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SCARCITY AND PREFERENCES (DATA ENVELOPMENT ANALYSIS OF MOSCOW REGION CORPORATE FARMS)

NIKOLAY SVETLOV[*]

ABSTRACT

The aim of this paper is to offer a theoretical framework for revealing farms' preferences based on a data envelopment model and to test a hypothesis regarding short-term profit maximising behaviour of Moscow region corporate farms. Data from 2002 and 2003 are used. The initial hypothesis is rejected in favour of Baumol's oligopolistic (revenue-maximising) behaviour. Non-monetary utility components do not pertain to the revealed corporate farms preferences. With respect to the revealed preferences, the scarcest resources in 2002 and 2003 are machinery (56.3 and 50.6 % of farms, respectively), cows (47.7 and 37.6 %), haylands and pastures (39.2 and 50.6 %). The political implication of this study is a need for institutional improvements which aim to lower transaction costs, improve access to market information, and increase competition within the market environment.

Keywords: *Utility function, revealed preferences, Data Envelopment Analysis, corporate farms, Moscow region, oligopoly.*

1 INTRODUCTION

For the purpose of developing a regional agrarian policy, it is necessary to know the preferences which determine farm level decision-making. This knowledge:

[*] Moscow Timiryazev Agricultural Academy (MTAA), Russian Federation,
E-mail: svetlov@timacad.ru.

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- Facilitates the correct prediction of farms' reactions to a given change in either a political or market environment;
- Justifies microeconomic models, since being based on an incorrect assumption about farm utility, the modelling commonly ends in biased estimations or even fails.

Methodological issues of approaching farm's utility are discussed in AMADOR et al., (1998), LIEN and HARDAKER (2001). These papers suggest a set of survey and data processing tools that aim to identify decision-making determinants. However, it is possible that the reported and revealed preferences may differ.

Discussion of Russian farm preferences mostly concentrates on the validity of the profit-maximising behaviour assumption. SEROVA (1999) argues that this assumption cannot be applied to Russian farms for historical and institutional reasons. In BEZLEPKINA (2004) the opposite position is taken and shown to be in accordance with the available data on Moscow region corporate farms. SVETLOV (2002b), by means of a farm sample approach, shows that, in addition to short-term profit (which is imposed), farm utility is sensitive to depreciation, wages and herd population.

These differences can be caused by both temporary and methodological reasons. Therefore, at least two research tasks can be identified: Improving methodology by making it simple, reliable and transparent; regularly monitoring preferences in order to register and explain observable changes.

The aims of this study are:

- To offer a theoretical framework for revealing farms' preferences;
- To test the hypothesis regarding short-term profit maximising behaviour displayed by Moscow region corporate farms;
- To measure the scarcity of resources used by Moscow region corporate farms in order to identify institutional imperfections and to help develop reasonable agrarian policies.

2 THEORETICAL FRAMEWORK

A theoretical base for revealing preferences, developed in SVETLOV (2002a), rely on classical results in mathematical programming (KUHN and TUCKER, 1951; UZAWA, 1958) and on the general reciprocity theorem by LOURIER (1966). The latter, unlike duality theory, deals with the reciprocal exchange of an objective function and a bound constraint. Following this theorem, a reciprocal problem has the same optimum as an original one, and the Lagrangean vectors of both problems differ only in scale and order of the components. This result spans all mathematical programming problems, regardless of (non)convexity, providing that their feasible sets are closed.

Briefly, the theoretical framework is the following: Assume that $\mathbf{x}^* = (x_1^*, x_2^*, \ldots, x_n^*)$ is an optimum of the problem

$$\max_{\mathbf{x}}(u(\mathbf{x}) \mid \mathbf{x} \in X), \tag{1}$$

where $\mathbf{x} = (x_1, x_2, \ldots, x_n)$ is a vector of state variables, $u(\mathbf{x})$ is an objective function and X is a set of feasible solutions. If this problem is convex, then

$$\max_{\mathbf{x}}(\langle \boldsymbol{\varphi}, \mathbf{x} \rangle \mid \mathbf{x} \in X), \tag{2}$$

where $\langle \boldsymbol{\varphi}, \mathbf{x} \rangle$ is a tangent to $u(\mathbf{x})$ in $\mathbf{x}^*$, yields the same optimum $\mathbf{x}^*$. From UZAWA (1958) and LOURIER (1966) it follows that, having defined $\mathbf{h} = (x_2, \ldots, x_n)$ and $\mathbf{h}^* = (x_2^*, \ldots, x_n^*)$, the optimal solution of the problem

$$\max_{\mathbf{x}}(\varphi_1 x_1 \mid \mathbf{x} \in X, \mathbf{h} = \mathbf{h}^*), \tag{3}$$

is also $\mathbf{x}^*$, and Lagrangean multipliers for the equation $\mathbf{h} = \mathbf{h}^*$ are $\varphi_2 \ldots \varphi_n$ providing that $\boldsymbol{\varphi} = (\varphi_1, \varphi_2, \ldots, \varphi_n)$. It is assumed here that the optimum and the tangent are both unique; SVETLOV (2002a) spans the general case.

Presume now that (1) represents an economic agent that makes a choice from among the technologies belonging to a technological set X by maximising a utility represented by an unknown function $u(\mathbf{x})$, which moves this agent to an observable position $\mathbf{x}^*$. Then, as follows from the aforementioned transformations, it is possible to recover $\boldsymbol{\varphi}$ by solving the problem (3), thus revealing a tangent to $u(\mathbf{x})$ in $\mathbf{x}^*$. This tangent represents the local preferences of the economic agent (1) in a vicinity of $\mathbf{x}^*$.

3 EMPIRICAL MODEL

In this study, the empirical specification relies on data envelopment method of representing a technological set (CHARNES et al.,1978). The empirical model is formulated as

$$\max_{k,\boldsymbol{\lambda}}(h_{im,1} - k h_{im,2} \mid \mathbf{A}_m \boldsymbol{\lambda} \le k \mathbf{a}_{im}, \mathbf{B}_m \boldsymbol{\lambda} \ge \mathbf{b}_{im}, \mathbf{H}_m \boldsymbol{\lambda} = \mathbf{h}_{im}, \langle \mathbf{i}, \boldsymbol{\lambda} \rangle = 1), \tag{4}$$

where $\mathbf{a}_{im}$ and $\mathbf{b}_{im}$ are actual inputs and outputs on a farm i accessing m-th technological set; $\mathbf{h}_{im} = (h_{im,1}, h_{im,2}, \ldots, h_{im,6})$ is a vector of utility components on the same farm; $\mathbf{i}$ is a vector of ones; matrices $\mathbf{A}_m = (\mathbf{a}_{im})$, $\mathbf{B}_m = (\mathbf{b}_{im})$, $\mathbf{H}_m = (\mathbf{h}_{im})$; $\boldsymbol{\lambda}$ is a vector of intensities of available technologies; k is a scalar.

The utility components, which compose $\mathbf{h}_{im}$, are revenue ($h_{im,1}$, thousand roubles), short-term costs ($h_{im,2}$, thousand roubles), wages ($h_{im,3}$, thousand roubles), short-term loans ($h_{im,4}$, thousand roubles), long-term loans ($h_{im,5}$, thousand roubles), and cow population ($h_{im,6}$, thousand roubles).

Some of the named utility components need special comments. Loans appear here, on one hand, as a possible source of liquidity, which is valuable under the Russian conditions characterised by the hindered access of farms to sources of financing; on the other hand, some managers are seen as displaying loan-averse behaviour because they are uncertain about their ability to repay them due to high risks, both market and political, and inaccessible (too expensive) insurance.

The available literature suggests that managers may overestimate herd utility (see e.g. BEZLEPKINA, 2004), which justifies the presence of cow population among utility components.

Depreciation is excluded from costs, as this specification deals with the short-term profit maximisation hypothesis.

There are 9 inputs: Arable land (ha); pastures and haylands (ha); agricultural labour (number of agricultural workers); sources of financing production costs (thousand roubles per year); number of sows; number of cows; number of sheep; fixed production assets (thousand roubles); machinery (approximated by spare part expenses, in thousand roubles).

Arable land is represented by an actually available area on the right hand side of the $\mathbf{A}_m\boldsymbol{\lambda} \le \mathbf{a}_{im}$ constraint, but for a sown area on its left hand side. The reason is that many farms waste arable land due to a lack of machinery, lack of short-term financing or difficult competition against imports. Thus, arable land area cannot be used as an indicator of technologically-justified consumption of arable land, which must appear on the left hand side of this equation. As beef cattle are not bred in the Moscow region, there is no need to split cows in the model into dairy and meat breeds. Beef is produced only through the rejection of calves or dairy cows.

The outputs are grains (kg×100); potatoes (kg×100); vegetables (kg×100); other crops (thousand roubles); beef (kg×100); pork (kg×100); mutton (kg×100); other meat (kg×100); milk (kg×100); wool (kg×100); other animal production (thousand roubles); and non-agricultural production (thousand roubles). Poultry farms are not included in this study.

The objective function of (4) is equivalent to minimising k from the point of view of the resulting optimal solution. However, the form of short-term profit maximisation, which is actually used in (4), allows a monetary measure of shadow prices, which is convenient for the analysis.

The hypothesis is that the farms display shout-term profit-maximizing behaviour. This is tested in the following way:

- The vectors $\boldsymbol{\gamma}_{im}$ of shadow prices for the constraint $\mathbf{H}_m\boldsymbol{\lambda} = \mathbf{h}_{im}$, which correspond to $\boldsymbol{\varphi}$ in problem (2), are obtained from (4) for each farm *i* regardless of the corresponding *m*;
- The components of these vectors are statistically tested for differences from zero by means of *t*-test. According to the hypothesis, those which relate to revenue and short-term costs are expected to significantly differ from zero and to be close to 1 and -1, respectively. The rest of the components are not expected to differ from zero.

Scarcity of a resource is signalled by a non-zero component in a vector of shadow prices relating to the $\mathbf{A}_m\boldsymbol{\lambda} \le \mathbf{a}_{im}$ constraint. Widespread non-zero components throughout a set of farms indicates the prevalence of scarcity.

Shadow prices that characterise the constraint $\mathbf{B}_m\boldsymbol{\lambda} \ge \mathbf{b}_{im}$ are analysed by means of comparison against market prices. A large difference suggests one of the following:

- Large transaction costs;
- Misreported prices;
- A large difference between financial and economic prices (presence of a hidden utility attached to the output).

4 DATA

Moscow region corporate farm data from 2003 (364 farms) is used. For comparison and robustness tests, the model was also run using similar data from 2002 (381 farms). The source of data is the State Statistical Committee of the Russian Federation, which holds a database of approximately 250 variables regarding Russian corporate farms that have submitted their annual reports to the regional statistical institutions. The subset used in this study includes variables from all the utility components, inputs and outputs mentioned in Section 3 and, additionally, average prices of all outputs except those measured with revenue from sales. The prices are calculated as a revenue from sales of a particular output (thousand roubles) per amount of sales (kg×100).

The data envelopment approach commonly presumes that all technologies that are actually applied by farms appearing in the data set are available to any other farm. This is often true in the long run, providing that the farms have sufficient investment opportunities for adjusting their technological capacity. This is hardly the case of the studied farms, since their assets were formed under a very different institutional system and price structure. A lot of time and money is required for complete technical restructuring, which often requires developing branches of agricultural production that are completely new for a particular farm.

Following the experience of an earlier study (SVETLOV, 2004), a simple and practical means of avoiding this problem are used. They are based on the assumption that if a farm does not sell a given output, then the technologies that produce this output are unavailable to this farm in the short run.

In order to implement this approach, the initial data sets from 2003 and 2002 are classified into subsets so that all farms in a subset produce exactly the same set of outputs. The criterion of forming such sets is later called a *production pattern*. Different production patterns correspond to different values of subscript m in (4). As soon as the production patterns are defined, the specific matrices $\mathbf{A}_m$, $\mathbf{B}_m$ and $\mathbf{H}_m$ are formed for each subset. This facilitates defining a production frontier that is specific for a particular production pattern. Among all the production patterns available from the data set of 2003, only six were used in this study, since others were represented by too few farms. In 2002, seven patterns were found to meet the requirements of this study. As a result, this study uses only 178 data items of the 364 available in 2003, and 199 of 381 data items available in 2002.

The definition of patterns is presented in Table 1.

BEZLEPKINA (2004) admits that Russian farms might misreport an amount of inputs and outputs (and, consequently, financial results). Commonly, the purpose of false reports is to hide thefts and illegal transactions. Since many farms neither really consider the option to be lenders, nor intend to raise the value of their shares, they have no reason to display good financial results and high production efficiency. That is why, commonly, they over-report inputs and under-report outputs. Consequently, using non-frontier data processing methodologies like OLS, a researcher can come up with confusing results.

In the case of data envelopment representation of a technological set, the farms that misreport their status in the described manner just move to the downside of the frontier and are unlikely to affect results considerably. At worst, this effect partially hides an existing technological capacity. Under these conditions, it is not possible to identify the distortions caused by this problem. Unless there are explicit reasons for attaching a certain outcome of the model to the problem of misreporting, one should interpret the outcome as "the best of available knowledge", since the data envelopment approach is less sensitive to this problem than non-frontier modelling.

Table 1: Production patterns involved in the analysis

Outputs	Production patterns						
	I	II	III	IV	V	VI	VII
2003							
Grains	+	+	–	+	–	–	×
Potatoes	–	+	–	+	–	–	×
Vegetables	–	–	–	+	–	–	×
Other crops	+	+	+	+	–	+	×
Beef	+	+	+	+	–	+	×
Pork	–	–	–	–	–	+	×
Milk	+	+	+	+	–	+	×
Other animal production	+	+	+	+	+	+	×
Non-agricultural production	+	+	+	+	+	+	×
Number of farms	62	44	28	23	11	10	×
2002							
Grains	+	+	+	–	+	+	–
Potatoes	–	+	+	–	+	–	+
Vegetables	–	–	+	–	+	–	+
Other crops	+	+	+	+	+	+	+
Beef	+	+	+	+	+	+	+
Pork	–	–	–	–	+	+	–
Milk	+	+	+	+	+	+	+
Other animal production	+	+	+	+	+	+	+
Non-agricultural production	+	+	+	+	+	+	+
Number of farms	59	54	29	21	12	12	12

Source: Author's calculations based on data of Moscow Region farm registry (2002, 2003; unpublished).

Notes: '+' means presence of the output in the production pattern, '–' means absence, '×' denotes a meaningless cell. The outputs that are absent in all modeled production patterns are omitted.

5 RESULTS

Table 2 presents the statistical characteristics of the components of $\boldsymbol{\gamma}_{im}$ obtained from (4) having been solved 377 times. This Table characterises the tangent to the revealed preferences of the studied farms in their actual states.

Table 2: Statistical characteristics of tangents to revealed preferences functions in the actually observed state of a farm

	Revenue	**Costs**	**Wages**	**Short-term loans**	**Long-term loans**	**Herd population**
2003: Average	1.049	-0.041	-0.264	-0.254	0.007	-12.139
2003: Standard deviation	0.540	0.604	2.058	0.944	2.037	40.361
2003: *p*-value	**0.948**	0.054	0.102	0.212	0.003	-0.236
2002: Average	0.765	-0.095	-0.106	-0.290	0.486	6.448
2002: Standard deviation	0.439	0.345	1.341	6.757	3.093	16.239
2002: *p*-value	**0.919**	0.217	0.063	0.034	0.125	0.309

Source: Author's calculations based on data from the Moscow Region farm registry (2002, 2003; unpublished).

Note: Bold values indicate a significant difference from zero at a 90 % confidence level.

The components of $\boldsymbol{\gamma}_{im}$ are empirically distributed nearly symmetrically. The excess of the empirical distributions is considerably higher than that of a normal distribution. Because of this, the *t*-test is applied here with the reservation that the rejection of the hypothesis regarding the zero value of a component is even more reliable than follows from the confidence level. However, if the hypothesis is not rejected, it is not wholly convincing that it would not also be rejected if one knew the true distribution.

As follows from Table 2, the data from 2003 reject the null hypothesis of this study, which is formulated in Section 3, at a 90 % level of confidence. No utility components except revenue are shown to reliably belong to the true utility function: The hypotheses regarding their insignificance are not rejected. Surprisingly, the revealed preferences miss costs: $\gamma_2 \approx 0$, where $\boldsymbol{\gamma} = (\gamma_1 \ldots \gamma_6)$ is a vector of averages throughout $\boldsymbol{\gamma}_{im}$. As for the revenue, $\gamma_1 \approx 1$ (difference from unity is rejected at a 90 % confidence level). This perfectly conforms to BAUMOL'S (1967) theory, which suggests the revenue maximizing behaviour of agents acting under the conditions of oligopoly-type competition, concerned mostly with preserving and increasing their share of the available market.

The data from 2002 yield similar results, but the marginal utility of the revenue noticeably, although not significantly in a statistical sense, differs from 1 (mean value is 0.77). The possible cause is that in 2002, the farms (especially vegetable producers) made their decisions under very unstable prices, which made it scarcely possible to optimize production programmes.

With respect to the above-reported results, the question can arise whether the test throughout the set of $\boldsymbol{\gamma}_{im}$-vectors obtained from subsets based on different production patterns is valid. The data from Table 3 suggest that the heterogeneity possibly caused by differences in production patterns cannot be attributed to the corporate farms utility function.

In Table 3, the values of γ_{im} are averaged over m, except for the least numerous subsets, which are joined together. In 2003, the conclusion regarding the revealed preferences in all subsets remains the same throughout all production patterns.

Table 3: Average tangents to revealed preferences functions in the actually observed state of a farm (by subsets)

Subsets	Revenue	Costs	Wages	Short-term loans	Long-term loans	Herd population
			2003			
I/2003	1.04	-0.07	-0.34	-0.41	0.04	-0.16
	(-0.97)	(0.09)	(0.14)	(0.31)	(-0.02)	(0.01)
II/2003	1.02	-0.13	0.13	0.00	-0.46	-11.25
	(-0.95)	(0.33)	(-0.09)	(0.05)	(0.15)	(0.35)
III/2003	1.36	-0.08	-1.25	-0.04	0.73	-31.65
	(-0.96)	(0.09)	(0.43)	(0.08)	(-0.34)	(0.33)
IV-VI/2003	0.88	0.14	0.19	-0.44	-0.11	-23.44
	(-0.94)	(-0.13)	(-0.05)	(0.24)	(0.06)	(0.52)
			2002			
I/2002	0.60	-0.16	0.41	0.66	0.04	4.91
	(0.74)	(0.30)	(-0.27)	(-0.09)	(0.02)	(0.26)
II/2002	**0.88**	-0.07	-0.31	-0.42	0.69	3.07
	(1.00)	(0.20)	(0.34)	(0.39)	(0.41)	(0.19)
III/2002	**0.82**	-0.17	-0.28	0.95	0.00	9.63
	(1.00)	(0.66)	(0.34)	(-0.24)	(0.00)	(0.70)
IV/2002	**0.86**	0.17	-0.09	**-9.23**	0.65	10.01
	(0.91)	(-0.78)	(0.09)	**(0.95)**	(0.32)	(0.32)
V-VII/2002	0.83	0.26	-1.11	1.87	1.18	12.57
	(0.88)	(-0.37)	(0.25)	(-0.12)	(0.15)	(0.43)

Source: Author's calculations based on data from the Moscow Region farm registry (2002, 2003; unpublished).

Notes: Bold values relate to a significant difference from zero at a 90 % confidence level; values in brackets are *p*-values.

As for year the 2002, in subsets I/2002 and V-VII/2002 γ_{im} vary too widely to form any conclusion about preferences, but *p*-values associated with revenue utility are the largest. Subsets II/2002 and III/2002 yield the typical result, which is in line with Baumol's theory. Noticeably, farms of subset IV/2002, spanning strictly specialised dairy farms, display short-term credit-averse behaviour. As a farm is not the only actor making a decision whether or not to access short-term loans, this result rather indicates that banks tend to hamper the access of dairy farms to short-term loans. Yet, the reason for such differences in the revealed preferences is not clear: Unlike subsets I/2002-III/2002, farms of subset IV/2002 are profitable, on average, in 2002. It is likely that this outstanding result is just occasional, which is quite possible in the subset of only 21 farms.

Although not statistically significant, in 2002 a herd population is rather attractive to farms in all subsets, contrary to 2003 when the situation is opposite. It is possible that the difference is not occasional. The reason is that in 2002-2003, the production costs of dairy farming kept growing (by 9.9 %, according to the data sets used in this study), while milk and meat prices barely changed (growth of 2.1 %). This likely resulted in increasing fears about the commercial efficiency of milk production in the long run.

To conclude, in 2002 the set of farms is less homogenous with respect to $\boldsymbol{\gamma}_{im}$ than in 2003; however, the observed differences are not large enough to doubt the above formulated conclusion about revealed preferences.

Findings regarding resource scarcity in 2002 support most of the earlier results for the same year reported in SVETLOV (2004): The scarcest resources are found to be machinery (56.3 % of farms), cows (47.7 %) and land (haylands and pastures – 39.2 %, arable land – 26.6 %). The difference is that the model (4) shows low scarcity of the sources of production cost financing (10.6 %). This is explained by the constraint on short-term loans, which, unlike in SVETLOV (2004), explicitly appeared in the model (4): In 27.1 % of farms, at least one of these two constraints is bound. The presence of a long-term credit constraint also partially captures the effect of short-term financian shortages: Omitting this constraint, when it is bound, often leads to turning short-term financing into a scarce resource. In 2003, the situation barely changed: Scarcity of machinery is registered in 53.4 % of farms, of haylands and pastures – in 50.6 %, of cows – in 37.6 %, of arable land – in 36.5 %. The share of farms lacking sources of production cost financing increased to 24.2 % (either of themselves or of short-term credit – to 34.8 %).This is an expected change, as the year 2002 was characterized by lower profits than the previous two years.

Other fixed inputs rarely constrain farms' utility function.

Mean values of shadow prices for inputs are shown in Table 4. This table includes four inputs that are not considered as utility components, represented by data from both years and used in the majority of farms, thus providing representative statistics. Due to decreased profitability, an average shadow price of arable land decreases in 2003. So the positive changes in land shadow prices in 2002, in comparison to earlier periods, noted in SVETLOV (2004), appeared to be temporary. For haylands and pastures, however, the shadow prices remained nearly unchanged. Due to the continuing reduction of the number of employees and the growth of wages, the shadow price of agricultural workers more than doubled. Finally, the incentives to expand machinery usage quadrupled.

The above presented results remain robust throughout numerous tests by means of changing the empirical model specification: Varying control for return to scale, trying different combinations of utility components, including depreciation into costs, and omitting outstanding technologies.

In the majority of solutions, despite a particular model specification, k in (4) is equal to 1. Hence, the revealed preferences are attached to the *actual* state of the studied farms in 2002 and 2003. This note addresses the methodological problem originating at the possible difference of tangents to a true utility function in actual and optimal, with respect to (4), states of farms.

Table 4: Average values of shadow prices of inputs, thousand roubles per unit

Year	Arable land, per ha	Haylands and pastures, per ha	Agricultural workers, per man	Spare parts, per thousand roubles
2003	1.81	4.51	104.30	7.20
2002	4.19	4.17	50.85	1.92
Growth	-2.39	0.34	53.45	5.28

Source: Author's calculations based on data from the Moscow Region farm registry (2002, 2003; unpublished).

Note: The values are mean values.

The difference between shadow prices and actual prices barely changes in 2003 compared to 2002 for all outputs (Table 5), giving no reason to presume large biases in shadow price estimations. The data on pork are not presented in this table, as, due to relatively heterogeneous subsets of pork-producing farms, the estimated value varies too widely in robustness tests.

Table 5 suggests that the potatoes, vegetables and milk markets are close to equilibrium: Average market prices are close to average shadow prices in both years.

As for grains and beef, we observe the evidence of either serious market distortions persisting through time or of misreported revenues or sales. In the case of grain, as data show, this problem deepens in 2003. In our case, both explanations are possible. In particular, it is to be expected that the reported sales might include grain used by farm employees for feeding own cattle. However, a special study is necessary to split possible causes of the observed difference between actual and shadow prices.

Table 5: Average values of actual and shadow prices of outputs, roubles per unit

	Year	Grains, per kg	Pota-toes, per kg	Veget-ables, per kg	Other crops, per rou-ble	Beef, per kg	Milk, per kg	Other animal produc-tion, per rouble	Non-agricul-tural produc-tion, per rouble
Prices	2003	2.76	5.97	4.68	1.00	18.15	5.84	1.00	1.00
	2002	2.19	4.89	4.33	1.00	19.50	5.60	1.00	1.00
Shadow prices	2003	8.65	5.37	4.17	11.70	37.72	5.19	2.77	1.93
	2002	6.18	6.70	3.60	5.26	40.96	5.51	1.16	2.51
Shadow per actual prices ratio	2003	3.13	0.90	0.89	11.70	2.08	0.89	2.77	1.93
	2002	2.82	1.37	0.83	5.26	2.10	0.98	1.16	2.51

Source: Author's calculations based on data from the Moscow Region farm registry (2002, 2003; unpublished).

Notes: The values are mean values. Actual prices are calculated using reported revenues and amounts of sales.

The greatest changes in shadow prices between the two years are observed for outputs measured in a monetary form. This is explained by structural changes in the composition of these outputs. The difference between shadow and actual prices of these outputs is larger than that of others. In the case of crop production other than grains, potatoes and vegetables is the largest. This effect can be caused by unavailability to the majority or farms of a specific technology (for instance, strawberry production) used by a single farm located at the production frontier. Hence, there is no reason to attach an economic meaning to this value.

The tests for robustness by means of changing the model specification show that the estimations presented in Tables 4 and 5 are robust enough to justify economic conclusions.

6 CONCLUSIONS AND DISCUSSION

1 The study presented in this paper argues that the behaviour of Moscow region corporate farms is close to revenue maximising behaviour, which is theoretically expected in the case of oligopoly. Having occupied a sizeable share of a regional market of agricultural production, each farm tends to keep this share occupied rather than to care about costs.

2 It is found that the revealed preferences are homogenous with respect to production patterns reflecting farm production specialisation, and display robustness to changes in the empirical model specification within the justified theoretical framework.

3 Increasingly widespread land scarcity compared to the late 1990s is an important positive change creating preconditions of efficient resource allocation. However, the estimations for 2003 show that the arable land shadow price growth was not caused by long-term processes that could be expected to persist under the absence of a purposeful land value policy. The lack of machinery has surpassed the problem of lack of sources of production cost financing, which was a central constraining factor of agricultural production in the first decade of market reforms in agriculture.

4 Since an oligopolistic behaviour results in lower outputs and higher consumer prices compared to a profit-maximizing behaviour, this study suggests seeking institutional improvements that would allow lower transaction costs, easier access to market information and a more competitive market environment. It should be noted that splitting existing production units can raise transaction costs instead of the expected positive impact on competitiveness. Alternatively, creating *new* farms, either corporate or family, due to capital inflow from other branches of the economy (for instance, from food processing enterprises lacking a resource base) might improve resource usage and increase competitiveness without a considerable negative influence on transaction costs.

Future studies of corporate farms utility is justified by the following problems that remain unsolved.

1 Although the variance of herd population utility proves that the difference of this utility component from zero is occasional, the uniform sign of this component within a year, as displayed in Table 3, suggests that in fact this utility component might be reliably different from zero, at least in some of the studied farms. It is important to provide a methodology that would allow identifying such farms. The possible significance of the herd population utility is also justified by the highly excessive (the excess is 2.07) empirical distribution of herd population utility. A theoretical base of possible significance for this utility component (at least for some farms) is a large time gap between making decisions about herd population and its effect, which makes expectations regarding the future effectiveness of milk production a noticeable factor of farm preferences. In this respect, the utility of herd population is a subject for more detailed study.

2 The results of this study allow another interpretation: The monopoly or oligopoly of suppliers might hinder the ability of farms to control their costs. This reasoning is in line with a position of many Russian agrarian economists, who stress a much higher rate of farm input price growth in farms in the most appropriate way. Although the production patterns approach is simple and handy, the strict evidence that it perfectly facilitates throughout the set of farms. Finally, there exists the problem of a grouping

technique which would reflect the availability of technologies to ported by the empirical model. Nevertheless, a detailed study of the relations between the studied farms and their suppliers seems to be necessary in order to ensure the validity of the foremost conclusion of this study.

3 It is possible that the utility of short-term loans is not reliably homogenous within the studied data sets. The factors that could influence it need a special study. One of the possible factors is the relation between banks and farms, which are not uniform throughout the set of farms.

4 Finally, there exists the problem of a grouping technique which would reflect the availability of technologies to farms in the most appropriate way. Although the production patterns approach is simple and handy, the strict evidence that it perfectly facilitates the purpose it is engaged for is currently missing. Testing alternative grouping approaches is one more promising direction of future studies.

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