to the specific situation in Russia and, apparently, in other transitional economies. Different studies conducted in countries with developed market economy give grounds to suppose that large farms have better access to credit – primarily due to economy on transaction costs and lower business risks. But this conclusion is true when “physical” size of a farm coincides with its “economic” size, i.e. when a farm is relatively efficient in using resources. In Russian agriculture resources are distributed so that many assets are used inefficiently and thus “physically” small farms free of excessive facilities are often more viable. Respectively, they have better access to financial resources. Remember that land area variable in our regression has a negative sign while machinery variables proved insignificant. At the same time another size parameter – receipts from marketing – has a positive impact on credit probability.

As we have shown in our study, soft interest rate is not a sufficient tool for cardinal solution of the farm credit access problem. The currently effective system of credit subsidizing that envisages a partial compensation of interest directly to the borrower is more advantageous as compared with earlier mechanisms of direct distribution of budget funds by the authorized banks. This system to a lesser extent distorts competition on the credit market. However, compensation of interest rate cannot ensure an “inflow” of capital to agriculture if the sector is not attractive for banks due to high risks and poor economic performance of borrowers. Thus most efficient will be measures that directly diminish the risk of short normal source of debt settling, i.e. improvement of economic efficiency and lessening of income volatility. The state can influence farms’ economic performance primarily by helping to create normal agricultural infrastructure. Risks can be lowered by, for instance, forming of insurance system.

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