What is Behind the Fall in Russian Agricultural Production?

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Abstract

This study analyses the causal factors of fall in Russian farm output focusing on financial determinants. Translog production function is estimated on panel of 17653 large-scale farms for 1996-1998 period using fixed-effects and accounting for inter-regional climate differences. Output elasticities are analysed for sub-samples of crop and animal producing farms. The reserarch findings show that budget transfers to the farms are inefficient and result in taxation of farms. Farms are operating under the soft budget constraints that have to be removed to improve farm production performance.

Keywords: production, Russia, debts, credit, budget transfers.

1. Introduction

When reforms of the agricultural sector in Russia began in 1992, many analysts predicted that farmers would become profit maximizers and, consequently, improve the productivity and efficiency of their operations. After an initial dip in agricultural production, therefore, Russian agriculture was supposed to recover significantly. This recovery in agricultural production has yet to materialize (Osborn and Trueblood, 2001a). Low production and financial performance of agricultural enterprises have resulted in decline of gross agricultural output (over 40% between 1991-1998) and a large proportion (84,4% in 1998 and 60% in 1999) of the unprofitable agricultural enterprises (Goskomstat, 2000 a).

Russian economy has experienced many changes since the economic reforms started in the beginning of the 90-s. The reform of the agricultural sector has resulted in a widely spread privatization. Government intervention via subsidies or other instruments were greatly reduced. The restructuring process in the country created uncertainties for farmers and resulted in fragmentation of farms or farm ownership. Compounding the problem was the shortage of technical and business management skills for successful private farming that had been absent under the previous system. Previous linkages between farms and the up- and downstream industries broke down. The whole set of problems was worsened by the lack of agricultural finance and credit (Trzeciak-Duval, 1999).

A key question of interest to policymakers that emerged early in the reform process – and is still critical today – is whether Russia would be able to raise its overall agricultural productivity and what should be done for that. Recently many research efforts are focusing on the sources of agricultural growth, especially in the transition economies in Central and Eastern Europe. A number of studies have documented a robust relationship between farm performance and financial constraints (Arnade and Gopinath, 2000; Voigt and Uvarovsky, 2001; Macours and Swinnen, 2000) although the unit analysis has been usually at the level of country, region or agricultural sector as a part of Russian economy. The studies by AFE (AFE, 2000, 2001) conclude that declining demand for agro-food products was one of the major factors causing agricultural output fall. Extensive views over Russian agricultural sector development and state policies can be found in (Macours and Swinnen, 2000; Serova, 1999, 2000, 2001; Serova *et al.*, 2000 a,b).

In this research we continue investigating the performance of agricultural sector under financial constraints using the *farm level* data. Liquidity constraints emerging through different sources is not the last factor to look at. An internal lack of finance due to negative profitability of farm business cannot be sufficiently compensated by means of external financing via bank commercial credit

as farms cannot offer adequate collateral. Budget support originated from subsidy transfers, reduction of taxes, credits with reduced rate is considered to be insufficient, but it cannot be increased since Russia claimed to join the WTO that has several regulations in regards to state support to agriculture. According to (AFE, 2001), subsidy transfers are mostly inefficient in Russian agriculture – they are not adequate to transitional nature of economy – as they are aimed at covering the deficit of working capital, whereas they are so small that would better assist in promoting the institutions for agrarian developments. Compensations for fodder to livestock and poultry producing farms prolong their inefficient business and stimulate unfair competition. Compensations of expenses for grain and oil seeds are questionable as these business in crop production remains profitable (AFE, 2001).

Thus, on the one hand farm activities are constrained in liquidity. On the other hand, the state in transition countries tends to soften the liquidity constraints by subsidising the farms and mostly by means of allowing the enterprises to generate *tax arrears* that is a part of total debt payables (Schaffer, 1998). Since 1992 agricultural enterprises accumulated high debts, their level in constant year 1995 prices was increasing throughout 1995-1999 (by 73%), especially its outstanding level (by 117%). Debt receivables account for less than 20% in total debts and its level from 1995 to 1999 has declined by 10%.

In the studies on Russian agricultural data at the oblast level the financial conditions approached through the level of subsidy (see Voigt and Uvarovsky, 2001) are found to be positively influential for the level of farm output. For the transition cross-country study Carlin *et al.* (2000) shows the importance of removing the soft budget constraints in achieving better performance of firms. In our view, both phenomena should be taken into account in investigating farm production performance.

The objectives of this research can be summarized as follows: (1) to quantify the relative importance of the causal factors for agricultural output decline, (2) to analyze how budget transfers and credit policy influence output adjustments and productivity changes. The importance of this study is that it deals with the individual farm data, whereas many research have been focusing on the regional Russian agriculture data, thus it enable us to draw the conclusion for farm level policy developments.

In this research we focus on large-scale agricultural farms located in 76 regions of Russia. The explanation for using these production entities is 1) the availability of data, and 2) these farms are still the major source of agricultural production: in 1995-1999 they produced about 44.5% of Russian gross agricultural output, although the share was constantly declining: from 50.2% in 1995 to 40.3% in 1999 (Goskomstat, 2000).

In attempting to answer the research questions we come to the conclusion that farms face soft budget constraints that lower their production performance. Our results also show negative relation between budget transfers and production that corresponds with the conclusion about inefficient state support program in agriculture that even results in taxation of farms. Demand conditions are found to be influential for the level of farm output as well as favorable climate conditions. There is no strong evidence that farms specialized in crop and animal husbandry production react differently to the changes in market environment and adjust inputs and outputs.

The paper is organized as follows. The next section discusses an econometric framework used in this study. Section 3 summarizes the data, presents the description of variables and introduces the empirical model. Section 4 presents the research findings. Conclusions can be found in Section 5.

2. Econometric framework

The topical problem of agricultural production decline in transitional economies has drawn attention of agrarian economists in Eastern European countries. Macours & Swinnen (1999) admit that one of the essential reasons for output decline is the financing problem due to reduced supply of agricultural credit, market uncertainty and high inflation. According to the survey conducted by Goskomstat in 1998, 78% of Russian agricultural enterprises reported a lack of finance as the most significant limiting factor of agrarian development; 55% mentioned high interest rates; 48% underlined consumers' insolvency (Goskomstat, 2000 a). Also the respondents mentioned insufficient support from the state, critical condition of the fixed assets, high taxes and inefficient management.

Empirical testing for the relationship between liquidity constraints and firm behavior can be often found in the literature on investments. In a number of studies it has been demonstrated that availability of external finance influences investment decisions (see e.g. Hubbard *et al.* (1995), Volchkova (2001), Budina *et al.* (2000)) and that financial variables (cash flow, income or liquidity) should be included in the investment equation.

Production function framework also allows studying the impact of liquidity constraint on farm performance and it has been widely applied in agricultural studies that focused on impact of various factors on agricultural output. We follow Nickell (1996) and others in focusing on Total Factor Productivity (TFP) in a panel data framework. This concept was successfully applied in studies on impact of (a) ownership, competition and privatization (Brown and Earle, 2000, 2001a) and (b) competition and infrastructure development (Brown and Earle, 2001b) on industrial firm's productivity in Russia, (c) impact of various factors on agricultural sector of transition countries (Macours and Swinnen, 2000, 2001). Several studies employ this concept in technical efficiency analysis (see e.g. Voigt and Uvarovsky, 2001; Osborne and Trueblood, 2001a,b).

The general line to follow this approach is, in addition to common factors of production function (employment, capital), to identify potential causal factors for farm performance that may shift the isoquant and to introduce them into production function.

Our model assumes that agricultural enterprise output is determined by standard factor inputs such as labour W, capital K, land L it has available, materials M it consumes. To estimate the impact of financial determinants on production efficiency – and thus on total factor productivity (TFP) – the variables characterizing the financial variables are included as function shifters in a production function model. Thus, enterprise's output Q can be written as

$$Q = F(W, K, L, M, A) \qquad (1)$$

where F is production function and A indexes total factor productivity (disembodied) with A=A(**X**, u). Vector **X** consists of a set of variables that reflect the financial environment the enterprise faces and u is a disturbance residual factors affecting productivity.

Important model specification issues are the choice of the functional form and methods of dealing with potential data problem (omitted variables, multicollinearity, heteroscedatsicity, endogeneity). In this study we have highly sufficient number of observations and thus we employ a flexible functional form *translog* as this form meets lower *a priori* requirements than the Cobb-Douglas form on the basic production behaviour. Therefore, the translog form should give a more appropriate replication of the real situation.

Assuming a translog form for F and an exponential for A in (1), the equation for the *level* of productivity can be written as

$$\log Q_{nt} = \Sigma_i \alpha_i \log X_{int} + \alpha_W \log W_{nt} + \alpha_K \log K_{nt} + \alpha_L \log L_{nt} + \alpha_M \log M_{nt} + \alpha_{WW} (\log W_{nt})^2 + \alpha_{KK} (\log K_{nt})^2 +$$

$$\alpha_{LL}(\log L_{nt})^2 + \alpha_{MM}(\log M_{nt})^2 + \alpha_{WK}\log W_{nt}\log K_{nt} + \alpha_{WL}\log W_{nt}\log L_{nt} + \alpha_{WM}\log W_{nt}\log M_{nt} + \quad (2)$$

$$\alpha_{KL}\log K_{nt}\log L_{nt} + \alpha_{KM}\log K_{nt}\log M_{nt} + \alpha_{LM}\log L_{nt}\log M_{nt} + \alpha_n + u_{nt}$$

where *log* refers to the natural logarithm, *n* and *t* index farm and year respectively, *i* indexes the variable in a set of financial environment (*i*=3 in our case: budget transfers, short-term bank credit, debt debt payables), α_n is farm specific effect, α's are the parameters to be estimated.

3. Data and variables

The agricultural firm panel data in this study employs the data of the Goskomstat (State Committee for Statistics) agricultural registries: annual industrial censuses on all Russian medium and large agricultural enterprises. The data do not cover family farms and subsistence household plots.

Agricultural registry mostly contains variables that are collected from the special annual agricultural reports (forms 5APK-16APK) and thus has rather broad range of technological variables (land area by varieties of crops, heads of animals, crop and livestock output by types in physical and Rouble values, inputs by categories in Rouble value, etc.) and, unlike financial reports (forms 1-5), has very limited data on financial aspects. We have obtained files with these registries for years 1995 to 1998 and merged them by enterprise identification codes (KOD_OKPO). Each registry contains 26000-27000 KOD_OKPOs over 77 subjects of the Russian Federation (oblasts)[1]. By linking the enterprises over years 1995-1998 we have 26896 observations in 1995, 26874 in 1996, 26987 in 1997, and 27287 in 1998. We omit from the analysis the farms that are classified as public, religious, charitable, political, professional union organizations; foundations, representative offices, consortiums, scientific stations, trial fields, family farms. We also drop out the observations that have a narrow specialization to make the sample more homogeneous. The restricted regression sample contains year 1996 to 1998 data for balanced panel of 17653 agricultural enterprises in each year[2]. This sample covers 65% of total number of agricultural enterprises, 59% percent of total employment in agriculture, 65% of total agricultural land used by the corporate farms, and 45% of gross agricultural output by corporate farms in 1996-1998 on average. Table I.1 demonstrates the construction of the sample.

The required indices on farm output, capital, financial characteristics are either taken from the statistical yearbooks or computed from the sample. Next, we turn to a discussion of our measures of variables of interest. All variables are measured in Rouble value, else otherwise stated. Farm output Q_{nt} is measured as netto-gross revenue. Capital K_{nt} is measured as value of fixed assets at the beginning of a year. Labor W_{nt} is measured as a number of farm employees. Land L_{nt} is measured as agricultural area in hectares. Materials M_{nt} is taken as costs of materials (seeds, fodder, mineral fertilizers, oil products, energy, fuel, spare parts, other). Budget transfers S_{nt} is measured as a value of granted subsidies that is a sum over subsidies and compensations for different outputs and inputs. Credit $CRED_{nt}$ is valued as amount of short-term credit at the beginning of a year. Variable $DEBT_{nt}$ is taken as a value of payments due at the beginning of a year.

All monetary variables are normalized by the base year prices (1996). To deflate the variables we use the price indices, either obtained from (Goskomstat, 2000) or we calculate the Tornqvist price index (Coelli, 1999). Description of variables and indices and descriptive statistics of the main variables are presented in Appendix.

[1] There are 89 subjects of the Russian Federation. The database does not include data from Chechnya, and the ten autonomous districts (*okrugi*) are aggregated together with the regions that surround them.

[2] Since financial characteristics such as credits, debts are lagged by one year, the time period is reduced to 1996-1998.

To specify a model, which is flexible over time, we extend the specification in (2) by adding the time-year dummies: YR96 is one for year 1996 and zero otherwise; YR97 is one for year 1997 and zero otherwise. $Weather_{rt}$ variable accounts in the model both for yearly changes and for inter-regional climate condition changes. This variable is proxied as the ratio of grain yield in the region to the national level of grain yield for each year. Unfortunately, better variables for climate conditions are not available. We introduce the $Demand_{nt}$ variable to control for demand conditions. This variable is measured as a year-to-year change in agricultural sales by the other agricultural enterprises in the region. One would expect farms to maintain higher productivity when demand is high, due to factor adjustments costs (e.g. see Brown and Earle, 2001b).

We justify the decision to run estimations for sub-samples of farms with different *specialization* by the following: a) animal production is likely to respond with a shorter lag period than crops, where an important output reaction can occur within a one year production cycle, b) Sedik *et al.* (2000) highlight the important differences between crop and livestock production while studying efficiency of crop producing farms; c) crop production during the analyzing period was profitable, whereas livestock production was unprofitable the whole period that may also indicate the differences in the analysis; d) subsidizing policy is oriented mostly on support of animal production. Thus, dummy variable $Spec_n$ takes value one if farm has a larger than 50% share in animal production, otherwise it takes value 0. We have sufficient number of observations in both sub-samples: share of crop farms is 60% and 40% for farms specialized in animal husbandry. We expect that crop producing farms tend to be more efficient and thus have relative better estimates of the corresponding variables of interest.

We are aware of the *reverse causality* problem between liquidity and productivity that is subsidies may be more likely to go to worse farms or that credits may be more likely granted to the better farms. It is commonly acknowledged that it is rather difficult to find appropriate instrumental variables for subsidies, credits, and debts. An appropriate way would be to compute the level of subsidies according to the statutory values per unit of output and input cost and to use the aggregated value as instrument. However, data of this type are hardly accessible and available to us only for years 1999-2000. Brown and Earle (2000, 2001a) construct the instruments so that they are the average values over all the other firms in the region. We apply the same idea in constructing the instruments for subsidies, credits and debt variables.

Having the panel structure of the data set we employ the fixed-effect estimation techniques. Estimation is performed in Stata 7.0 statistical program.

4. Estimation results

Estimation results for the regressions based on the overall sample, sub-samples of crop and livestock producing farms are analyzed in this section. We run two tests to check whether the instruments are reliable. The results of the Davidson-MacKinnon test for endogeneity (Greene, 1997) correspond with conclusion that constructed instruments explain the endogenous variables well. The results of the second test show that for each first stage regression, the group of instruments is jointly significantly different from zero.

The explanatory power of the final model specification is 0.70, the proportion of significant parameters at the 5% level is 0.68. Groups of financial, year dummies and control variables are significantly different from zero. According to an F-test, the Cobb-Douglas production function is not an adequate representation of the data, given the specification of the translog model. Estimation results for the overall sample are presented in table 1.

Table 1. Fixed-effect estimation results for overall sample

Dependent variable: Q	Estimate	Standard error	t-statistic	P-value
Credit	-0.0366	0.0066	-5.58	0
Debt	0.0092	0.0154	0.6	0.55
Budget transfer	-0.0050	0.0028	-1.75	0.079
Workers	0.3909	0.0754	5.18	0
Capital	0.1059	0.0229	4.62	0
Land	0.1474	0.0968	1.52	0.128
Materials	0.4710	0.0440	10.71	0
Workers^2	0.0316	0.0079	3.99	0
Capital^2	0.0016	0.0009	1.9	0.058
Land^2	0.0256	0.0068	3.74	0
Materails^2	0.0160	0.0026	6.15	0
Workers*Capital	0.0082	0.0044	1.85	0.065
Workers*Land	-0.0345	0.0106	-3.26	0.001
Workers*materials	-0.0090	0.0072	-1.25	0.212
Capital*Land	-0.0056	0.0033	-1.71	0.087
Capital*Materials	-0.0159	0.0027	-5.89	0
Land*Materials	-0.0291	0.0059	-4.91	0
Dummy yr96	-0.1111	0.0202	-5.49	0
Dummy yr97	0.0272	0.0044	6.14	0
weather	0.1232	0.0113	10.92	0
demand	0.8242	0.0191	43.19	0
constant	-5.8536	0.4313	-13.57	0

The estimates of all financial variables except for credit are not significant at the 5% level. A negative relation between short-term credit and agricultural output is surprising. A possible explanation is that the credit market itself is underdeveloped and producers do not take bank loans because they are not able to use land as collateral, due to legislation and its low market value. If they do take bank loans they might be using it for other than improving input-output allocation purposes, perhaps due to poor monitoring of credit use. This finding can be considered as evidence for the presence of the SBCs. An unexpectedly negative (significant at 10% level) estimate for budget transfers serves as an indicator of inefficient state support program that even results in taxation of farms. Compensation of expenses for agricultural inputs results in raising the prices of these inputs but not increase in inputs use (APF , 2001).

The estimates for production factors have the expected positive sign and are significant at the 1% level (except for land). To characterize the changes in farm output due to changes in input we compute the first order derivatives of the production function with respect to each factor that represent the output elasticities. The results can be found in Table 2.

Table 2. Output elasticity with respect to inputs

Inputs	Overall sample			Livestock producing farms			Crop producing farms		
	1996	1997	1998	1996	1997	1998	1996	1997	1998
Labour	0.280	0.276	0.272	0.059	0.053	0.053	0.527	0.526	0.516
Capital	-0.003	-0.004	-0.004	0.006	0.006	0.007	-0.010	-0.013	-0.012

Land	-0.095	-0.092	-0.084	-0.170	-0.166	-0.153	-0.100	-0.097	-0.092
Materials	0.141	0.145	0.149	0.082	0.088	0.092	0.266	0.266	0.269

Output elasticity for labour is slightly declining in dynamics and it is greater than zero. This on one hand, does not correspond with findings by other authors that labour is an overused farm input, on the other hand, taking into account that inputs use in general declined, it can be stated that on average agricultural enterprises experience a declining labour productivity. Negative output elasticity for land corresponds with the conclusion that farms in Russia use too much land. Possibly, this result is driven by the measure we used for land - agricultural land area – while due to lack of inputs some hectares may not be used at all. As it was expected, materials is one of the limiting factors in farm production, because these inputs (fuel, electricity, fertilizers, seeds, concentrates, etc.) often require cash, which is limited in farm enterprises.

Better weather conditions determined in our model through the ratio of regional grain yield to national grain yield correspond with growing output. The assumption that a higher demand would lead to higher productivity is supported by significantly positive corresponding estimate. The year effects show that, controlling for other variables, TFP declined in 1996 (dramatic fall in farm profitability after 1995) and 1998 and raised in 1997, corresponding with a modest economic growth in Russia that year. When estimating the model with dummies for years 1997 and 1998, the estimation results change only slightly, the direction of the impact of all other variables stays the same. Time dummy for year 1997 again has significantly positive coefficient, as well as for year 1998 dummy.

Crop producing farms, being mostly profitable, were expected to be less liquidity constrained than those specialized in animal husbandry production. Therefore, one would expect that extra source of liquidity granted to livestock production will improve its level more efficiently than for crop producing farms. Estimation results for two sub-samples of enterprises (crop and animal husbandry) demonstrate that there is no difference in coefficients of financial variables and thus there is no major difference in performance of these types of farms in relation to financial environment. Different signs of output elasticity, however, points to a weak evidence that livestock producers are lacking buildings and constructions and other relevant equipment. Furthermore, it might indicate that crop producers accumulate overvalued stock of assets such as machinery, harvesting equipment, constructions that are no longer used in production but are still on the balance sheet. Labour and materials are less constrained inputs on livestock farms (smaller magnitude of elasticity coefficient) than on crop farms.

Robustness check was performed examining the results excluding the two regions that are mostly urban: Moscow and St.Pitersburg[3] (same is done in Brown and Earle, 2001b). These two regions are frequently claimed to be outliers in a number of dimensions of economic development, and it may also be argued that farm in these regions can be better off due to more developed infrastructure and advantages of large cities with a high agro-food product demand. Comparing with the estimations that included Mosocw and St.Petersburg regions, the effects of all estimates change slightly without influencing the number of statistically significant parameters.

5. Conclusions and discussion

This paper focuses on the determinants of Russian farms productivity decline. In line with the conclusions of AFE (2000, 2001) our results also show negative relation between budget transfers and production that corresponds with the conclusion about inefficient state support program in agriculture that even results in taxation of farms. Based on the current findings we conclude that farms in Russia are experiencing SBCs, which have to be removed to improve productivity perform-

[3] These observations account for 3% of total number of observations.

ance. The SBCs have the same negative impact on farm productivity for differently specialized farms.

We find that land is an excessive factor in farm production and labour and materials are the limiting factors. Negative output elasticity for capital on crop farms and positive for livestock farms give a weak evidence that animal husbandry producers are lacking buildings and constructions and other relevant equipment and crop producers accumulate overvalued stock of assets such as machinery, harvesting equipment, constructions that are no longer used in production but are still on the balance sheet. Farm output is positively determined by favorable weather conditions and the higher consumer demand.

We see the following extensions of the current study. As several other studies using the regional aggregated data have found some evidence for the diverse trends in farm efficiency, the next question to answer in line with our study would be are there any geographic sub-patterns in productivity developments. We are aware of the problem with limitations of budget transfers variable used as indicator of the state support in this study. There are other alternative approaches to measure real state support (accounting for budget and price transfers). Introducing such measures as nominal rate of protection (NRP) and effective rate of protection (ERP) may serve as good indicators for the impact of state policies on farm production performance. Both measures serve as a summary indicator for all actions with regard to taxation and subsidization, causing domestic and border prices to differ from each other (ERP also includes the combined effects of price distortions on output and input markets). At the moment, however, only all-Russia regional (for 11 regions) aggregates have been computed in preliminary study in this field (see e.g. Valdes and Kray, 2000).

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Appendix

Table I.1. Construction of the Sample

Number of firms:	1995	1996	1997	1998	Total	% of total
In the Agricultural Registry	26896	26874	26987	27287	108044	100
After omitting the farms with specific status*	23997	23707	23906	24644	96254	89.1
After omitting the strictly specialized farms**	23322	22878	23067	23657	92924	86.0
After omitting observations with extreme values of worker per hectare***	22799	22294	22347	22590	90030	83.3
After forming the balanced panel and omitting the observations with missing variables	17653	17653	17653	17653	70612	65.4

* public, religious, charitable, political, professional union organizations; foundations, representative offices, consortiums, scientific stations, trial fields, family farms.
**fishery farms, poultry farms, farms when one type of production (grain, potato, sunflower, sugar beet, vegetables, other crop, beef, pork, lam, poultry meat, milk, wool, eggs, other livestock production) take more than 90% in total revenue.
***We omit from the analysis farms that have workers per hectare >0.100 and <0.005 in combination with large/small acreage (>15000, <100) and number of employees (>2000, <50).

Definition of variables

Price indices:

$TPIO_{nt}$ is a Tornqvist price index for aggregated output computed by employing the price indices data by categories of agricultural output available at the national level and output structure by individual farms.

$TPIM_t$ is a Tornqvist price index for materials (consisting of mineral fertilisers, concentrates, seeds, electricity, fuel, oil products, spare parts, and other) was constructed on the base of the average national structure of materials and the price indices of each component at the national level

$TPIC_t$ for fixed asset constructed by using the average structure of fixed assets on agricultural enterprises and price indices of fixed assets in the sectors of economy.

$TPIS_{nt}$ is a Tornqvist price index for budget transfers constructed in the same way as for output (using the structure of subsidies by their categories).

CPI_{rt} is the regional level consumer price index.

Variables:

Capital K_{nt} is the natural logarithm of fixed assets at the beginning of a year in year 1996 $TPIC_t$ prices.

Credit $CRED_{nt}$ is valued as natural logarithm of short-term credit at the beginning of a year in year 1996 CPI_{rt} prices.

$Demand_{nt}$ variable is measured as a year-to-year change in agricultural sales by the other agricultural enterprises in the region.

Labor W_{nt} is measured as natural logarithm of a number of farm employees.

Land L_{nt} is measured as natural logarithm of agricultural area in hectares.

Materials M_{nt} is taken as natural logarithm of costs of materials (seeds, fodder, mineral fertilizers, oil products, energy, fuel, spare parts, other) in year 1996 $TPIM_t$ prices.

Q_{nt} if the natural logarithm of netto-gross revenue in 1996-year $TPIO_{nt}$ prices.

$Spec_n$ is a dummy for farm specialization and it takes value one if farm has a larger than 50% share in animal production, otherwise it takes value 0.

Budget transfers S_{nt} is measured as natural logarithm of granted subsidies (that is a sum over subsidies and compensations for different outputs and inputs available in the data set) in year 1996 $TPIS_{nt}$ prices.

Variable $DEBT_{nt}$ is taken as a value of payments due at the beginning of a year in year 1996 CPI_{rt} prices.

$Weather_{rt}$ variable is proxied as the ratio of grain yield in the region to the national level of grain yield for each year.

$YR96_n$ is a year 1996 dummy equals one if year is 1996 and zero otherwise.

$YR97_n$ is a year 1997 dummy equals one if year is 1997 and zero otherwise.

Descriptive statistics

Table I.2 Descriptive statistics of the main variables (52959 observations, years 1996-1998)

Variable	Symbol	Dimension	Mean	Standard deviation	Minimum	Maximum
Revenue	Q	10^3 Roubles of 1996	3201.6	6391.8	3.7	285167.2
Credit	CRED	10^3 Roubles of 1996	88.0	632.9	0.0	76224.5
Debt	DEBT	10^3 Roubles of 1996	1610.5	7605.8	0.0	1099135.3
Budget transfer	S	10^3 Roubles of 1996	362.4	938.8	0.0	49419.0
Land	L	hectare	5930.2	4843.0	100.0	29929.0
Materials	M	10^3 Roubles of 1996	3339.1	4710.2	2.0	182459.2
Workers	W	Men	202.9	144.4	51.0	1864.0
Capital	K	10^3 Roubles of 1996	39449.2	50441.5	0.8	5407235.8