Microeconomic Analysis of Russian Agricultural Enterprises

with special reference to subsidies and debts

Irina Bezlepkina

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Abstract

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This thesis provides a microeconomic analysis of the impact of debts and subsidies on input-output allocation and performance of agricultural enterprises in Russia in the past decade. The study uses descriptive methods, non-parametric method such as Data Envelopment Analysis, parametric regression analysis of production and profit functions and cluster analysis. The data source contains annual records of 20,000 Russian agricultural enterprises and 150 dairy enterprises in the Moscow region mainly from the period 1995-2001. During 1990-2001, agricultural enterprises kept their leading role in supplying 79.4% of agricultural output (data of 1999), accumulating 69% of labour and 85% of land recourses in agriculture and receiving most state support, thereby determining the performance of the agricultural sector. The analysis showed that subsidy policies distorted producer incentives and caused misallocation of inputs and outputs. However subsidies contributed to more efficient performance by relieving financial constraints. Although total debts in the Russian agricultural sector exceeded the profits tenfold, debts and in particular debts payable positively influenced performance of agricultural enterprises through the financing provided by input suppliers. However soft budget constraints, as excessive debt and subsidies to loss-making enterprises, displayed a negative impact on the performance. Oversized agricultural enterprises and lack of response of dairy producers to milk prices suggested that their structure and behaviour were adjusting too slowly to the new market environment. On well-performing dairy farms, higher wages, milk prices, dairy productivity and subsidies signalled better management practices in place since pre-reform times. Appropriate financing forms a crucial factor in Russian farming. The efficiency of large-scale farming in Russia could be improved by government programs focusing on coordination of subsidy programs, promotion of labour, land and credit markets and facilitating improvement in farm management and wage increases.

Keywords: Russia, agricultural enterprises, transition, performance, debts, subsidies, soft budget constraints, efficiency, productivity.

Preface and acknowledgements

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Irina Bezlepkina
Wageningen, July, 2004

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Chapter 1
General Introduction

1.1 Background

From the beginning of reforms initiated in 1992 in the Russian economy, the agricultural sector has experienced dramatic macroeconomic shifts, as well as institutional and structural changes. Agricultural producers were confronted with liberalised markets, a dismantled planning system, abolished state procurement, reduction of state subsidies, lack of technical and business management skills and credit resources (Trzeciak-Duval, 1999; Serova, 2000; Liefert and Swinnen, 2002). The reforms were incomplete – Russia was given a score of 5.6 on a 10-point scale for the level of economic policy reform (see Csaba and Fock, 2000). Due to the emergence of family farms at the beginning of the 1990s, the dual structure in Russian agriculture inherited from the pre-reform period (corporate farms versus household production, see Pallot and Nefedova, 2003a) became even more complex.

The development of agricultural enterprises – the main category of producers in the Soviet period – deserves special attention. These producers experienced a more dramatic fall in output (56.3%) than the whole sector did in the period 1990-1996. They continued operating a large share (80%) of total agricultural land. The performance of agricultural enterprises continued worsening up to 1999, with a large number of loss-making enterprises, low returns, declining partial productivity measures and high indebtedness (see Goskomstat, 2002).

As follows from empirical studies at the regional level, agricultural enterprises only slowly reacted to price changes in the period 1994-1995 (Arnade and Trueblood, 2002) and demonstrated low technical efficiency in the period 1992-1997 (Sotnikov, 1998; Sedik *et al.*, 1999; Voigt and Uvarovsky, 2001; Osborne and Trueblood, 2002a) partly due to financial constraints and output targeting (Arnade and Gopinath, 2000). In the earlier years of transition, despite the rapidly changing environment, the internal organisation and incentives for producers did not really change (Lerman, 2001; Liefert and Swinnen, 2002).

At the enterprise level, empirical research is inconclusive about the extent to which agricultural producers have adjusted to the new environment in the years following the reforms. The latest improvements are observed after 1998, the year of financial crisis that resulted in increasing demand for domestic agricultural products (Serova *et al.*, 1999a). The effects of

farm-level characteristics and various policies aimed at improvement of performance in more recent years are still to be assessed.

Besides the shift to a liberalised market economy, the major agricultural policy change during transition was a substantial reduction of subsidies granted to agriculture (Serova, 2000; Liefert *et al.*, 2003b). The efficiency of subsidy programs has received little attention in the literature (see e.g. Serova *et al.*, 2001). Under conditions of low profits and reduced subsidies external finance is important. However, total bank loans in Russian agriculture are not high and even 24% lower than total subsidies (data from 1997-2000, see Manellya, 2002). External finance appears in the form of debt payables that are widely observed in Russian agriculture. Lerman (2000) refers to a "financial paradox to be explained, because unlike in the West, when losses usually go together with mounting debts leading to collapse, this is not the case in Russia, nor in other Former Soviet Union countries". This paradox is closely linked to the presence of soft budget constraints (SBCs), the situation where consistently loss-making enterprises receive external finance in the form of subsidies or credits (see Schaffer, 1998).

Previous literature has not addressed the relation between the performance of agricultural producers, high debts and subsidy programs. In 2002-2003, the situation of high debt and insolvency of agricultural farm enterprises remained problematic (Serova, 2003a,b) and resulted in the introduction of the federal program "On financial recovery of agricultural enterprises" (Anonymous, 2002b). It is believed that given the current small share of state support to agriculture in GDP, and the Russian strategy of pursuing higher domestic support in WTO negotiations, subsidies to agriculture are more likely to rise rather than fall in the near-to-medium term (Liefert *et al.*, 2003b). Given the changes in state policies with respect to enterprise indebtedness and changes in subsidy classification and policies complying with WTO requirements (see Shick and Karlova, 2003), studying the impact of these policies is highly relevant.

1.2 Research objective and questions

The objective of this research is to conduct a microeconomic analysis to acquire more insight into impact of debts and subsidies on input-output allocation and performance of agricultural enterprises in Russia. From this broad objective, five specific research questions are defined and developed in the subsequent chapters:

1. How did organisation, structure, performance and financial policies develop in Russian agriculture in the period 1990-2001?

2. What is the impact of subsidies on input-output allocation and performance of Russian agricultural enterprises?
3. What is the impact of debts on input-output allocation and performance of Russian agricultural enterprises?
4. What is the impact of the historical performance and pre-reform conditions on the current performance of Russian agricultural enterprises?
5. To what extent did agricultural enterprises adjust to the economic environment during transition?

1.3 Data used in the thesis

Many studies analysing the transition economies mention data problems. At the beginning of transition, complete sets of national statistics were not available. The proposed solutions were either to take what data were available and see how far one could get, or collect new data by means of surveys and case studies (Hanisch *et al.*, 2002). Ten years of transition had generated an enormous stock of data for empirical research.

Different enterprise-level data sets are employed to address the research questions of this thesis. The enterprise-level data are supplemented with regional (Goskomstat, 2001b) and national statistics (Goskomstat, 2002) for the period 1990-2001. The first enterprise-level data source is the agricultural registry, which includes annual records on about 27000 Russian agricultural enterprises from the period 1995-2000 (Goskomstat, 2001c). This data set contains primarily variables collected from annual agricultural reports and only a few from financial statements. The data from a subset of about 150 dairy farms located in the Moscow region (about one-third of all agricultural enterprises in this region) are supplemented with years 1990 and 2001 and with the financial reports of these enterprises for the period 1996-2001.

The changes in organisation, structure, policies and performance of agricultural enterprises are studied at the national level using mainly country-level data from statistical yearbooks. Data on agricultural enterprises from European and west-Siberian Russia are used to study the impact of debts and subsidies on productivity. The sample of dairy farms in the Moscow region is used in the other applications presented in this thesis, since it is the richest one in terms of variables (including financial and historical data from 1990). The details of data, variables and consistency of the data in the sample are found in the corresponding chapters and their appendices. The relation between the quality of the data and the conclusiveness of the results is presented in the concluding chapter of the thesis.

1.4 General approach and outline of the thesis

This section presents the research approach and the main contents of Chapters 2-6 which were originally written as separate papers.

This research uses a positive approach and analyses of historical data. The theoretical concepts of performance used in this study are productivity, profitability and efficiency. Neoclassical concepts – i.e. production and profit functions – have been widely used in production economics and generated a great stock of knowledge (see Chambers, 1988; Shumway, 1995). Neoclassical studies have attempted to understand variations in farm performance in Central and Eastern European Countries (CEECs), particularly through technical efficiency (Gorton and Davidova, 2004; Curtiss, 2002). Bezemer (2001) and Hanisch *et al.* (2002) concluded that neoclassical models are suitable when investigating individual behaviour within a set of given institutions. Neoclassical theory forms the theoretical framework for analysing the effect of subsidies and debts on input-output allocation and performance in this thesis. Also, the theoretical framework draws upon knowledge generated from empirical studies and the reviews on developments in Russian agriculture. Reflecting on the different definitions of enterprise performance, and aiming to answer the research questions posed above, several quantitative approaches were used. These include parametric modelling of the production and profit functions, non-parametric technical efficiency analysis, and cluster analysis.

Chapter 2 addresses the first research question and helps to acquaint readers with current developments in Russian agriculture. Using country-level data, it reviews changes in agriculture in the period 1990-2001 and indicates research directions for the analysis of enterprise performance under conditions of the current financial environment. This chapter also discusses the importance of each group of agricultural producers: agricultural enterprises, family farms, and subsistence households, referring to their history and current economic role.

The empirical Chapters 3-6 draw upon neoclassical economic theory and enterprise-level data. Chapter 3 analyses the impact of subsidies and debts on production levels of 19,000 agricultural enterprises in 61 Russian regions, thereby answering the second and third research questions. The modelling approach allows debts and subsidies to affect the level of production through production technology. This approach also permits deriving the technical relationship between inputs and output and for assessing the values of marginal products to provide insight into the degree of over-use or under-use of resources.

After Chapter 3, the studies are based on a smaller sample of dairy farms in the Moscow region. Chapter 4 models the effect of subsidies on profitability and input-output allocation,

thereby focusing on the second research question. More specifically, it studies the influence of subsidies on allocation of variable inputs, land, labour, livestock, milk and other outputs. Chapter 5 focuses in more detail on the structure of debts and their impact on performance, addressing the third research question. Non-parametric technical efficiency analysis is combined with regression analysis in order to model the effect of debt structure on pure technical efficiency. Detailed data on debts are used to analyse the impact of different debt categories and soft budget constraints on managerial performance.

The final empirical chapter (6) differs from Chapters 4 and 5 in the use of pre-reform data from 1990. This allows studying the impact of historical performance on current performance, with reference to the fourth research question. The theoretical concept of the four-dimensional farming environment (institutional, social, economic and physical) that influences farm performance (see Boehlje and Eidman, 1984) is used to determine the characteristics of an enterprise, its past and present performance. Cluster analysis is used to differentiate between groups of well and poorly performing enterprises based on the selected measures of performance and the four-dimensional environment.

All empirical chapters contribute to answering the last research question, i.e. the extent to which agricultural enterprises have adjusted to the new economic environment. In Chapter 4 this is done by studying the price responsiveness of milk supply, and demand for variable inputs. In Chapters 3-5 the relation between performance and adjustment in size is analysed. Chapter 6 adds to the understanding of adjustment from the pre-reform point of view.

Chapter 7 forms a synthesis of preceding chapters and contains a discussion of caveats and advantages of the data and methods used. It also presents a synthesis of results. Comments on the outlook for future research and the list of main conclusions finalise the thesis.

Chapter 2
Developments and performance in agricultural enterprises in Russia, 1990-2001

Abstract

This paper presents an overview of developments of Russian agricultural enterprises in the period between 1990 and 2001. A multi-layered structure of agriculture presented by different categories of non-commercial and commercial producers requires a clear distinction of policies with respect to their targets and end results. The agricultural enterprises maintained their leading role in marketed agricultural production and represent the main focus group among the agricultural producers for policy-makers. This paper reviews organisational and structural changes to these enterprises in the period studied, and their economic and financial performance. The paper also examines current policies for resolving the problems in agriculture.

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2.1 Introduction

A dramatic decline in agricultural production in Russia and its deteriorating performance has been a popular topic in the economic literature on Russian agriculture. Russia has been assigned a score of 5.6 on a 10-point scale for the level of the economic policy reform, signalling its incompleteness (see Csaba and Fock, 2000). Productivity decline is evident from a casual glance at partial productivity measures, such as the total value of output per unit of land or labour (Osborne and Trueblood, 2002a). After a continuous decline in gross agricultural output in the period 1990-1996, the first annual recovery of 1.5% was observed in 1997, which was later hampered by the financial crisis in 1998. The expectations on growth in agriculture are decreasing. Even after its second period of growth in the years 1999-2001 of 4-7% annually and of 2% in 2002, the sector demonstrated a negative growth of 0.3% in the first half of 2003, which was partly due to unfavourable weather conditions in 2003 and partly due to a lack of any new economic impulses (Serova, 2003b).

Having observed a sharp agricultural contraction in Central and Eastern European countries after instituting reform measures, the agricultural decline in Russia was expected, to a large extent (von Cramon-Taubadel and Zorya, 2003). Even though Russian agriculture is represented by different categories of producers (agricultural enterprises, family farms, and subsistence households), the major influence on overall economic developments in the sector is exerted by agricultural enterprises, for two reasons. First, during the last decade they experienced a greater decline in their output − by 60% versus 40% in the overall agriculture sector. Many researchers (see, for example, Serova *et al.*, 1999a; Trzeciak-Duval, 1999; von Cramon-Taubadel and Zorya, 2003) stressed the inevitability of a recession in agriculture as a result of new market conditions: liberalised markets, a dismantled planning system, abolished state procurement, market-oriented decisions of input suppliers and output consumers, a lack of technical and business management skills as well as of credit resources. Second, since family farms did not emerge as a significant source of agricultural production during the whole of the period 1990-2001, all these factors are directly relevant for agricultural enterprises, i.e. the main group among the commercial producers, who were compelled to implement their decisions under developing and rapidly changing market conditions. Thus, the analysis of organisational, structural, economic, and financial developments of agricultural enterprises which were the major producers in the Soviet era and still manage about 80% of total agricultural land in Russia − is of key interest to policy makers.

In addition to a general agreement on the incompleteness of reforms in agriculture, the literature identifies the following key problems of agricultural enterprises development: price disparity, cuts in subsidies, and debt problems. The decline of output to input price ratios, i.e. the declining terms of trade for agricultural producers, especially in the beginning of the period of reform, is named as one of the major causes of the economic losses that the agricultural sector has experienced in the years thereafter (Macours and Swinnen, 2000b; Manellya and Goncharova, 2002; von Cramon-Taubadel and Zorya, 2003). The cuts in subsidies to agriculture formed the major agricultural policy change during transition (Serova, 2000; Liefert *et al.*, 2003b). The worsened economic performance of the enterprises has resulted in their high indebtedness, which has been a problem from the beginning of the reforms (Manellya and Goncharova, 2002; Yanbykh and Yastrebova, 2002), by limiting the financial possibilities of producers and leading to a lack of investment.

This paper provides a compact overview of developments in Russian agriculture during the past decade, focusing on agricultural enterprises. It complements other reviews at the country level by covering a longer time period (see also Serova *et al.*, 1999a; Liefert and Swinnen, 2002; Manellya and Goncharova, 2002; Osborne and Trueblood, 2002a; Uzun, 2002; von Cramon-Taubadel and Zorya, 2003). First, it contributes to a discussion on the importance of each group of agricultural producers: agricultural enterprises, family farms, and subsistence households, referring to their history and current economic role. Second, it presents the developments of agricultural enterprises during the period 1990-2001 in terms of their structure, organisation, and performance. In the second part of the analysis, the paper provides an illustration of agricultural price, subsidy, and credit policy, which experienced the most dramatic changes from the beginning of transition, but it also examines current policies for resolving the problems in agriculture. The statistics are presented in such a way as to ensure the consistency between the definitions of different producers that are used in agricultural statistics (see also Appendix 2.1).

2.2 The importance of agricultural enterprises in Russian agriculture

In the pre-reform year 1990, the Russian agricultural sector accounted for about 16.6% of its GDP and supplied about 12.9 % of national employment. The agricultural system was based on state land monopoly, i.e. agricultural enterprises were permitted to use land free of charge. The state distributed major inputs and investments in the agricultural sector, fixed the

wages and controlled the internal regulations. Moreover, it dictated the production plans and thus regulated the production structures of the sector and the regions.

Prior to the reforms, three types of agricultural producers could be distinguished: collective farms (*kolkhoze*s), state farms (*sovkhoze*s), and households. As a rule, *sovkhoze*s were mainly located around cities, were larger than *kolkhoze*s and were often strictly specialised in their output. These two types − the *kolkhoze* and the *sovkhoze* − became almost indistinguishable from one another in the pre-reform period. Both were state-owned, with managers who were appointed by regional agricultural committees reporting to the state administration and hiring significant numbers of personnel (Serova, 2000). *Kolkhoze*s and *sovkhoze*s were primarily involved in agricultural production. In addition, they also supplied services such as supply systems for water, heater, and gas, kindergartens, and other domestic services. In the belief that they had an obligation to people living in villages (Pallot and Nefedova, 2003a) and encountering difficulties in shedding the provision of these services to municipalities, the enterprises continued doing this at the expense of their economic performance. Households operated on small plots producing labour-intensive crops (potatoes, vegetables, and fruits) and livestock products (meat, milk, eggs) mostly targeted for self-consumption. They were limited in accessing the majority of inputs and services apart from those provided by a collective or state farm that enforced their dependency, which was to become evident after the reforms.

The transition to a market economy in agriculture required the emergence of new production units with institutional and management structures adjusted to the market conditions. In 1992, a farm restructuring campaign was started, which led to the re-registration of the former *kolkhoze*s and *sovkhoze*s. The Russian agriculture sector today is characterised by three[1] categories of producers: agricultural enterprises (former state and collective farms), household plots (subsistence plots) and family farms (new commercial operators that did not exist prior to 1989). Since we have observed some inconsistency in names and population of agricultural producers in other studies, we pay special attention from the outset to the definitions used in national statistics for each category of agricultural producer, and for the agricultural sector as a whole. Within identified categories, national statistics distinguish the following subgroups (see Figure 2.1 and Appendix 2.1). Agricultural enterprises are split into two groups: (a) large scale and medium (LaMAE) with an average number of employees larger or equal 60, and (b) small agricultural enterprises with less than 60 employees, and other subsidiary plots of industrial, transport, and scientific establishments as well as other institutions (SAEaO). Household plots consist of home-adjoining plots (*priusadebnyi uchastok*), garden plots (*sadovyi i ogorodnyi uchastok*) and summer-residence areas (*dachnyi uchastok*). The State Statis-

State Statistical Committee (*Goskomstat*) gathers various data on entire populations of LaMAE enterprises, and on a sample of small enterprises. Data on family-based entities are also gathered from a sample (see Goskomstat, 1996). Some figures in statistical issues are reported for overall agriculture, which include totals across three categories; figures for agricultural enterprises are sometimes reported only for a group of LaMAE. Given the data availability, in this paper the numbers are presented either for all agricultural enterprises or only for LaMAE, maintaining maximum consistency in deriving the relative measures.

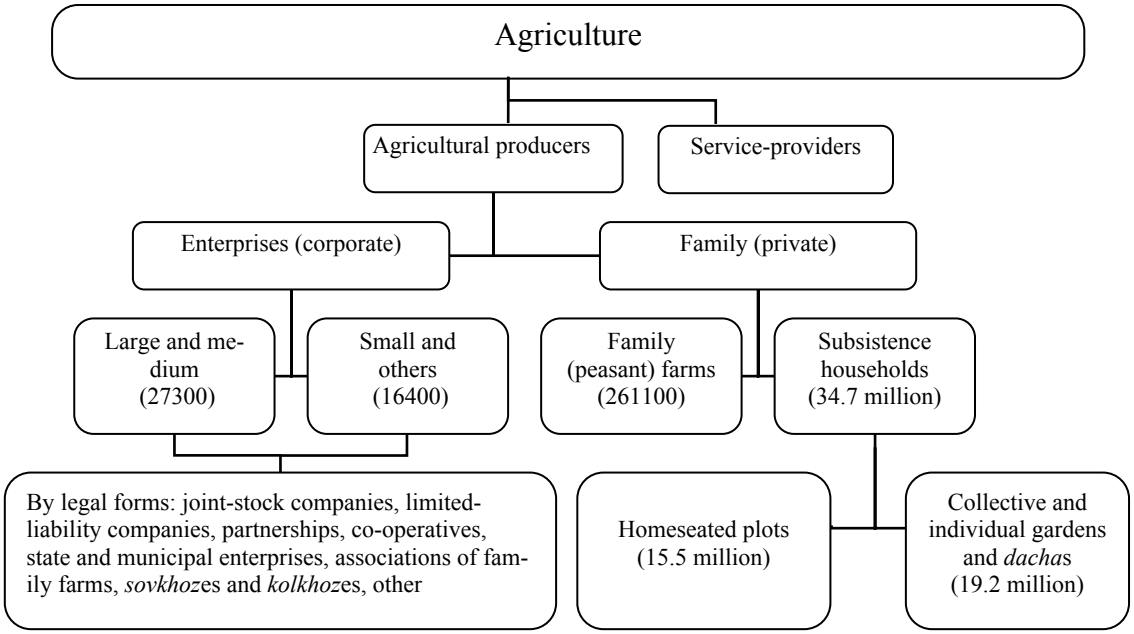

Figure 2.1 Organisations in Russian agriculture (number of producers in 1999 in parentheses)

The number of LaMAE has remained above 24,000 since 1990; they still operate about 80% of the total agricultural land area in Russia with average land area being about 5600 ha. An average family farm operates 50 ha of agricultural land. In the period 1990-2001, the smallest average land plots of 0.07 ha (well-known as six "sotok", equivalent to 0.06 ha), were managed by households (*dacha*s, *sady i ogorody*). With regard to the data in 2002, about 67% of the total number of households in Russia (52.7 million) possessed a household plot, although only 27% of the population lives in rural areas (Goskomstat, 2004a).

Table 2.1 Number of producers and land use by categories of producers

	1990	1991	1995	2000	2001
Number (x 1000)					
agricultural enterprises: LaMAE	25.8	25.5	26.9	27.6	24.8[1)]
family farms	4.4	49	280.1	261.7	265.5
households with plots (total):	29900	n.a.	38700	36000	35300
individual home-adjoining plots	16300	n.a.	16300	16000	16000
collective and individual gardens and *dacha*s	13600	n.a.	22400	20000	19300
Agricultural land area (ha)					
per LaMAE	7845	7306	5729	5424	5891
per family farm	41	41	43	58	62
per household:	0.14	n.a.	0.20	0.22	0.23
per individual household	0.20	n.a.	0.36	0.39	0.41
per garden-plot	0.07	n.a.	0.08	0.09	0.09
Percentage of agricultural land[2)] used by:					
agricultural enterprises:	98.1	91.2	81.7	80.0	78.7
LaMAE	94.7	87.5	73.5	76.0	74.6
SAEaO	3.4	3.7	8.2	4.0	4.1
family farms	-	0.6	5.4	7.9	8.8
individual land users:	1.8	2.8	3.4	3.7	3.9
individual home-adjoining plots	1.4	1.9	2.5	2.9	3.1
collective and individual gardens and *dacha*s	0.4	0.7	0.9	0.8	0.8

[1)] In 2001 the State Statistical Committee (*Goskomstat*) adjusted the list of LaMAE. The reduction in population of agricultural enterprises has also influenced the average size characteristics of agricultural enterprises.

[2)] Other users of agricultural land (municipalities, rural administrations, and users of common land in rural areas) make up the total to 100%.

Source: Goskomstat (2002).

Unlike the reformers' prior expectations, family farming did not become more widespread than large-scale farming after restructuring. Despite the emergence of 275 thousand family farms − mainly during the period 1990-1994 − their share in total agricultural production and in agricultural land nevertheless remained rather low in the years thereafter (see table 2.1 and 2.2), which is an indication of their minor, although still increasing, economic role in agriculture. The importance of subsistence households in agriculture remains high. After 1990, the number of households with plots and the shares of all main agricultural outputs by these non-commercial producers increased up to 1999 and slightly declined afterwards, reflecting an overall improvement in the economy.

Table 2.2 Composition of agricultural production[1)] by main categories of producers, %

	1990[2)]			2001		
	Agricultural enterprises	Households	Family farms	Agricultural enterprises	Households	Family farms
Grain	99.7	0.3	0.01	88.2	0.8	11
Sugar beet	100	-	0.01	93.6	0.7	5.7
Sunflower seeds	98.6	1.4	0.0[3)]	81.9	1.9	16.2
Potato	33.9	66.1	-	6.3	92.5	1.2
Vegetables	69.9	30.1	-	17.8	79.9	2.3
Meat	75.2	24.8	0.01	41	57.1	1.9
Milk	76.2	23.8	-	47.2	50.9	1.9
Eggs	78.4	21.6	-	71.4	28.1	0.5
Wool	75.5	24.5	-	35.2	58.8	6
Total agricultural production	73.7	26.3	0.0	43.9	52.4	3.7

[1)] Gross output is measured in actual prices.

[2)] First year of reporting the numbers for family farms.

[3)] 0.0 means the value is smaller than 0.01.

Source: Goskomstat (2002).

A declining importance of agricultural enterprises, combined with a growing number of households, and the emergence of a new group of family farms, is apparent from the data on gross agricultural output. Table 2.2 shows that, in the past decade, agricultural enterprises remained the major producers of cereals, sugar beet, and sunflower seeds. However, they lost their dominant position in animal production, with the exception of eggs (71.4% in 2001). The relation between the output percentages of different categories of agricultural producers in 2001 is assessed by means of a regional analysis in Uzun (2003). The lowest output shares by agricultural enterprises in total regional agricultural production (26.1%) correspond to the highest number of loss-making enterprises (>80%) and correspondingly with the highest shares by subsistence households (71.8%), and the lowest shares by family farms (2.1%). Thus, the weakened position of agricultural enterprises contributes to non-commercialisation in agriculture (prevalence of production by households).

However, the gross agricultural output also includes products for internal consumption. The finally marketed, i.e. sold, products are rather easy to observe *ex post* from the revenues. The degree of marketability differs substantially across the categories of producers. The percentage of marketed and non-marketed production by households is very difficult to identify

(Pallot and Nefedova, 2003a) because their output is (a) under-recorded and (b) involves informal exchange and gift-giving networks. Goskomstat (1999b) reports that, starting from 1997, households sold about 10% of vegetables, 18% of milk, 22% of cattle meat and poultry, thus demonstrating the lowest degree of marketability. The available data allows for computing the shares of marketed agricultural output for three categories of producers in 1999 (see Table 2.3).

Table 2.3 Degree of marketability, shares of marketed and gross output in 1999

	Degree of marketability			Calculated shares of marketed output			Shares of gross output		
	Agricultural enterprises	Households	Family farms	Agricultural enterprises	Households	Family farms	Agricultural enterprises	Households	Family farms
Grain	53.1	4.1	52.8	92.8	0.1	7.1	92	0.9	7.1
Potato	41.1	6.1	40.2	32.4	63.1	4.5	7	92	1
Vegetables	69.8	7.1	67.1	68.0	25.5	6.6	20.9	77	2.1
Meat	100	23.4	94.9	71.5	25.5	3.0	38.9	59.4	1.7
Milk	81.1	16.8	81.7	80.2	17.0	2.8	48.6	49.7	1.7
Eggs	93.1	8.2	89.6	95.9	3.6	0.5	70.1	29.5	0.4
Total				79.4	16.5	4.1	40.6 (41.2)[1)]	57.0 (56.3)	2.4 (2.5)

[1)] The total shares of gross output were recalculated to achieve comparability; total shares in parentheses account for sunflower seeds, sugar beet, and wool production and are taken from Goskomstat (2002).

Source: own calculation based on Goskomstat (1999b, 2002).

In addition to a large share in total agricultural land and a long history, the importance of agricultural enterprises is also indicated by the largest shares of marketed agricultural products (except for potatoes). Households do not directly compete with agricultural enterprises, since (a) they specialise in labour-intensive production given the small size of their land plots and (b) they produce primarily for non-commercial purposes. Since family farming did not develop as was expected, and private households mainly serve social purposes rather than commercial purposes in agriculture (see Pallot and Nefedova, 2003a), the performance of the agricultural sector is, and most likely will remain determined by the performance of agricultural enterprises. The development of these enterprises is of key interest to policy makers and is assessed in the next section.

2.3 Development of agricultural enterprises in 1990-2001

This section reviews the performance of agricultural enterprises, in some cases referring to a group of large and medium enterprises, for which the data are available[1]. The restructuring in agriculture that took place in 1990-1994, combined with the rapid increase in input to output price ratio and substantially reduced budget support, induced structural changes to enterprises, resulting in a worsening of their performance. As a result, the financial status of the enterprises became vulnerable. To save space, the numbers in the tables are presented for the earliest and the latest years including 1998, the year of the financial crisis. In some cases, other years in which obvious changes occurred are also reported.

2.3.1 Structure and organisation

2.3.1.1 Structure

Agricultural enterprises experienced noticeable changes in terms of their size. In 1990-2000, the land area, number of employees, and the livestock were reduced. As a result of these reductions, the average size of LaMAE continued declining during the whole period 1990-2001 (Table 2.4). Before the reforms, the government was focusing on the production of high-value products, e.g. meat, to keep up the standards for Soviet society (see Liefert *et al.*, 2003a). From 1995 onwards, the relation between crop and livestock activities changed towards more crops, which partly reflects the abolishing of the previous targets of the planned economy. Per capita meat consumption also declined from 75 kg to 45 kg in 1990-2000, indicating deteriorating consumer purchasing power (see Liefert *et al.*, 2003a).

The output per enterprise declined by 74% in the period 1990-2000. Since the reduction in farm resources (land, workers) was lower than 74%, the partial productivity measures have worsened. Downsizing of agricultural enterprises did not lead to improvements in productivity or profitability, as will be demonstrated in Table 2.10.

[1] Uzun (2002) concluded that the economic and financial performance of SAEaO is similar to that of LaMAE.

Table 2.4 Average size of agricultural enterprise and production structure (based on LaMAE)

	1990	1991	1995	1998	1999	2000	2001	2000[1)] in % to 1990
Number of workers, persons	322	310	248	193	188	170	171	-47
Sown area, ha	4300	4200	3200	2800	2700	2500	2600	-42
Livestock	1756	1584	976	636	615	574	600	-67
Output, 10^6 RUB of 2001	56	48	23	15	15	14	16	-74
same in 10^3 USD of 2001	1845	1598	749	489	486	474	531	-74
Share of crops, % in total	38	38	48	47	51	56	53	18
Share of livestock, % in total	62	62	52	53	49	44	47	-18

[1)] The comparison was done for the year 2000 to keep the consistency in population of agricultural enterprises, which was changed in 2001.

Source: based on Manellya (2002) and Goskomstat (2002).

2.3.1.2 Organisation

After of the initial stages of the reform, *kolkhoze*s and *sovkhoze*s were restructured, and the majority of them started to operate under new legal forms, determining the external organisation in agriculture: producer co-operatives, various joint stock companies and limited liability companies, partnerships. After 1994, the majority of agricultural enterprises reorganised themselves into new legal forms (see Table 2.5). The share of *kolkhoze*s and *sovkhoze*s continued to decline, and by 2003 it was down to 10%. At the beginning of 1995, about 62% of former *kolkhoze*s and *sovkhoze*s in Russia were re-registered into new forms (86% in 2003). In 1991-1995, the legal form was chosen by the reforming *kolkhoze*s and *sovkhoze*s rather randomly and the farms that were performing least well restructured by splitting up (Svetlov, 2000; Visser, 2003). After several major changes in the law (see, e.g. Anonymous, 1994), the enterprises continued restructuring to adjust the title and the organisational structure in accordance with the new legislation. For example, partnerships and limited liability companies switched to a co-operative form, since in their cases the maximum number of employees was in excess of 50, which was fixed by law. Some of the enterprises (e.g. collective and part-collective agricultural enterprises) were created conflicting with all existing regulations and thus also had to re-register (Uzun, 2002).

Table 2.5 Legal forms of agricultural enterprises (per January 1st), % to total

	1995	2001	2003
New forms:	62	81	86
Joint stock company: open	1	4	5
closed	17	13	11
Limited liability company	26	10	13
Partnerships	0	1	1
Co-operatives	7	43	46
Associations of family farms	3	2	1
Collective enterprises	7	2	2
State enterprise	0	7	5
Municipal enterprises	0	0	2
Sovkhoz	12	3	1
Kolkhoz	20	11	9
Other (trial fields, seed stations, etc.)	6	5	4
Total, %	100	100	100
Total number of enterprises[1)]	29993	23536	33125

[1)] Population of enterprises differs from earlier presented numbers in Table 2.1, since (a) another source was used, (b) not all regions were included and (c) small enterprises (SAEaO) were included.

Source: computed using Minselkhoz (1998, 2004a).

Russia followed its own path in establishing property rights in agriculture. In most cases, collective and state farmland was distributed in equal shares among collective farm members or state farm employees in the form of paper shares or certificates (see e.g. Tillack and Schulze, 2000; Lerman, 2001). The legislation ensured the rights of the shareholders to leave and run their own business, or to transfer into newly established enterprises. Private ownership became dominant, co-existing next to state, municipal, federal, and various mixed types of ownership. However, different organisational forms did not reflect different internal organisational structures, since most of the enterprises operated as co-operatives, where one employee had one vote irrespective of his capital share; another principle was almost impossible to introduce due to a large (500-800) number of shareholders (Uzun, 2002). An important observation is that the internal organisation did not really change after restructuring (Lerman, 2001).

The joint stock and limited liability companies are found to be the most efficient forms, and the co-operatives (the major legal form by the beginning of 2003) the least efficient form of farm business in Russia (Uzun, 2003). However, conclusions on the superior efficiency of

any of these legal forms are not unambiguous. According to Minselkhoz (2004b), adoption of the federal law "On bankruptcy" (Anonymous, 2002a) and "On financial recovery of agricultural enterprises" (Anonymous, 2002b) created more favourable conditions for co-operatives in the case of bankruptcy, thereby guaranteeing the security of their assets from creditors. Thus, it is probable that legal reasons rather than economic reasons motivated the producers to change their forms after 1995. To make possible any credible conclusions on the efficiency of one or other legal organisational structure, the relevant legislation should be thoroughly studied.

2.3.2 Policies

2.3.2.1 Price policy and terms of trade

Before the reforms, the output-input ratios in the former Soviet Union were rather artificial compared to world ratios[2], possibly due to the wide availability of cheap natural resources in Russia. In the initial years of reform, the ratios changed dramatically and remained so throughout the whole decade[3]. In the first years of transition, the state continued purchasing more than 40-60% of crops and more than 80-90% of livestock products[4] (Serova *et al.*, 1999a), thereby continuing to maintain the prices for agricultural products and keeping them lower than the real market price in order to soften the negative consequences of price increases of primary food products. Price liberalisation under the conditions of severe budget deficit has resulted in a price disparity between the industrial and agricultural sector.

The evolution of price ratios from 1992 onwards revealed a favourable situation in agriculture: for the whole period, with the exception of the years 1997 and 1998, the development of producer prices was better relative to input prices (Table 2.6). After the financial crisis of 1998, the situation remained rather stable and favourable for agricultural producers. However, in the first two years of 1990-1992, the terms of trade declined dramatically. The comparison

[2] For example, petrol-grain price ratio in USA was 3.5, 2.8 and 2.4 for the years 1992-1994 (Serova *et al.*, 1999b), respectively, whereas in Russia it was 0.69, 2.21 and 2.63.

[3] As follows from Table 2.6, the development of the consumer price index differs from agricultural input and output price indices. Therefore, the agricultural output price index is used to deflate the monetary values presented in this paper to account for the inflation in the sector more precisely.

[4] Even in the period 1999-2000, the supplies to the state amounted to about 20% of crops and 55% of livestock products (Goskomstat, 2000a).

with the current situation is often made with respect to the pre-liberalisation period, since the technology inherited from the pre-reform period and which had for decades adapted to former price ratios, has hardly changed. Anchored to 1990, the ratio between output and input prices, output and consumer prices remained below one for the whole decade, resulting in a complex adjustment to new price ratios.

Table 2.6 Input and output price indices and terms of trade

	1991	1992	1993	1995	1997	1998	1999	2000	2001
Price index to the previous year									
Agricultural output	1.7	9.0	10.5	3.4	1.1	1.1	2.0	1.4	1.3
Agricultural input	1.9	15.5	9.2	3.2	1.2	1.1	1.6	1.5	1.2
Consumer price index (CPI)	2.6	26.1	9.4	2.3	1.1	1.8	1.4	1.2	1.2
Terms of trade									
output-to-input-price ratio, 1990=1	0.89	0.52	0.59	0.60	0.48	0.49	0.61	0.56	0.59
output to CPI, 1990=1	0.65	0.23	0.25	0.40	0.46	0.28	0.41	0.46	0.49
output-to-input-price ratio, 1992=1	1.72	1	1.14	1.15	0.93	0.95	1.17	1.08	1.14
output-to-CPI ratio, 1992=1	2.90	1	1.12	1.78	2.06	1.24	1.82	2.06	2.18

Source: based on Goskomstat (2002).

2.3.2.2 Subsidy programs

Besides the shift to a liberalised market economy, the major agricultural policy change during transition was the cutting of the large amount of subsidies (Serova, 2000; Liefert *et al.*, 2003b).

Table 2.7 Subsidies on LaMAE

	1992	1993	1995	1997	1998	1999	2000	2001	2001 in % to 1992
Total subsidies, in 10^9 RUB of year 2001	179.7	72.3	43.6	34.6	30.9	12.5	14.0	12.1	-93
Subsidies to gross output[1)], %	14.6	8.5	7.2	6.8	7.7	3.1	3.5	3.0	-79

[1)] Usually subsidies in agriculture are related to agricultural revenue. However the revenues were available only from 1995 onwards.

Source: calculations based on Goskomstat (2002) and Manellya (2002).

Overall, the level of subsidies in constant prices was reduced by 93% in 1992-2000, with a particularly sharp reduction of 59.8% immediately after the price liberalisation in

1992-1993, when producers had a great need to compensate the gap in input-output prices (Table 2.7). Its share in the gross output of agricultural enterprises was also substantially reduced.

In the centralised Soviet Union economy, subsidies were the key element of price policy since they compensated for the difference between administered output prices and actual production costs. In the beginning of the reform period, the producer subsidies replaced the consumer subsidies. The state support to agricultural enterprises was expected to compensate for the worsening terms of trade in the period after 1991. In 1992, the government introduced direct subsidies for livestock products. Since that time, the livestock sector has absorbed a large fraction of total budgetary transfers (see Table 2.8), while remaining the major loss-making sector in agriculture (see later Table 2.10). Since 1998-1999, the subsidy policy has shifted to the regional level. By the year 2000, two thirds of the domestic support was being financed by the regional ministries of agriculture (Manellya and Goncharova, 2002).

Regional and federal programmes in the region compensated for costs of mineral fertilisers, energy, soil improvement, for keeping productive animals, etc. and provided price premiums (Table 2.8). The proportion between product subsidies in crop and livestock activities in 1996-2000 experienced some changes, which was especially noticeable in 1998. This was possibly partly due to failures in the federal budget in a year of financial crisis, when only 27% of the initially scheduled subsidies were allocated to agriculture (Manellya, 2002). A relatively high subsidy-to-costs ratio for cereals (Table 2.9) was also observed in 1998. Possibly, the government tended to secure grain supply and thus put efforts on price premiums (after the harvest), having realised that compensations of costs (often acquired before the harvest) are not sufficient. The changes in composition of subsidies in 1996-2000 were rather non-systematic. In 2000-2001, two new programmes were introduced for subsidising the interest rate on seasonal credit and subsidising insurance costs. Additionally, analysis of the structure of federal budget shows that the composition of subsidies from the federal budget has not changed since the beginning of the 1990s (Shick, 2002).

As follows from the above description, a portion of the subsidies was granted as price premiums (mainly in livestock) and a portion as compensations of costs (mainly in crop production). At the producer level, both types of these subsidies *post factuum* were accounted per output, i.e. after they are received. Further analysis is done for gross subsidies that are a sum of subsidies and compensations.

Table 2.8 Shares of crop- and livestock-related subsidies granted to agricultural enterprises, %

	1996	1997	1998	1999	2000
Total subsidies in crop and livestock	100	100	100	100	100
Crop (to total):	24.6	30.6	46.5	33.2	43.6
Direct[1)] crop product subsidies (price premiums), to total crop subsidies	30.2	26.2	60.8	38.2	49.4
Sum of compensations in crop production, to total crop subsidies:	69.8	73.8	39.2	61.8	50.6
energy and gas	9.6	7.6	2.7	3	0
mineral fertilizers and chemicals	44.2	48.9	24.4	28.8	27.4
soil improvement	16	17.3	12.1	30	15.3
flax and hemp production	0	0	0	0	2.1
elite seed production	0	0	0	0	5.8
Livestock (to total):	75.4	69.4	53.5	66.8	56.4
Direct[1)] livestock product subsidies (price premiums), to total livestock subsidies	68.2	73.5	79.3	77.7	69.2
Sum of compensations in livestock production, to total livestock subsidies:	31.8	26.5	20.7	22.3	30.8
costs of livestock breeding	6.1	7.5	8.5	9	13.5
concentrates purchased	23.7	17.1	10.6	12.3	14.5
costs of feed transported	1.4	0.9	1	1	0
purchase of productive livestock for breeding	0.6	1	0.6	0	0
subsidies to sheep production	0	0	0	0	2.2
subsidies to reindeer production	0	0	0	0	0.6

[1)] The shares of product subsidies (price premiums) in crop and livestock production (derived as the remaining percentage from the corresponding crop or livestock subsidies) can be somewhat smaller, e.g. due to unreported percentage of subsidies for agriculture-related catastrophes or disasters.

Source: based on Manellya (2002).

The analysis of allocation of gross subsidies per agricultural output is further elaborated in Table 2.9, using the profitability ratios (operational profit to cost) with gross subsidies (see Table 2.10) and without gross subsidies, which are available form the national statistics. This table presents the difference between the profitability measures with and without gross subsidies, which equals the percentage of gross subsidies in production costs of marketed products.

As follows from Tables 2.9 and 2.10, during the period 1995-1999 the government continued subsidising profitable and non-profitable activities. Some percentage of gross subsidies was given to crops, which remained profitable for the whole period (except for cereals in 1998, which were however immediately subsidised at the 19% cost rate). In livestock, the

subsidy rate for meat production was even lower than that for egg production, which was profitable. Following the general reduction in subsidies and subsidy level in output (see Table 2.7), the subsidy rates in costs also continued declining for all products. Confirming the observation made earlier, their proportion among the activities did not change radically.

Table 2.9 Percentage of subsidies and compensations in production costs of marketed products by LaMAE, %

	1995	1996	1997	1998	1999[1)]
Cereals	12	10	9	19	7
Sunflower seeds	1	1	2	3	0
Sugar beet	9	9.4	10	7	3.4
Potatoes	8	7	7	6	4
Vegetables	3	3.6	3.5	4	3
Milk	11	8	9	8	6
Cattle meat	7	7	6	5	4
Pig meat	12	14	14	10	10
Eggs	8	11.9	10	7	3

[1)] Data after 1999 were not available.

Source: based on Manellya (2002).

2.3.2.3 Credit policy

Before the reforms, loans were allocated to producers according to credit plans approved by regional and federal administrative bodies, usually irrespective of financial credibility. The ratio of loan repayment was very poor, regularly leading to loan restructuring and writing-off without any loss of a farm's property. From the very beginning of the economic reforms in Russia, the agricultural sector faced a lack of credit resources. Because of a low return on assets (ratio of profit to total assets excluding land) in agriculture (3.1% in 2001) compared to, for example, industry (8.8% in 2001), credit shifted away from agriculture to other sectors of the economy[5]. The state attempted to provide the agricultural sector with seasonal credit by introducing so-called direct credit. The provision of direct credit both in mone-

[5] Although it is acknowledged that the assets are overvalued in agriculture (see e.g. Voigt and Uvarovsky, 2001), this is true for other sectors of the economy as well, because the revaluation indices by types of fixed assets were derived by the Ministry of Finance for the whole economy. The comparison of the numbers presented is valid for an indicative purpose.

tary (1992-1994) and commodity (1995-1996) forms resulted in debt restructuring and write-offs due to the inability of enterprises to repay loans. From 1997, the year in which the Special Credit Fund was established, the indebted enterprises continued receiving credit from regional administrations, which used the regional quota for credit resources believing it would improve farm financial performance (Yanbykh and Yastrebova, 2002). On the one hand, such a system supplied cheap credits to the producers, but on the other hand nullified the economic incentives of poorly performing farms and created unfair conditions for farms performing well. A new system of subsidized credit for agriculture was introduced at the end of the 1990s. Farms were provided the loans at 25% of the Central bank refinancing rate. From 2000, any commercial bank could apply to provide subsidized credit to farms, which implies that state (regional authorities) are not involved directly in the process of credit allocation.

2.3.3 Economic and financial performance

Financial and economic performance measures are closely related and thus are analysed jointly in this section. The profitability, the number of loss-making enterprises, and solvency indicators are considered. The number of loss-making agricultural enterprises remained relatively high during the transition period (46% in 2001), whereas in 1991 5% of all enterprises were unprofitable[6]. The profitability (including subsidies) was particularly low in 1996-1998 in overall agriculture and especially in livestock (Table 2.10).

Up to the year 2000, the profitability of the livestock sector and especially cattle meat remained negative. The low (negative) profitability of livestock products is partly due to low livestock productivity. For example, in the period 1991-2001 an average dairy cow on agricultural enterprises produced 2100-2600 kg of milk annually, which is very low in comparison with, for example, Baltic countries of the former Soviet Union (3000-5000 kg in the same period, source: FAO, 2004). The profitability of agricultural activities substantially improved in 1999, the year after the financial crisis of 1998. Imported agricultural products became relatively more expensive, and consumers switched to less expensive local products. The in-

[6] Although it is debatable whether these figures are correct due to the observed data inconsistency, it is still a very high proportion. Producers tend to reduce declared profits to avoid taxation or to hide pilfering of inputs and outputs. In addition, barter and black market deals are not reported. Thus the number of loss-making farms could be somewhat smaller (see e.g. Yastrebova, 2002). On the other hand, the threat of bankruptcy would counterbalance the incentives to exaggerate losses, thus the number of loss-making farms is probably accurate (Osborne and Trueblood, 2002a).

creased demand for agricultural production led the producers to increase their prices and also achieve higher sales.

Table 2.10 Profitability[1)] of products (including subsidies and compensations) and percentage of loss-making enterprises (based on LaMAE), %

	1991	1992	1996	1998	1999	2000	2001
Agricultural activities	43	89	-17	-22	15	13	10
Crop production (excl. subsidies)[2)]	89	211	22	2	48	49	0.2
Cereals	104	305	42	0	56	65	48
Potatoes	120	150	24	13	93	51	31
Vegetables	97	99	2	13	67	17	22
Sunflower seeds	231	381	30	34	98	54	75
Sugar beet	-2	95	7	-7	2	7	5
Livestock production (excl. subsidies)[2)]	30	42	-32	-32	-0.2	-6	4
Milk	17	31	-34	-28	22	13	17
Cattle meat	23	57	-47	-54	-24	-33	-23
Pig meat	15	37	-31	-29	-10	-21	1.4
Eggs	74	30	11	21	20	12	22
Percentage of loss-making enterprises, to total number of LaMAE	5	5	79	88	54	51	46

[1)] Profitability is derived as the percentage of revenue (incl. subsidies) minus costs to costs of marketed products. This measure greatly depends on the accuracy of costs accounted at the enterprise level (see also footnote 6). Alternative profitability measures per products are not available.

[2)] Goskomstat (2002) does not provide profitability of crop and livestock production. Goskomstat (2000c) provides profitability of crop and livestock production corrected for subsidies and compensations.

Source: Goskomstat (2000c, 2002).

The level of indebtedness of the enterprises has been a problem from the beginning of reforms in many sectors of the Russian economy. This problem was particularly severe in the farming sector (Manellya and Goncharova, 2002; Yanbykh and Yastrebova, 2002). At the beginning of 2001, about 5% of enterprises (including processing) were in the proceeds of bankruptcy; of which 58% were pronounced bankrupt (Minselkhoz, 2004b). Table 2.11 presents several aspects of a debt situation in agriculture. Since the number of enterprises other than LaMAE is not available and the figures on debts and ratios are available at the level of the economy only, it was not possible to derive average figures.

Table 2.11 Debts in agriculture (at the economy level, i.e. including service providers)

	1995[1)]	1996	1997	1998	1999	2000	2001
Total debts to pay, 10^9 RUB of 2001	262	341	438	515	316	287	278
Total debts to receive, 10^9 RUB of 2001	61	60	64	73	54	48	49
Ratio of receivable debt to payable debt	4.3	5.7	6.8	7.0	5.8	6.0	5.7
Total net profit, 10^9 RUB of 2001	14	-92	-100	-131	26	21	26
Total net profit of LaMAE, 10^9 RUB of 2001	9	-96	-116	-126	24	19	25
Current debts to current assets (incl. debts from customers) ratio	0.60	0.73	0.90	1.13	1.06	1.07	0.97
Percentage of debts in total debts to pay to:							
banks	40	31	23	18	16	16	19
suppliers	18	20	21	23	22	21	19
the budget (taxes) and off-budget funds (social security payments)	8	20	27	34	37	37	35
others (wages, promissory notes, other providers of loans)	34	29	29	25	25	26	27
Percentage of enterprises with outstanding (> 3 months) debts to total number of enterprises in agriculture							
to all creditors	89	87	89	90	90	89	n.a.
to banks	34	36	42	47	48	48	n.a.
to suppliers	69	78	81	82	83	82	n.a.
to budget and off-budget funds	60	72	77	81	80	79	n.a.
from suppliers	74	75	75	77	79	79	n.a.

[1)] Data before 1995 were not available.

Source: own calculations based on Goskomstat (2002) and Manellya (2002).

On average, agricultural enterprises in the period 1995-2001 failed to collect some 32% of their revenues from customers, which on the one hand is an indication of their weakness in managing their debtors, yet on the other hand does not explain such a high level of farm debts (to banks, suppliers, state), which exceeds the level of debts from the buyers by 4-7 times. Having no sources to repay debts due to low profits (losses in 1996-1998), the enterprises ran into solvency problems. The ratio of current debts to current assets worsened in the period 1995-1998. A low debt repayment capacity of the enterprises resulted in accumulation of bad debts, i.e. outstanding debts. The percentage of enterprises with outstanding debts to be paid was close to 90%, with some variation in the type of creditor. Starting in 1996, when the en-

terprises experienced the negative profits for the second time since the beginning of the reforms, the state strengthened its role as main creditor. This observation confirms the finding of Schaffer (1998) that the soft budget constraints (SBCs) in transition countries are often imposed by the tax authorities. The number of enterprises with outstanding debts to banks (48% in 2000) and the percentage of debts to banks (16% in 2000) are the lowest, demonstrating a rather low involvement of agricultural producers in relations with commercial banks.

According to the current debts ratio and the level of debts, the debt situation in agriculture improved substantially after 1998. In 2001, the level of net debts (payables minus receivables) was reduced by 10 billion RUB, whereas net profit increased by 5 billion RUB. Thus, not only did increased profitability positively contribute to lowering farm indebtedness, but also some debts were probably written-off.

2.4 Discussion and conclusions

In this paper, we have presented an overview of the developments of Russian agricultural enterprises over the past 10 years. The analysis of recent structures in agriculture showed that this group kept its leading role in the marketed part of agricultural output. Households maintained the production of labour-intensive potatoes and vegetables, meat and milk, despite the decrease in profitability. This confirms their prime goal as self-sufficient non-commercial production, which nevertheless remains socially important for about 67% of Russian households. Inherited from the Soviet era, the functioning of households remained linked to the agricultural enterprises, which was often not beneficial for the enterprises, as shown in Sedik *et al.* (1999). This symbiosis of two categories of agricultural producers should be analysed further and be taken into account when drawing conclusions on the performance of agricultural enterprises.

Agricultural enterprises experienced a substantial decline in size, which was not only partly facilitated by restructuring (e.g. splitting up), but was also a result of low (negative) profitability as a result of failing to maintain the output and resource use at the pre-reform level. Downsizing of agricultural enterprises resulted in lowering of partial productivity measures, e.g. output per worker, dairy cow productivity. However, given the low (negative) shadow prices of labour and land (see Bezlepkina *et al.*, 2004c), the downsizing may have increased productivity. Given the fact that the major changes in farm size had already occurred during the restructuring in 1991-1994, the agricultural enterprises remained large-scale producers. It is difficult to predict whether they will be more actively integrated into even lar-

ger structures such as agroholdings – vertically integrated producers in the agriculture and food sector with finance and management often coming from outside the sector – since not much is known about these newly established entities (see Ryl'ko, 2002) and there are no recent state regulations with regard to their current formats. No empirical evidence exists to indicate whether these new operators have a higher productivity level compared with other forms of farm organisation.

The restructuring of agricultural enterprises has resulted in a wide variety of organisational forms. Since the legislation on farming continued changing over time, it is likely that legal reasons rather than economic ones motivated the producers to change their forms. No credible empirical evidence exists regarding the efficiency of one or other type of organisational structure. The analysis of economic efficiency of producers with different forms should be accompanied by a thorough study of legislation and account for the historical performance of producers. It is possible that restructuring will continue to take place directed not so much at changing the form, since the farms gained no benefits from it, but more towards the restructuring of management or changing their profile. Such a change in profile could, for example, be to an intermediary between the market and family farms on the one hand, and semi-commercial[7] households on the other, thereby facilitating their relations with suppliers and buyers. This, however, should be accompanied by government action to create favourable conditions for both small and large producers.

The majority of the agricultural enterprises were in a poor financial position and continued accumulating debts in 1995-1998, especially to the state budget, which indicates the presence of SBCs. The debt situation improved after 1998 (current-debt-ratio reduced), however the total debts of the sector exceeded the profits tenfold. As a result, about 60% of agricultural enterprises had their bank accounts blocked for several years, thereby making it impossible for them to conduct financial transactions with their suppliers and buyers (Manellya, 2002). Farm indebtedness results in a lack of the external credits that are required to run operations and to finance investments. The policy-makers expect that, in the future, agricultural credit can be promoted by improving the land market through using a plot of land as a source of valuable collateral. However, given the historically low value of land in Russia (see Gataulin *et al.*, 2003), these expectations are somewhat optimistic. Promoting a credit market for agri-

[7] Uzun (2002) approximated that the land size of a household plot is far above the averages derived from the national statistics (exceeds 10 ha). It is reasonable to assume that some households act more like family farms, but are not registered as such.

culture faces a major obstacle – low profitability in agriculture. Possibly, the crop sector, which experiences a higher degree of seasonality and demonstrates positive profits (without subsidies), would be most suitable to improve credit relations. However, since about 80% of all enterprises have outstanding debts, it is likely that a lack of security for creditors due to an unfavourable debt situation also creates obstacles to credit development in this subsector.

As we have shown, a distortion of price ratios in agriculture at the beginning of the reform period negatively contributed to the economic performance of enterprises in the years thereafter (similar to other transition countries, see Macours and Swinnen, 2000b). At the expense of agriculture, the output prices were controlled by the state, which continued purchasing, for example, more than half of the livestock products up to 2000. A control of output price growth was not compensated by subsidies, since their level dropped by about 60% in 1992-1993. Given the current less than one percent of GDP level of state support to agriculture, and the Russian strategy of pushing for bound domestic support in negotiations for WTO, subsidies to agriculture are more likely to rise rather than fall in the near-to-medium term (Liefert *et al.*, 2003b). However, the non-transparency of agricultural support in agriculture complicates the analysis of its impact. It can be concluded that subsidy programmes require a thorough reconsideration with respect to their targets and end results. To meet the WTO requirements on agricultural support, the Ministry of Finance in Russia is working on an improvement of the classification of budget expenditure. Adjusting its policies to the WTO regulations, introducing target-oriented subsidies, e.g. rates per unit of sales, per hectare and head of livestock, would be desirable to achieve consistency with OECD classification (see Shick and Karlova, 2003). However, it is not possible to draw conclusions on the impact of this type of subsidy or income subsidy – which is favoured in Western countries since it is less trade distortive – as empirical analysis has yet to be performed.

A multi-layered structure of Russian agriculture inevitably makes it difficult when register national statistics. Data collection for different types of producers is based on different methods and often results in data being incompatible, making it difficult to consistently derive relative measures for a certain group of producers. Various studies often cite the numbers without clarifying the underlying sample of enterprises (e.g. large and medium, or all including small and other). To facilitate economic analysis on developments in agriculture, these inconsistencies should be removed. Towards the end of 2003 and the beginning of 2004, the government started organising the adjusted registration of agricultural producers (Goskomstat, 2004c), which is planned to take place in the second half of 2006. What is very promising is that the individual characteristics on gender, education of the owner (manager) and some en-

vironmental characteristics will be also collected. A good alternative for economic analysis is to use the enterprise (farm) level data from corresponding censuses of large and medium, small agricultural enterprises and family farms (Goskomstat, 2001c). Since there is a lack of research at the enterprise level in Russia, especially on operational and management aspects, such studies are of great importance for providing empirical support in explaining the developments that were reviewed in this paper.

Appendix 2.1

Definitions used in Russian agricultural statistics (based on Goskomstat, 2002)

Category of *agricultural enterprises* (organisations) include large, medium and small enterprises (production co-operatives, joint-stock companies, limited-liability companies, state and municipal enterprises, *sovkhoze*s and *kolkhoze*s) and subsidiary (secondary) units of industrial, transport, scientific establishments, religious, charity, public, military, education organisations and other institutions.

Category of peasant farms (*family farms*) is represented by a form of entrepreneurship, according to which a farmer operates on leased or own land area to produce and/or process and sell agricultural products. This category closely corresponds to the definition of a farm in Western economies.

Category of *subsistence households* (khozyaistva naseleniya) include individual household homeseated plots, collective and individual gardens, and *dacha*s. Land is allocated to or purchased by households to produce agricultural production or for recreation purposes. Farming is organised either on a collective or individual base.

Category of *agricultural commodity producers* (sel'skokhozyaistvennye tovaroproizvoditeli) includes agricultural enterprises (small, medium and large) and family farms.

Agricultural production (produktciya sel'skogo khozyaistva) includes gross output of all three categories of agricultural producers.

Within a national economy, *agricultural economy* (otrasl' sel'skogo khozyaistva) includes production by agricultural commodity producers and by agriculture-related service providers (veterinary, agrochemical, and land reclamation services).

Agro-industrial complex (agro-promyshlennyi kompleks) includes organisations that provide services to agriculture, agricultural production itself, and food-processing industries (not studied in this paper).

Chapter 3
Impact of debts and subsidies on agricultural production: farm-data evidence

Abstract

This study used a production function approach and farm-level data from 19,000 Russian large-scale farms for the period 1995-2000 to analyse the impact of debts and subsidies on production. Regional differences and farm-specific characteristics were accounted for by using fixed-effect estimation. The results showed a negative relation between subsidy and production, implying the presence of soft budget constraints, and a positive relation between debts and production, suggesting that the more debts (to suppliers) the enterprise is able to generate, the more secure its production would be. The results indicated that such inputs as labour, land, livestock, capital and materials were overused. Russian agricultural enterprises tended to use labour-intensive technologies.

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3.1 Introduction

The agricultural sector in Russia has experienced a sharp decline in outputs and inputs over the past ten years. The productivity decline is evident from a casual glance at partial productivity indicators, such as the total value of output per unit of land or labour (Osborne and Trueblood, 2002a). A decline in gross agricultural output in the period 1990-1996 and in 1998 was followed by 2-7% annual growth in the period 1999-2002. However, the sector demonstrated a negative growth in the first half of 2003, which was partly due to unfavourable weather conditions in 2003 and partly to a lack of any new economic impulses (Serova, 2003b).

Most empirical studies of the transition process have focused on the radical reformers among Central and Eastern European Countries (CEEC), thus leaving room for analysis of the performance of more gradual reformers such as Russia (Budina *et al.*, 2000). The Russian agriculture sector today is characterised by three[1] categories of producers: agricultural enterprises, household plots and family farms. Analysis of recent structures in agriculture shows that agricultural enterprises have kept their leading role in the marketed part of agricultural output and that the performance of the agricultural sector is and most likely will continue to be determined by the performance of agricultural enterprises (see Bezlepkina *et al.*, 2004b).

In 1998, 78% of Russian agricultural enterprises named a lack of financing to be the most important factor limiting their development (Goskomstat, 2000b). This implies insufficient internal finance caused by a negative profitability. Sufficient external finance also cannot be offered to agriculture because commercial credit avoids the unprofitable agricultural sector and also because farmers do not have adequate collateral (see Yastrebova, 2002). Cuts in subsidies to agriculture formed the major agricultural policy change during transition (Serova, 2000; Liefert *et al.*, 2003b). The financial concerns of Russian farms are increasing as a result of the declining volume of direct budget support to agriculture[2]. Agricultural enter-

[1] These are agricultural enterprises (former state and collective farms), household (subsistence) plots and family farms (new commercial operations that did not exist prior to 1989). The emergence of vertically integrated entities which control the whole agro-production chain and processing is a new development in the Russian agricultural sector. In this paper they were not considered agricultural producers since they represent instead a form of financial corporate management. Statistical data on these entities are not available. It is to be expected though that figures on them are contained in the category of agricultural enterprises. For further reading, see Ryl'ko (2002).

[2] In transition economies, direct subsidies are not the only source of governmental support. Sources of more

prises are underfinanced (Arnade and Gopinath, 2000; Svetlov, 2002b; Liefert *et al.*, 2003c). The main objective of this research is to analyse whether extra financing in the form of subsidies or borrowing can improve enterprise productivity. Given the current small amount of state support to agriculture in the GDP, and the Russian pursuit of higher domestic support in the WTO negotiations, subsidies to agriculture are more likely to rise than fall in the near-to-medium term (Liefert *et al.*, 2003b). Following Bezlepkina *et al.* (2004c) and Manellya (2002), subsidies rather than commercial bank loans contributed to farm finance, because the majority of farms received subsidies and not bank loans, and the subsidies in the sector exceeded the bank loans (1997-2000 data). Thus a study of the impact of subsidies on performance under current debt regulations addresses a relevant policy issue. A number of studies have documented a negative relationship between farm performance and financial constraints. These studies were made at the national (e.g. Macours and Swinnen, 2000a), regional or sectoral level of the Russian economy (e.g. Arnade and Gopinath, 2000; Voigt and Uvarovsky, 2001). Average figures from national statistics do not reveal the differences between enterprises, because the heterogeneity of enterprises in Russia is enormous (see Uzun, 2002). The distinctive feature of this study is that it dealt with individual farm data, focusing on large-scale agricultural farms in the European and west-Siberian parts of Russia. This allowed adjusting for the heterogeneity of the sample resulting from differences in farm management, location, quality of soil, and other farm-specific characteristics.

The remainder of this paper is organised as follows. The next section briefly presents the development of performance in agricultural enterprises and its link to subsidy and debt policies. Section 3.3 discusses the theoretical and empirical model used in this study. Section 3.4 presents the data and estimation technique. Section 3.5 presents the research findings. Conclusions and discussion are found in Section 3.6. An extensive description of the data and sample selection are described in the Appendices.

3.2 Subsidies, indebtedness and performance in Russian agriculture

The Russian economy has experienced many changes since the beginning of economic reforms in the 1990s. In the initial years of reform input-output price ratios changed dramatically and remained so throughout the whole decade. After the financial crisis of 1998, the situation remained rather stable and favourable for agricultural producers. State support to ag-

indirect support are the reduction of taxes, subsidised credit rates, etc. (Legeida, 2001).

ricultural enterprises could not compensate for the worsening terms of trade in the period after 1991. Overall the level of subsidies in constant prices declined by 93% in 1992-2000; a sharp reduction of 59.8% followed right after the price liberalisation of 1992-93 (Table 3.1). The portion of subsidies in gross output of agricultural enterprises also declined substantially. The majority of agricultural enterprises were in a poor financial position and continued accumulating debt in 1995-1998. As a result, about 60% of agricultural enterprises had their bank accounts blocked for several years, making it impossible for them to do business with their suppliers and buyers (Manellya, 2002). Non-payment by customers partly worsened the debt situation in agriculture, but does not explain the high level of farm debt (to banks, suppliers, state), which exceeded the level of buyers' debts by 4-7 times. Although the debt situation improved after 1998, total debt in the sector exceeded the profits tenfold. In 2001, the level of net debt (payables minus receivables) declined by 10 bil. RUB, whereas net profit increased by 5 bil. RUB. Therefore, the reduction of debts was not only caused by increased profitability, but likely also by debt forgiveness[3].

It is remarkable that the nature of debt in Russia differs from that in western agriculture where most debts are to commercial (agricultural) banks. In 1996, when enterprises experienced negative profits for the second time since the beginning of reforms, the state began to strengthen its role as main creditor. This observation confirms the finding of Schaffer (1998) that soft budget constraints (SBCs), i.e. the situation where consistently loss-making enterprises receive external finance in the form of subsidies or credits, in transition countries are often imposed by the tax authorities.

Since 1992, when the government introduced direct subsidies for livestock products, the livestock sector has absorbed a large fraction of total budgetary transfers, while remaining the major loss-making sector in agriculture (see Table 3.2). In livestock production, about 70-80% of subsidies is granted as price premiums. By contrast, in crop production the largest share of subsidies is granted as cost compensations.

Table 3.2 presents the difference between profitability with and without subsidies as percentages of subsidies in the production costs of marketed products. Following the general reduction in subsidies and percentage of subsidies in output (see Table 3.1), the subsidy rates in costs also continued to decline for all products. The proportion between different farming activities did not change radically over the indicated period.

[3] It has become a practice in Russia to write off and restructure debts (Yastrebova, 2002). The latest debt-restructuring campaign was initiated in 2002 (Minselkhoz, 2004b).

Table 3.1 Profits, subsidies and debts in Russian agriculture (in 10^9 RUB of 2001)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Percentage of loss-making enterprises	5	10	59	57	79	82	88	54	51	46
Net profit	413	220	-5	9	-96	-116	-126	24	19	25
Total debts to pay	n.a.	n.a.	n.a.	262	341	438	515	316	287	278
Incl. accounts payable:	n.a.	174	165	157	236	336	422	267	241	225
Suppliers	n.a.	n.a.	n.a.	32	55	75	56	48	48	45
State	n.a.	n.a.	n.a.	14	57	95	83	82	85	82
Accounts receivable	n.a.	125	81	61	60	64	73	54	48	49
Total output	1228	847	799	608	541	507	402	400	394	397
Total subsidies	180	72	53	44	36	35	31	13	14	12

Source: calculations based on Manellya (2002) and Goskomstat (2002).

It is remarkable that during the period 1995-1999 the government continued subsidising, for example, grain at more or less similar rates as livestock activities, although the profitability ratios differed substantially. Due to differences in the profitability of crop and livestock activities and the different degree of coupling to inputs and outputs, the impact of subsidies may differ on crop and livestock farms, which until now has not been investigated in the literature.

The impact of subsidies and debts on resource allocation and performance may be positive or negative. At the micro level, subsidies impede competition by creating unequal farm operating conditions. Furthermore, they can lead to ineffective distribution of resources, give wrong market signals and perpetuate loss-making enterprises (Legeida, 2001). The theoretical background to the debt-performance relation can be found in Nasr *et al.* (1998) and Hadley *et al.* (2001). The absence of bankruptcy risk[4] and the possibility of renegotiating debts or receiving subsidies are thought to be a consequence of SBCs (Sotnikov, 1998; Bezlepkina and Oude Lansink, 2003a), i.e. the loosening of financial discipline (Kornai, 2001). A twofold effect of debts on performance can be expected. If managers are lax, a negative debt-performance relation in Russian agriculture is to be expected. Since agricultural enterprises

[4] Prior to enactment of the federal law "On bankruptcy" (Anonymous, 2002a) and "On financial recovery" (Anonymous, 2002b), only about 5% of agricultural enterprises were bankrupt at the end of 2000, 58% of which were declared bankruptcies (Minselkhoz, 2004b), while in 1999-2000 about 25% of all Russian farms were close to bankruptcy (Uzun, 2002).

are lacking financial means to run operations, accounts payable and subsidies may likely provide farms with working capital in the form of "trade credit" (see Svetlov, 2002a; Yastrebova, 2002), thereby suggesting a positive effect.

Table 3.2 Profitability[1)] and subsidy[2)] on large and medium agricultural enterprises, %

	1995		1996		1997		1998		1999	
	profit-ability	sub-sidy	profit-ability	sub-sidy	profit-ability	sub-sidy	profit-ability	sub-sidy	profit-ability	sub-sidy
Grain	43	12	32	10	15	9	-19	19	49	7
Sunflower seeds	133	1	29	1	3	2	31	3	98	0
Sugar beet	30	9	-2	9	-15	10	-14	7	-1	3
Potatoes	75	8	17	7	-2	7	7	6	89	4
Vegetables	38	3	-2	4	-4	4	9	4	64	3
Milk	-12	11	-42	8	-42	9	-36	8	16	6
Beef	-27	7	-54	7	-61	6	-59	5	-28	4
Pork	-16	12	-45	14	-45	14	-39	10	-20	10
Eggs	19	8	-0.9	12	4	10	14	7	17	3

[1)] Profitability is derived as the percentage of revenue (excluding subsidy) minus costs to costs of marketed products. This measure greatly depends on the accuracy of costs accounted at the enterprise level.

[2)] Subsidy represents the percentage of subsidies in costs.

Source: Goskomstat (2002).

There have been a number of empirical papers studying the relation between subsidies, debts and the efficiency of firms in Russian agriculture. Analysis of aggregated data at the regional level in Sedik *et al.* (1999) showed a negative impact of subsidies on the technical efficiency of Russian crop producers in 1991-1995. This leaded to the hypothesis that farmers tend to put less effort on farming activities, as a larger part of their income is guaranteed through subsidy. Farm-level data analysis in Epstein (2001) for the St. Petersburg region showed a positive relation between subsidies and performance, although with low marginal effect. Bezlepkina *et al.* (2004c) concluded that, although subsidies have a distorting effect on the input-output mix, they relieve the credit constraints on dairy farms.

Sotnikov (1998) conducted a regional analysis on the effect of short- and long-run debts on technical efficiency for the period 1990-1995 and found a negative effect of short-term debts. Results of studies of the individual enterprises are mixed. Schulze *et al.* (2001) found no statistically significant relation between profitability and absolute level of accounts payable of farm enterprises in the Volgograd region. Epstein (2001) found that the more success-

ful enterprises (defined by an aggregate index of financial and economic performance) in the St.-Petersburg region had larger debts to input suppliers, whereas other farms accumulated debts to the state. A similar result was found for dairy farms in Moscow (Bezlepkina *et al.*, 2004a): soft budget constraints had a negative effect on managerial efficiency, and the relations with suppliers through trade credit had a positive effect. The findings differ across regions due to differences in the institutional environment as well as in the composition of debt in various regions.

3.3 Theoretical and empirical model

The literature often studies the impact of the economic and institutional environment on production using a productivity model (see Nickell *et al.*, 1997) or augmented production model (see Konings *et al.*, 2002). Both are standard production function models extended by a residual productivity term, representing factors that affect the productivity of regular inputs. Following this approach, the relation between inputs, outputs and other factors is given by:

$$Q = A \cdot F(X) \qquad (1)$$

where F is the production function; X is a vector of inputs; A indexes total factor productivity (disembodied) with A=f(Z, u). In this paper, the vector Z is a set of variables that reflect the financial environment the enterprise faces and u is a residual factor affecting productivity. The financial environment is characterised by variables affecting the availability of financing, i.e. subsidies and loans.

The production function represents the relationship between input(s) and output(s) and thus indicates the productivity. Productivity is the ratio of output to input for a single input-output case, and the ratio of an index of outputs to an index of inputs in the multiple input-output case (Coelli *et al.*, 1998). Figure 3.1 represents a single input-output case with two given levels of subsidies, z_1 and z_2.

Figure 3.1 shows that when the level of subsidies changes, the production function exhibits a different slope (and intercept), i.e. the production function shifts. The output level at subsidy level z_2 is higher than at level z_1. In this case productivity of input X (Q/X_1) is also higher at subsidy level z_2. In this paper the reference to the impact of subsidies (debts) on production and on productivity is the same. The effect of debts is modelled in a similar way as for subsidies.

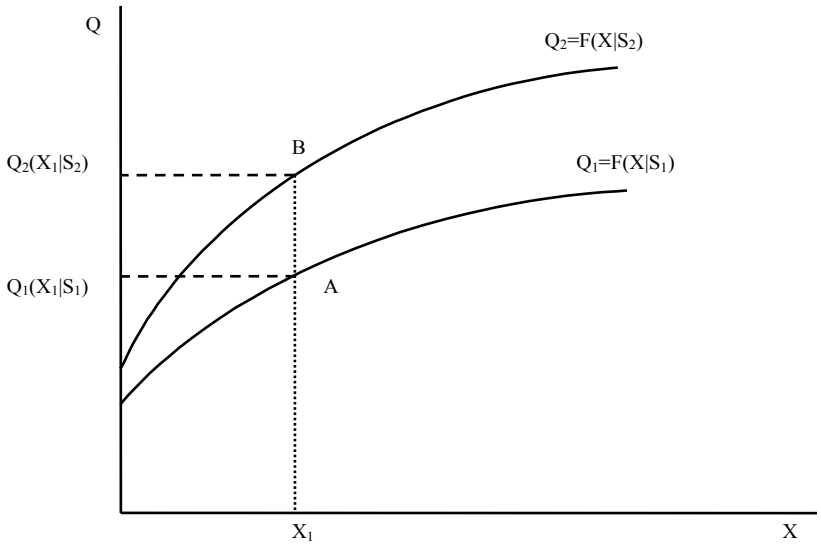


Figure 3.1 Production at different levels of subsidies

A production function framework has been widely applied in agricultural studies of the impact of various factors on productivity. Examples of this in transition countries are studies of the impact of (a) ownership, competition and privatisation on an industrial firm's productivity in Russia (Brown and Earle, 2001) and in the Ukraine (Schnytzer and Andreyeva, 2002), and (b) various factors on the agricultural sector of transition countries (Macours and Swinnen, 2000b). In this paper financial factors are modelled as production function shifters and are represented in the Translog by single, squared and interaction terms (see also Celikkol and Stefanou, 1999; Oude Lansink *et al.*, 2000). Given the social role of subsidies (see also Epstein, 2001), subsidy policy is implicitly dependent on the number of workers. In some regions the subsidies are dependent on the number of livestock head (see Bezlepkina *et al.*, 2004c). Therefore the presence of cross-terms of subsidies and inputs is appropriate. Similarly, the debt situation may influence the use of inputs, which is accounted for in the cross-terms of debts and inputs.

Assuming a Translog specification, production for farm *n* is given by:

$$\log Q_{nt} = \alpha_n + \sum_{i=1}^{5} \alpha_i \log X_{\text{int}} + \sum_{i=1}^{5}\sum_{j=1}^{5} \beta_{ij} \log X_{\text{int}} \log X_{jnt} + \sum_{i=1}^{2} \gamma_i \log Z_{\text{int}} + \sum_{i=1}^{2} \delta_i \left(\log Z_{\text{int}}\right)^2 + \sum_{i=1}^{5}\sum_{j=1}^{2} \gamma_{ij} \log X_{\text{int}} \log Z_{jnt} + \sum_{k=1}^{T-1} \psi_k Year_k + e_{nt} \quad (2)$$

where Q_{nt} is output of farm *n* in year *t;* X_{int} are productive inputs for farm *n* at time *t* with *i*=1 (labour), 2 (land), 3 (capital), 4 (livestock) and 5 (materials); Z_{jnt} is the vector of financial

determinants with j=1 (subsidies) and 2 (debts); $Year_k$ is year dummy; T is the time dimension and e_{it} is an error term accounting for random events. The advantage of using the absolute level of subsidies determined by the model is that it controls for subsidy-size relation without arguing what the best size variable is. Using subsidy per revenue (see Sedik *et al.*, 1999; Voigt and Uvarovsky, 2001) would not be appropriate since output is the dependent variable. The values $\alpha, \beta, \gamma, \psi$ and δ are parameters to be estimated, and α_n is a farm-specific effect representing unobserved variables such as management, quality of soil, location and climate.

In efficiency studies of Russian agriculture the subsidy was modelled as the determinant of inefficiency, which is a part of the error term in the stochastic frontier[5] (Sedik *et al.*, 1999; Voigt and Uvarovsky, 2001). Note that using a stochastic frontier model restricts the effect of subsidies to either the efficiency or the location of the frontier. The specification (2) used in this study does not require such an *a priori* choice.

3.4 Data and estimation

The agricultural firm data in this study are from the State Committee for Statistics (*Goskomstat)* agricultural registries (Goskomstat, 2001c). This data source contains annual records of all enterprises involved in agricultural activities based on reports submitted to local statistical offices annually. These reports providing input data for annual tax forms are the only official sources of farm accounting statistics. The data from the Agricultural Registry are supplemented by regional statistical price indices from Goskomstat (2001b) and the collected data on projected and actually granted federal subsidies differentiated by region (available from the authors on request). A source of statistical data on agriculture such as the Agricultural Registry has not yet been discussed in the international literature. Therefore further de-

[5] Besides using the parametric stochastic frontier analysis (SFA), non-parametric methods such as Data Envelopment Analysis (DEA) could be used. There is an ongoing discussion in the literature about the choice between SFA and DEA in empirical applications. Many studies compare results produced by both methods and point to their advantages and disadvantages (Reinhard, 1999; Sharma *et al.*, 1999; Osborne and Trueblood, 2002b). An alternative way of studying the relation between subsidy (debts) and performance is to focus on dynamic measures of performance, such as productivity growth, which can be computed as, for example, a Malmquist productivity change index in a parametric (Kumbhakar and Lovell, 2000) or non-parametric way (Fare *et al.*, 1994). In this case however, the panel decreases by one year. For an overview of different methods of technical efficiency analyses of agricultural firms see also Lissitsa and Babicheva (2003).

tails about its contents, the actual meaning of variables and the procedures for selection of observations are presented in Appendix 3.1.

This research focused on large-scale agricultural farms – the successors of *kolkhozes* and *sovkhozes* – located in the European and west-Siberian part of Russia (see Figure A3.3 in Appendix 3.2). Correcting for errors and outliers (units of measurement between years and between variables for one observation, type of organisation, possible mistypes and radical downsizing as a result of restructuring), using lagged values of debts, and skipping single observations (to enable fixed-effect estimation) resulted in an unbalanced panel (see also Appendix 3.1 for details). The period 1996-2000 is represented by 77140 observations (19263 farms in 61 regions).

Next, the measurement of variables of interest is discussed. All variables were measured in 1000 RUB of 1996, unless stated otherwise. Variable input and output data were adjusted to a system of marketed production to ensure the comparability of the data (see Appendix 3.1 for details). Farm output was measured as agricultural revenue. Variable input represented the cost of materials (seeds, fodder, mineral fertilisers, oil products, energy, fuel, spare parts, and other) used for the production of marketed agricultural output. Labour was measured as the annual average number of employees involved in agricultural activities. Land was measured in hectares of sown land. Both labour and land are not corrected for quality, due to a lack of data. Capital was measured as the value of depreciation. This measure does not fully resolve the potential problem of overvalued fixed capital widely discussed in the literature (for example see Lissitsa and Odening, 2001; Voigt and Uvarovsky, 2001), but it covers the costs of fixed capital involved in the production of the earlier defined marketed outputs. Standardised livestock units[6] complemented the measure of capital. Two financial factors were distinguished: subsidies and short-term debts[7]. Subsidies were measured as the sum of subsidies and compensations for different inputs and outputs. The registry provides the level of debts at the end of a year. Although it would be more appropriate to use the flow of new debts, the

[6] The following coefficients were used to convert number of animals into standardised head of livestock (see Goskomstat, 2001c): cows, horses (1.0); cattle (0.6); pigs (0.3); sheep and goats (0.1) and poultry (0.02).

[7] Long-term debts are not reported for all years. If long-term debts did not vary much between years, then the fixed-effect regression did not pick up the within-farm changes.

data were not sufficient to derive this value[8]. Short-term bank loan debts and debt payables[9], considered to be of the same nature, and aggregated in one variable. This value was corrected for accounts receivable; thus it takes in the ability to manage the debts owed by customers. The beginning-year value of debts was preferred in the analysis, as it indicated the initial financial condition of the enterprise and allowed avoiding the problem of endogeneity between the level of debts and output. The lagging of financial variables by one year reduced the time-period to 1996-2000.

All monetary variables are normalised by prices. The regional price index for aggregated agricultural input was used to deflate variable input and depreciation. All other monetary values were deflated by the regional price index for agricultural output[10]. The descriptive statistics are presented in Table A3.1 and the trends in Figures A3.1-A3.2.

Not much positive technological change is observable in Russian agriculture (Voigt and Uvarovsky, 2001) which inherited Soviet-era technologies. Therefore use of this technology by all Russian producers was presumed in this paper. Regional differences were accounted for by using fixed-effect estimation. The fixed-effect model (Baltagi, 1995) captured differences in farm-specific conditions by introducing a farm-specific intercept in the production function. The fixed-effect also accounted for price differences between farms due to variation in marketing channels.

The reverse causality problem between subsidies and production, or in other words, the problem that subsidies could be paid to the worse farms (Uzun, 2002), or by contrast were accumulated by more active managers, was handled in this study by applying an instrumental variable (IV) technique[11]. The 2-SLS estimation method allows consistent estimates when the

[8] The difference between the end and beginning value of debts also accounts for repayment of debts. It would be inappropriate to argue that negative growth of debts means a lack of additional funds through borrowing, because it might be just a result of the disciplined repayment of debts.

[9] Debt payables are available in one variable without differentiation as to debts to suppliers, budget, employees, etc.

[10] The development of the consumer price index differs from agricultural input and output price indices. Therefore the agricultural output price index is used to deflate the monetary values presented in this paper in order to account for the inflation in the sector more precisely.

[11] The problem with endogeneity of some factors is rather usual for other economic models (for example, the consumption model, where consumption is determined by the level of income, which by definition depends on consumption). The way to deal with such a problem is by applying the IV technique (see Greene, 2000).

right-hand variables are suspected of being correlated to the error term as a result of endogeneity. The instrumental variables should explain the variation in subsidies and be independent of the error terms in the production function. As often in empirical work, the subsidies were instrumented with their lagged values (see Greene, 2000). The part of actually paid gross subsidies their projected in the federal budget, as well as other exogenous variables in the model are also used as instruments. Debts represented the initial debt situation at the beginning of a year, which is exogenous to the input-output allocation decisions in a current year.

3.5 Results

The statistical package Stata 8.0 was used for the regression analysis. Estimation of the Translog production function (2) was performed for the sample of 77140 observations over the period 1996-2000. The fixed-effects specification was tested versus random-effects specification by means of the Hausman test. The test rejected the random-effects specification in favour of the fixed-effects specification at the 1% critical level (p-value=0.000). An implication of this test result was that the regressors were not independent of the farm-specific effect, a result that is frequently found in the estimation of production functions in agricultural economics literature. It is important to note that the fixed-effects specification captured farm-specific characteristics, including time-constant regional differences in physical and institutional environment.

The 2-SLS estimation of the full Translog specification given by (2) failed[12]. The final specification did not include interaction terms of financial variables, inputs, or squared terms of financial factors. This implied that financial factors acted as slope-neutral production shifters. The Davidson-MacKinnon test for endogeneity (see Greene, 2000) confirmed that instrumental variable estimation was required (the null hypothesis was not rejected at the critical 1% level). The year dummies were found to be statistically highly significant. Finally, using an F-test it was found that the Cobb-Douglas production function was not an adequate representation of the data (at the 1% level). The results of the final fixed-effect regression model are presented in Table 3.3. All parameters except for one cross-term were significant at the critical 1% level.

[12] The F-test with p-value of 0.948 showed that all estimates were insignificantly different from zero. The failure of this model was likely due to a large number of correlated variables and insufficient power of the instruments for the terms interacting with subsidies.

Table 3.3 Fixed-effect estimation results for overall sample, 1996-2000

Dependent variable: Q	Estimate	Standard error	t-statistic	P-value
Subsidy	-0.008	0.002	-5.30	0.00
Debt	0.005	0.001	6.70	0.00
Workers	0.598	0.031	19.20	0.00
Land	0.126	0.016	8.00	0.00
Materials	0.43	0.013	33.90	0.00
Capital	0.383	0.008	45.90	0.00
Livestock	-0.036	0.009	-4.20	0.00
Workers^2	-0.035	0.004	-8.70	0.00
Land^2	0.008	0.001	9.00	0.00
Materials^2	0.045	0.001	42.80	0.00
Capital^2	0.042	0.001	72.80	0.00
Livestock^2	0.004	0.000	11.00	0.00
Workers*Capital	0.016	0.002	7.80	0.00
Workers*Land	-0.053	0.003	-15.70	0.00
Workers*Materials	0.006	0.003	2.10	0.04
Workers*Livestock	0.018	0.002	9.50	0.00
Capital*Land	-0.015	0.001	-14.70	0.00
Capital*Materials	-0.092	0.001	-77.00	0.00
Land*Materials	0.023	0.001	16.50	0.00
Land*Livestock	-0.004	0.001	-4.80	0.00
Material*Livestock	-0.009	0.001	-11.20	0.00
Capital*Livestock	0.002	0.001	2.80	0.01
Dummy year 1997	0.093	0.002	50.70	0.00
Dummy year 1998	0.077	0.002	34.20	0.00
Dummy year 1999	-0.113	0.002	-56.70	0.00
Dummy year 2000	-0.01	0.002	-4.50	0.00
constant	-0.392	0.095	-4.10	0.00

Source: own estimation.

The main interest of this research was to analyse the impact of financial factors on farm production. It was expected that Russian farms suffer from liquidity constraints and that their production should increase due to extra subsidies and borrowings. As can be seen from the results, the coefficient for debts is positive and it is negative for subsidies.

The negative impact of subsidies can be explained by the prevalence of Kornai-type subsidies (see Kornai, 2001), i.e. subsidies that are granted to loss-making farms. This is also consistent with the demoralising role of subsidies, namely, the more income is guaranteed by subsidies, the less the effort farmers tend to put into actual farming (see also Sedik *et al.*,

1999; Voigt and Uvarovsky, 2001). Budget support in the form of subsidies is often granted for state-purchased products (Bezlepkina *et al.*, 2004c). In this case, the market incentives for such subsidies can be questioned. On the one hand, the enterprises continue receiving support. On the other hand, due to lower prices offered by the state, they have lower revenues from these outputs. In the period 1991-1995, the state continued to purchase more than 40-60% of crop products and more than 80-90% of livestock products (Serova *et al.*, 1999a); in 2000, approximately 19% of crop and 54% of livestock products were bought by the state (Goskomstat, 2000a). Lower revenues in this study imply a lower level of output. A weak response from agricultural enterprises to (output) prices (see Arnade and Trueblood, 2002) may be partly caused by subsidies that distort market signals. The negative impact of subsidies on output corresponded to the results in Bezlepkina *et al.* (2004c) that presented a negative relation between milk supply and subsidies for dairy farms in the Moscow region.

A positive relation between short-term debt and production suggests that debt payables – the major component of short-term debts in Russian agriculture – are used to finance working capital. Under poor bankruptcy procedures and debt forgiveness practice, accumulated debts do not pose a threat to production. In support of this, Epstein (2001) and Bezlepkina *et al.* (2004a) found that debt-to-asset ratios did not vary substantially between well and poorly performing enterprises, and that the amount of debts owed to suppliers was largest on well-performing farms. The results in Table 3.3 showed that the more debts (to suppliers) the enterprise was able to generate, the more secure its production would be. A negative relation between subsidy and production is evidence of soft budget constraints that cause managerial laxness. Having explicitly accounted for the presence of SBCs on agricultural enterprises, Bezlepkina and Oude Lansink (2003a) also found a positive relation between managerial performance and the stock of debt payables and a negative relation between SBCs and managerial performance.

The soundness of the results was assessed by performing the regression analysis for two subsamples of crop and livestock farms (defined by specialisation code available from the data). The results indicated no substantial difference in the estimates of financial variables between the subsamples. The robustness of the results was also checked by omitting very small and very large farms (see Table A3.1 in Appendix 3.2) by deleting the 10-% tails of the distribution of land and number of agricultural workers. The sample was reduced to 61725 observations and the results did not indicate any noticeable deviations when compared with the results in Table 3.3, thus leaving the conclusions based on the whole sample unchanged.

Table 3.3 also gives the technical relation between inputs X_i and X_j expressed by the equation $\frac{\partial \log Q}{\partial \log X_i} \Big/ \partial \log X_j = \beta_{ij} = \beta_{ji}$, which is positive for complements and negative for substitutes. The estimates in Table 3.3 revealed that labour is a complement for other inputs except for land. This relation suggested that the enterprises tended to use labour-intensive technologies. The substitutability of land for labour, capital and livestock contributed to the negative elasticity for land. Since land was measured as the area of sown land, substitutability of land and labour indicated that farms tended to intensify livestock production (more labour and less sown land). Less labour and more sown land signalled the overuse of land rather than the extension of crop production. The substitutability of land and livestock detected well the farm's specialisation either in crop or livestock production. The complementarity of livestock and capital is an expected relation for livestock farms, since more buildings and machinery are needed to accommodate more head of livestock.

The significant estimates of year dummies showed that, *ceteris paribus*, relative to the previous year production was increasing in 1997 and 2000, which were referred to as very good weather years (Liefert and Swinnen, 2002). After the bad weather of 1998, production declined. Despite better weather conditions in 1999 output continued to decline, which is attributable to the financial crisis of August 1998. The annual growth of 10.3% in 2000 did not compensate for the previous decline of 11.3% in the period 1996-1999.

To assess the impact of production factors on the level of farm output, the output elasticity with respect to production factors, the values of marginal product and returns to scale were computed (see Coelli *et al.*, 1998). The computed values were based on average values in the period 1996-2000 and differed significantly from zero[13] (Table 3.4).

Negative elasticities for capital, land and livestock signalled that producers were operating in non-economic area, i.e. where the production function exhibited a downward slope (see p.15 Coelli *et al.*, 1998). This implied, in general, that each extra unit of these inputs results in an output decline. The area of sown land was considered the most appropriate measure of land because some agricultural land may be left unused at no cost. Nevertheless the marginal product of sown land was negative[14]. This supported the conclusion that farms in Russia used too much land (see also Osborne and Trueblood, 2002b). Referring to the historically low value of land in Russia, Gataulin *et al.* (2003) cited the actual land prices at the auctions in Saratov

[13] The t-ratios were not computed because all estimates are highly significant.

[14] Calculations using the agricultural land also resulted in negative marginal product for this input.

region (southern region with rich soils). In 1998-1999, the price per hectare was 8 Euro, which is extremely low. Osborne and Trueblood (2002b) reported the shadow price of land in Russia to be 11 USD/ha in the period 1996-1998. For the Moscow region in the period 1996-2000, Bezlepkina *et al.* (2004c) also found a zero shadow price of agricultural land, whereas Gataulin *et al.* (2003) approximated the land price at 350 €/ha. In this study, sowing one extra hectare would result in losing approximately 8 USD in revenues at 1996 prices[15].

Table 3.4 Elasticity and value of marginal products and at the sample mean in 1996-2000

Output and inputs (Q, Xi)	Mean	E_{Xi} [1)]	VMP_{Xi} [2)]	Average price index[3)]
Output, 1000 RUB at 1996 prices	2856			1.790
Labour, workers	206	0.239	5.927	6.739
Capital, 1000 RUB at 1996 prices	354	-0.089	-1.283	
Land, ha	3573	-0.033	-0.048	
Materials, 1000 RUB at 1996 prices	2000	0.392	1.001	1.751
Livestock, standardized livestock unit	930	-0.002	-0.010	

[1)] Elasticity (E_{Xi}) is defined as $\partial \log Q / \partial \log X_i$.

[2)] Value of Marginal Product per unit of input (VMP_{Xi}) is defined as $p \cdot \frac{\partial \log Q}{\partial \log X_i} \cdot \frac{Q}{X_i}$, where p is average output price.

[3)] Given only if VMP>0 (source: Goskomstat, 2002).

Source: own calculations.

The negative output elasticity for capital suggests the overuse of this input. This result is in line with the conclusions of Osborne and Trueblood (2002b), who used a physical level of capital (number of tractors). The authors concluded that farms tended to be too machinery-intensive through the use of inherited Soviet-era technologies. The negative elasticity for capital found in this study is also caused by the problem of fixed-assets revaluation in Russian agriculture as already mentioned. This problem was not resolved by using depreciation values which indicated large stocks of low-value assets. Deriving more precise capital variable remains problematic since neither book values nor physical measures can be corrected for quality.

[15] The currency rate was 17.47 RUB per 1 USD in the period 1996-2000 (Goskomstat, 2002).

As a general observation, the large size of agricultural enterprises inherited from Soviet state enterprises remained burdensome. The strategy of shedding some unused inputs is an improvement in this respect (see also Liefert and Swinnen, 2002). For example using less input in 2000 resulted in increasing elasticity of land use. Although enterprises continued reducing livestock, the elasticity is negative. The result corresponds to the zero shadow prices reported in the same period for the Moscow region in Bezlepkina *et al.* (2004c). Substitutability between livestock and variable inputs mainly contributed to a negative elasticity for livestock. This relation meant that for example more fodder was used for a smaller number of livestock, which could indicate a better feeding ration[16]. The negative marginal products for land and livestock in this study pointed a low productivity for these inputs, due for example to limited use of fertilisers, pesticides and compound feed. The value of inputs is declining through the declining partial productivity which is observed in national statistics (Goskomstat, 2002). Why would enterprises maintain the use of low-output livestock or land? Since enterprises continued relying on subsidies that were partly coupled to livestock head numbers in order to prevent their decline, this could bring some productivity loss. It is also possible that enterprises that have not adjusted to the new environment tended to utilise as much resources as they used to previously, at the cost of lower productivity. During the earlier years of transition agricultural enterprises had difficulties adjusting to new conditions (see Lerman, 2001; Arnade and Trueblood, 2002; Osborne and Trueblood, 2002b).

Elasticity with respect to material costs was the greatest. However the value of the marginal product of variable inputs (fuel, electricity, fertilisers, seeds, concentrates, etc.) was lower than its price. This could indicate that materials were also overused in agricultural enterprises, which is consistent with overuse of fuel in crop production presented in Osborne and Trueblood (2002b). Finding lower VMP than the market price could be a result of an underestimated VMP, but also of an overstated price of materials given in statistical yearbooks. Underestimating VMP could be due to overestimated costs of production due to theft (see also Tavernise, 2001). The prices quoted in statistical yearbooks are more likely those involved in money transactions, whereas when materials are acquired through trade credits (debts to suppliers) the prices are lower in case the debts are not repaid. By acquiring materials at lower cost enterprises likely used the inputs inefficiently, for example by overusing them explicitly or implicitly (theft).

[16] It has been suggested that a lack of fodder was a limiting factor in livestock production during transition (see Svetlov, 2002a).

The relatively large elasticity of labour seemed contradicting the results of Liefert and Swinnen (2002), Osborne and Trueblood (2002b) and Svetlov (2002a) which suggested that labour was an excessive input. As follows from this study (see Table 3.4), in the period 1996-2000, one extra worker generated approximately 5927 RUB annually. This was lower compared to the average annual wage of 6739 RUB given in national statistics (Goskomstat, 2002), or 6806 RUB calculated from the sample data. On that basis labour was considered an excessive input. However this result should be treated cautiously because the level of farm wages might not account for other benefits such as use of inputs for household production at lower prices or payments in kind (see Pallot and Nefedova, 2003a), although this effect could be cancelled out by wage arrears in the sector.

Overall, the enterprises in the sample exhibited decreasing returns to scale[17] (0.506). Voigt and Uvarovsky (2001) found a decline from 0.72 in 1993 to 0.63 in 1998 returns to scale. The results demonstrated the overuse of land, labour, livestock and variable inputs, and signal technical and allocative inefficiency in agriculture. These conclusions were consistent with Osborne and Trueblood (2002b) who concluded that almost all inputs used in Russian agriculture can be considered redundant. Studies at the regional level that used technical efficiency method reported great inefficiency in Russian agriculture for the period 1993-1998 (Sotnikov, 1998; Sedik *et al.*, 1999).

3.6 Conclusions and discussion

In this paper, a production function approach was used to analyse the impact of financial factors such as subsidies and accumulated debts on production (and productivity) of large-scale Russian farms. This research moved beyond empirical studies based on aggregated regional data on Russian agriculture by applying farm-level data. The model was estimated on unbalanced panel over 19,263 farms in the period 1996-2000. The paper also provided analysis of the technical relations between production inputs.

The negative relation between subsidy and production indicated the presence of soft budget constraints. Subsidies were granted (partly) as Kornai-type subsidies, i.e. to loss-making farms, and caused managerial laxness. Farms were not heavily penalised for generating high loans and even increased their production because debts served as a financing source.

[17] Returns to scale (RTS) were defined as $\sum_{i=1}^{5} E_{X_i}$.

The negative impact of subsidies on production was also explainable by the policy of granting subsidies mainly for state-bought products (Borkhunov and Nazarenko, 2000): lower prices for products purchased by the state (see Goskomstat, 2000a) implied lower revenues. The market-incentive value of such subsidy programs is questionable. The negative impact of subsidies on output corresponded to the negative relation between input demand and subsidies reported for dairy farms in Bezlepkina *et al.* (2004c).

Having their large size due to Soviet-era practice, agricultural enterprises also used as much resources as they used to previously, and at the cost of productivity. This meant that such inputs as labour, land, livestock, capital and variable inputs were overused. Enterprises operated in the non-economical region of the production function. The negative marginal product of capital was explained by the well-known problem of overvalued fixed assets in agriculture. Negative marginal products for land and livestock were explained by the low productivity of these inputs (Goskomstat, 2002), which corresponded to low (negative) shadow prices (see Bezlepkina *et al.*, 2004c). Since the enterprises continued relying on subsidies which were partly coupled to livestock in order to prevent a decline of their numbers, some productivity loss resulted. The value of the marginal product of labour was lower than its costs, which indicated excessive labour in Russian agriculture, as confirmed by other studies (see Liefert and Swinnen, 2002; Osborne and Trueblood, 2002b). The complementarity of labour and other inputs except for land signalled that the enterprises used labour-intensive technologies.

This paper addressed the methodological problem of endogeneity of financial factors by applying the 2-SLS estimation technique. Furthermore, it found that the fixed-effects specification was preferred over the random-effects specification due to correlation between inputs, subsides, debts and the farm-specific effect. The results remained robust to excluding very large and very small farms from the sample and splitting the sample into crop and livestock farms.

In light of the conclusions of the negative effect of subsidies on production, it is important to understand the mechanism which results in this effect. The research on the allocation effect of subsidies that distinguishes coupled and decoupled subsides is promising. Since the negative impact of subsidies is often related to managerial laxness (Kornai, 2001), research on managerial efficiency would provide more insight into the performance of agricultural enterprises. Removing soft budget constraints or even bankrupting highly insolvent enterprises would require additional state support to accommodate the excess labour force. The worst

performing enterprises (as defined in Uzun, 2002)[18] received on average 950 RUB of subsidies per worker (in 1996 prices). Given the average annual wage of 4089 RUB (in 1996 prices), this would be equivalent to paying 2.8 months of unemployment benefits per worker (at the average wage level). This calculation showed that, *ceteris paribus,* paying subsidies to poorly performing farms allows workers to receive more from wages than from benefits, if the operations were closed down.

This study indicated the contrary effects of subsidies and debts on production (productivity). The results suggested that providing trade credit (debts to suppliers) to the agricultural enterprises likely reduced the actual costs of materials in case the debts were not repaid. Therefore it was not surprising to observe that debts positively influenced production. However, distinguishing between the debts to the state, suppliers, and banks would provide more insight into the relation between debts and performance.

[18] This method defines five groups of producers on the basis of balance profit, revenues, debt payables and debt receivables. Groups range in performance from best to poorest. The calculation is presented for the group of worse performing enterprises, which are close to bankruptcy (group 5).

Appendix 3.1

The Registry of Russian Agricultural Enterprises

The Agricultural Registry is the most comprehensive and large data set on individual agricultural producers available to researchers today. The registry offers several types of production data that correspond to different farm production reports. An overview of the original reports and their correspondence to production forms can be found in Minselkhoz (2000). In the following two subsections we discuss some peculiarities of the data in the registry with respect to sampling the observations and defining the variables for production function analysis.

Observations

For the period 1995-2000, the total number of annual observations was 163,077, representing more than 27,000 agricultural organisations in 77 Regions of the Russian Federation. These numbers corresponded to the number of large and medium agricultural enterprises, for which the national statistics provided aggregated data on inputs and outputs, profits and profitability ratios. Computing the totals from the registry of the physical indicators presented for agricultural enterprises in aggregated form in *Goskomstat* reports (agricultural land, number of employees, head of livestock, area under crops) for each year signalled some minor (within 1-2%) differences between the aggregates. Thus it was concluded that the registry covers the same observations which *Goskomstat* names "medium and large agricultural organisations". However in the original database some observations indicated smaller-sized agricultural activities which did not fit the *Goskomstat* definition of large and medium-sized enterprises in agriculture (>60 employees, see Goskomstat, 2001a). To facilitate checking data inconsistency and detect outliers, the final sample was made up of only large and medium agricultural enterprises[19].

[19] The small enterprises (with < 60 employees) were not considered, to avoid mistakes due to re-registering (for example, it is strange to observe an enterprise continuing to operate on 2000 ha, although the labour has been reduced from 160 to 9 employees). These sorts of problems in the data were possible reasons for finding the reverse relation between performance and land, and performance and labour. This also indicates very poor land regulations.

Codes for enterprise types ("1" small, "2" large and medium, "0" or "9" for not known) were available for year 1997 and 2000. These codes however did not always correspond to the above-given definition, such that small enterprises (code "1") could have more than 60 employees, and large and medium (code "2"), less than 60 employees. The codes from 1997 and 2000 sometime were different for the same enterprise, which indicated either an error or signalled the restructuring process[20]. Since the type of organisation and the restructuring was not the focus here, it has been decided to select those observations that in the first year of a panel (1995)[21] were coded as large and medium enterprises and had more than 60 employees. The enterprises that changed to code 1 (re-registered) were also removed. Finally, the agricultural firms that were marked as public, religious, charitable, political, professional union organisations, foundations, representative offices, consortiums, scientific stations and trial fields were excluded from the analysis. These firms are referred to as "other" in agricultural statistics and actually only part of their activities are related to agriculture.

Such criteria, and the later procedure of taking the lagged values, resulted in an unbalanced panel, in which the percentage of enterprises declined over the period 1996-2000. The empirical analysis focused on the European and west-Siberian parts of Russia (see Figure A3.3). The territories located to the right of the River Enisei on the mid-Siberian plateau were not included (the east-Siberian and far-eastern territories). The geographical and climatic conditions of these regions limited their role in agriculture (less than 11% in overall Russian agriculture). Moreover, some enterprises in these regions operated about 1 mil. hectares with a rather average number of employees, which made them outliers. Data on Chechnya were not present in the original database. The remaining 61 regions averaged 73% agricultural land and employed 77% of the labour force in agricultural enterprises in the period 1995-2000 (as documented in Goskomstat (2002).

[20] Probably for the reason that some producers did not fit anymore the definition of medium-size enterprises, Goskomstat reduced the number of large and medium enterprises in the registry in 2001 (see Goskomstat, 2002).

[21] Omitting the observations that did not fit the definition of Goskomstat (in 2000 for example) would result in a skewed distribution of the number of enterprises over the years, because the enterprises continued declining in size.

Variables

The registry gives a rather wide range of technological variables: sown area by varieties of crops, head of animals, crop and livestock output by types in physical and Rouble value, inputs by categories in Rouble value, etc. The data set included detailed data on subsidies. It also contained information on farm location, ownership, and type of organisational structure. Only few variables were available on farm financial aspects. The list of balance sheet variables in the registry does not distinguish the beginning or end values. Since balance sheets from farms in the Moscow region were available, the corresponding variables from the balance sheets and the registry were compared. Financial variables such as short- and long-term debts were given in the end-of-year values. Data on debts were incomplete for some of observations. The missing values and zeros were thoroughly checked.

The reports on revenues and subsidies (form 7-APK and its supplement) were subjected to some changes; the earlier design of subsidy reports was made more complete and precise by the authorities in 1996, and then in 2000, 2001 and 2002. However, as follows from the empirical data, producers tended to report the support in the form of both cost compensations and as subsidy recalculated to specific output. To avoid double counting of subsidies, an annual algorithm was developed that resulted in verifiable figures on the subsidies received.

Data transformations enabled verification of the dimension of Rouble values between different years, but also between the variables of the same observation. The latter might be a result of different sources (financial forms and specialised forms indexed with "APK") of the data in the registry. Available from national statistics, the average regional prices of agricultural products, and average wages in agriculture were used to make the comparison with variables from the registry to identify potential problems with measurement units.

The most important factors in production function were inputs and outputs. Several reports, e.g. 7-APK – 9-APK and 13-APK[22] provided detailed information on costs (by components) and revenues (by outputs), which refer to different systems in terms of accounting for costs and revenues. A consistent set of inputs and outputs should refer to the same production system, either marketable production or total production. Revenues and costs of marketed production were directly available from the data, whereas the value of total production was not available in monetary terms. To avoid all sorts of inconsistencies while recalculating the

[22] Form 7-APK "Output sales"; Form 8-APK "Costs of main production"; Form 9-APK "Production and costs in crop activities" and Form 13-APK "Production and costs in livestock activities".

level of output using prices, it was decided to focus on the marketable part of a production system. Besides the advantage that the data were directly available, this strategy avoided accrual counting (counting intermediate consumption)[23]. Therefore costs and revenues in Form 7-APK were used. However, the decomposition of costs into labour, materials and depreciation was not presented in 7-APK and therefore was assessed from Form 8-APK. In the dataset the further decomposition of materials into e.g. feed, seeds, fertilisers, fuel, etc. was not available for all years and therefore variable inputs were presented in one category.

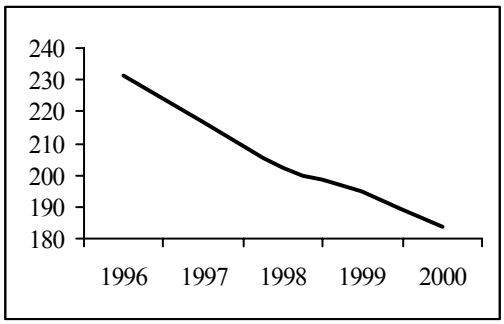
[23] In 9-APK and 13-APK, the input side of crops counts all inputs for production of crops (labour, capital, variable inputs), regardless of whether the crops were sold, used for seed or feed, or given to workers as payment in kind. Similarly, milk from dairy cows maybe partly used for internal consumption in cattle breeding activity.

Appendix 3.2

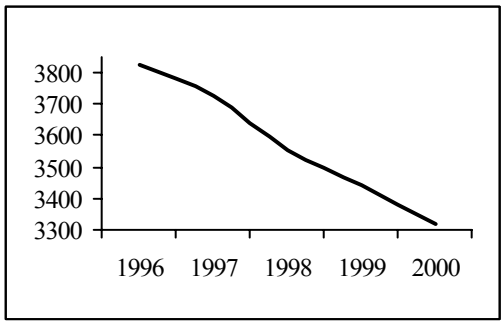
Table A3.1 Descriptive statistics of the variables, 77140 observations

Variable	symbol	Units of measurement	Mean	Std Dev	Minimum	Maximum
Output	Q	1000 RUB of 1996	2856	6000	4	344976
Labour	X_1	Number of workers in agri-culture	206	148	22	4757
Land	X_2	Hectares of sown land	3573	2962	0.5	54273
Depreciation	X_3	1000 RUB of 1996	354	498	0.5	17544
Materials	X_4	1000 RUB of 1996	2000	4957	2	270991
Livestock	X_5	Standardized livestock units	930	1784	0	83569
Subsidy	Z_1	1000 RUB of 1996	232	706	0	45368
Debts	Z_2	1000 RUB of 1996	1928	3810	0.01	668318

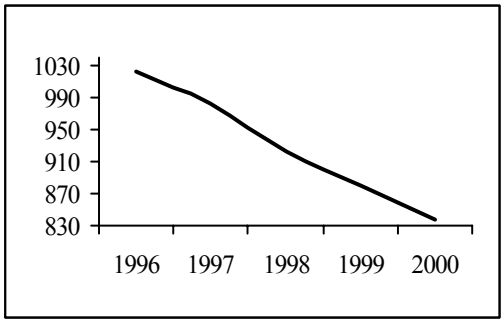
Figure A3.1 Sample means of production factors in 1996-2000



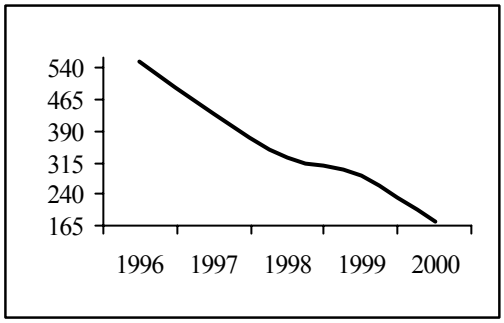
(a) agricultural workers



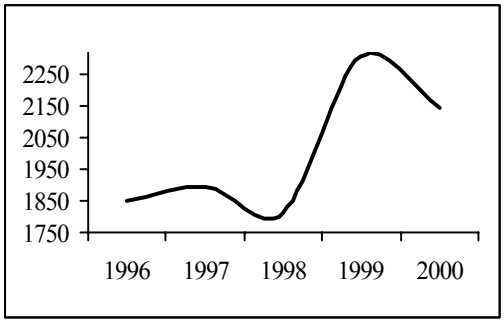
(b) sown land, hectares



(c) livestock, standard head numbers



(d) capital, 1000 RUB of 1996



(e) variable input, 1000 RUB of 1996

Figure A3.2 Sample means of output, subsidies and debts in 1996-2000

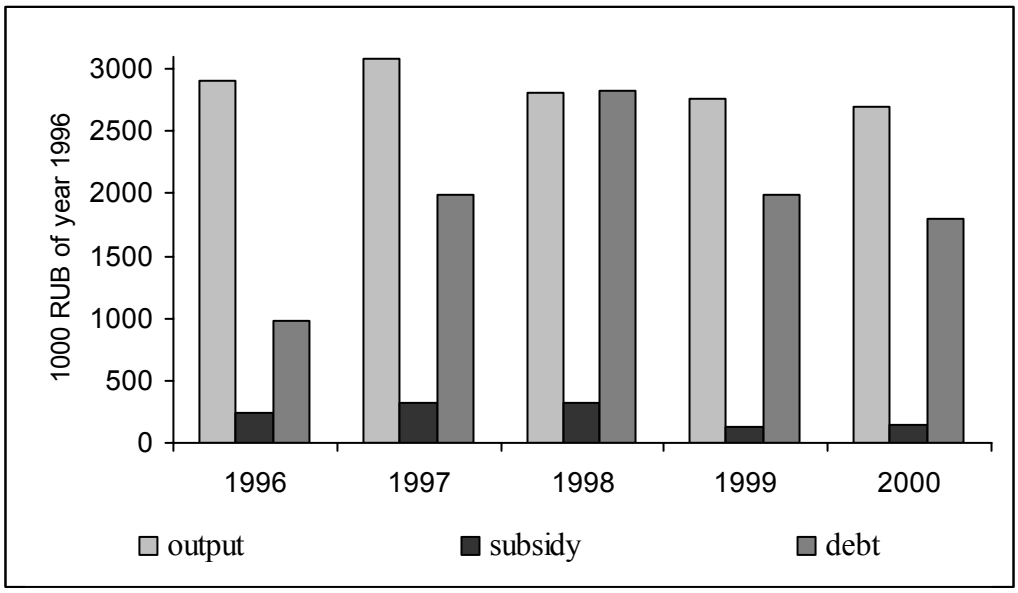


Figure A3.3 Russian regions used in the analysis (dark grey)

Chapter 4
Effects of subsidies in Russian dairy farming

Abstract

This study develops a microeconometric model of specialised dairy farms in Moscow Region using panel data over the period 1995-2001. The model is used to analyse the role of subsidies on profit and input-output allocation. Theoretical conditions for short-term profit maximisation are not rejected by the data. Differences between farms allow for a fixed-effect specification. The dairy producers in the region demonstrate a low responsiveness to market signals, but technology change becomes important. Labour, land and livestock had low shadow prices. Although subsidies have a distorting effect on the input-output mix, this study shows they relieve the credit constraints of dairy farms and have an important positive influence on farm profit.

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4.1 Introduction

In the past decade, Russian agriculture has passed through a major transformation process that had important effects on its development. The price liberalisation launched in 1992 was aimed at diminishing the role of central planning in the allocation of inputs and outputs in favour of the role of market prices. As a result, agricultural subsidies were sharply reduced. It remains an open question whether the transition period moved the agricultural producers towards reacting to prices and whether subsidies were important in their decision-making.

The majority of farms had low or negative profits and experienced a lack of liquidities. Arnade and Gopinath (2000) concluded that financial inefficiency is prevalent in Russian farming. If farm performance is limited by liquidities it may be expected that additional finance through subsidies will expand their production and lead to a positive shadow price of subsidies.

The objective of this paper is to analyse the effect of subsidies on production decisions (input-output allocation). In modelling the effect of subsidies, the first question to answer is whether subsidies directly influence the quantity of input and/or output, whether they are coupled. Decoupled subsidies are defined as subsidies that do not affect short-run marginal production decisions (Moro and Sckokai, 1999). Many studies including those for Russian agriculture (e.g. Sotnikov, 1998; Sedik *et al.*, 1999) implicitly model the subsidies as explanatory factors of technical inefficiencies. Thus, in these studies the subsidies are implicitly considered as coupled, because they influence the input-output composition and affect efficiency.

This paper introduces a novel way for modelling subsidies: the model keeps the option open for treating subsidies coupled or decoupled and allows testing for it empirically. This flexibility in the model is necessary, since − given the data − it is not possible a priori to categorise subsidies as fully decoupled or fully coupled. Thus, the subsidies are first introduced into the profit function as an exogenous factor, which is in line with the assumption of decoupled nature of subsidies; next they are tested for endogeneity. Endogenous subsidies are handled using instrumental variables. A second contribution of this paper is the development and application of a micro econometric model of Russian farms. The model builds on the profit function modelling of agricultural production for market economies (e.g. see Moschini, 1988; Oude Lansink and Peerlings, 1996), allowing for testing the regularity conditions of profit maximisation. Next to studying the effect of subsidies, the employed profit function allows to present the estimates of input and output elasticities at the enterprise-level, while previous studies document elasticity estimates for earlier years 1994-95 employing aggregated

data (Arnade and Trueblood, 2002). The data on Moscow region dairy farms from 1995-2001 allows for an analysis of dairy farming after the financial crisis of 1998. The results demonstrate that subsidies have an input-output mix disturbance effect and they cannot be classified as decoupled.

The remainder of this chapter is organised as follows. Section 4.2 presents recent developments in subsidising programs in Russia. Section 4.3 develops the theoretical model of farm production in the presence of subsidies. This is followed by the specification of the empirical model and a description of the data in sections 4.4 and 4.5 correspondingly. The paper ends with a discussion of the results and comments. Appendices on data (4.1, 4.3) and the theoretical model (4.2) support the paper.

4.2 Subsidies in Russian agriculture

In the centralised Russian economy, subsidies were the key element of price policy as they compensated for the difference between administered prices and actual costs of products. Prior to 1992, agricultural producers were granted subsidies and compensations, which were greatly reduced after the collapse of the soviet regime. Since 1992, when agricultural producers experienced a severe decline in their terms of trade, the livestock sector absorbed a large fraction of total budgetary transfers while remaining the major loss-making sector in agriculture. Since 1998-1999, the national subsidising policy has shifted to the regional level and by the year 2000, the regional ministries of agriculture financed two thirds of the domestic support. In the Moscow region in 1995-2001 the largest portion of subsidies (83%) on dairy farms was granted from regional budgets. Despite declining trends in both output and subsidies, the subsidies-to-agricultural-output in the region remained at 12.5 % in 1997-1998 (see Kuleshov, 2000). The level of subsidies and percentage of subsidies in agricultural revenue decreased right after the 1998 financial crisis lowering down to 2.4% in 2000 (see Graph A4.2 in Appendix 4.3).

Next, the nature of subsidies, i.e. whether they can be considered as coupled or decoupled, is discussed. Regional and federal programs in the region compensate costs of mineral fertilisers, energy, soil improvement, for keeping productive animals and provide price premiums for livestock products, which implies that a major part of subsidies is linked to revenues and costs, i.e. subsidies are rather coupled. However, subsidies and compensations are granted to the farm a *posteriori*, after the farm management has provided the corresponding documents on revenue and costs to the local authorities. Especially before 1999 the payment

of subsidies was delayed. Thus, part of actually received subsidies in the current year is linked to costs and revenues of the previous period. Empirical data show that part of the subsidies is reported as "other", which may compensate for losses due to extraordinary climatic conditions and classify as decoupled subsidies.

The national statistical yearbooks hardly provide any regional or national data on the level of subsidies or price premiums differentiated by outputs and inputs. Serova *et al.* (2001) stressed that data on budgetary transfers from different statistical sources are conflicting and not transparent. This complicates the analysis of subsidy policies. There is no strong evidence from the literature and legislative norms to classify subsidies in Russian agriculture as coupled or decoupled. As it follows from Kuleshov (2000) and Goskomstat (1999a, 2000a), in 1997-2000 about 70-80% of milk was sold via state channels at the 3-6% lower then average milk prices. This leads to the assumption that in Moscow region higher subsidies might be associated with higher percentage of sold products to the state, since subsidies to livestock were paid for state-delivered products (see Anonymous, 1999). Empirical data on dairy farms in the region have no information on pricing by different supply channels and unfortunately do not allow disentangling subsidies into coupled and decoupled.

4.3 Theoretical model

We start from a theoretical model to describe the behaviour of dairy farms. Given the multiple input and output structure of the dairy farms, a dual short-term profit function approach is a relevant theoretical framework. Here the two-stage model is presented to demonstrate the relation between profit, inputs, outputs and subsidies. Key assumptions in this model are that at the first stage farm enterprises are maximising short-term profit and at the second stage they maximise the overall profit consisting of a sum of first-stage profit and subsidies. The first-stage profit is subject to a convex technology, given quantities of fixed inputs and subsidies and given prices of outputs and variable inputs. The latter assumption implies that farm enterprises are price takers in markets of variable inputs and outputs. Subsidies are coupled assuming producers account for subsidies while making production decisions at the first stage. In the first stage, short-term profit $\pi(p,w,z_1,z_2)$ under (1a) is maximised subject to a technology constraint (1b), a credit constraint (1c) and a subsidy constraint (1d).

$$\pi(p, w, z_1, z_2) = \underset{y,x}{Max}\{p \cdot y - w \cdot x \mid z_1, z_2\} \quad (1a)$$

$$s.t. \quad F(y, x, z_1) \leq 0 \quad (1b)$$

$$w \cdot x \leq A(z_2) \quad (1c)$$

$$Z(y, x) \leq z_2 \quad (1d)$$

The arguments of the profit function $\pi(.)$ are output price p, input price w, fixed input z_1 and subsidies z_2. This function is assumed to be non-decreasing in output prices, non-increasing in input prices, convex and linearly homogeneous in prices, continuous and twice differentiable (Chambers, 1988). The credit constraint[1] imposes the restriction that costs of inputs cannot exceed available credit (A), that is a nondecreasing function of subsidies (z_2). The function describing the generation of subsidies is given by $Z(y,x)$ and is assumed to be nondecreasing in quantities of inputs and outputs. The optimisation of $\pi(p,w,z_1,z_2)$ gives the optimal allocations of outputs and inputs (y^* and x^*, respectively) given the quantity of subsidies (and given prices and fixed inputs).

If subsidies are coupled, then they affect the allocation of inputs and outputs, i.e. subsidies play a similar role as prices. In case they are fully decoupled, subsidies have a pure wealth increasing effect without altering the input-output decisions. However, irrespective of their degree of coupling, subsidies may serve as a source of liquidity. The situation then falls into four possible outcomes defined by farms constrained/unconstrained in liquidity and coupled/decoupled subsidies. We limit the analysis to coupled subsidies case. Figure 4.1 presents the condition for optimal allocation of coupled subsidies for credit constrained and unconstrained producers derived in Appendix 4.2.

For credit constrained farms, i.e. farms that have insufficient financial means to purchase input quantities to the profit maximising levels, subsidies may provide financial means to finance inputs required during the production process and enlarge short-term profit in that way[2] (see Figure 4.1a). Farms that are not credit constrained (Figure 4.1b) lie on the downward sloping curve representing the effect of subsidies on short-term profit.

[1] This is a simplified form of expenditure-constrained profit function. Lee and Chambers (1986) provided a good example of credit constrained profit modelling framework.

[2] Over the years 1996-1998 empirical data support the assumption that subsidies rather than short-term credit contribute to farm finance. In that period about 95% of farms received subsidies, whereas only 37% of them in received credit with the total sum of subsidies over all farms in the sample exceeding total level of credit by 44%.

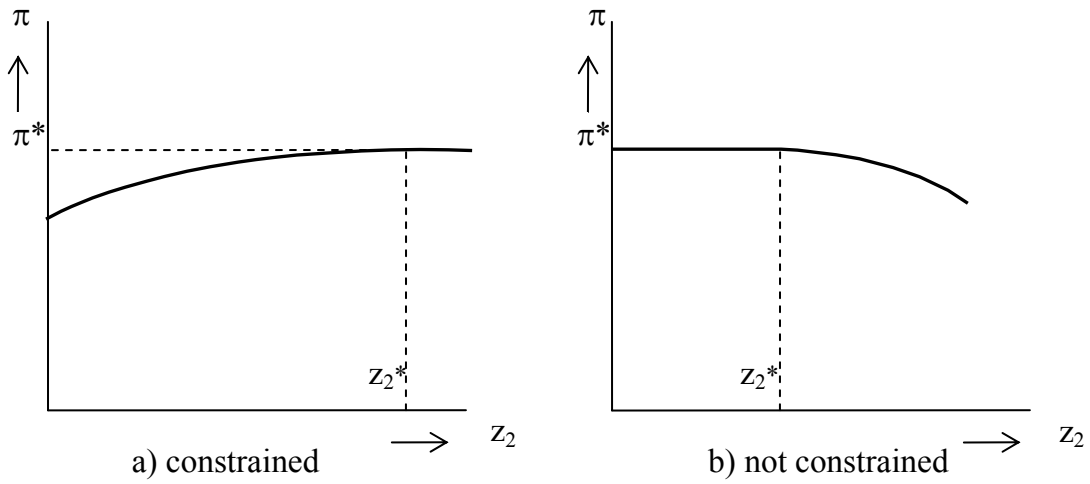


Figure 4.1 Effect of coupled subsidies on short-term profit

In case of coupled subsidies, input and output allocation at the first stage will be adjusted so as at the second stage to optimise *overall* profit $G(\cdot)$ consisting of the sum of short-term profit and subsidies. Overall profit $G(\cdot)$ is maximised subject to a subsidy equality constraint (2b), determining the optimal value of subsidies, given y^* and x^* and given fixed inputs z_1, i.e.

$$G(p, w, z_1) = \underset{z_2}{Max}\{\pi(p, w, z_1, z_2) \quad + \quad z_2 \mid z_1\} \qquad (2a)$$

$$s.t. \qquad z_2 = Z(y^*, x^*) \qquad (2b)$$

Under the assumption that farms need subsidies as a source of liquidity, including them under (2a) in the profit function provides a correction of the profit maximising levels of inputs and outputs. If firms are not credit constrained (Figure 4.1b), then allocative efficiency of subsidies is obtained at the point reflected by the combination (π^*, z_2^*) where the shadow price of subsidies is zero. To the right from (π^*, z_2^*) subsidies will cause misallocation of input and output resulting in a decrease short-term profit π only in case of no liquidity constraint. Being unconstrained, due to extra subsidies farms can expand inputs and outputs and find themselves operating at inefficient level. However, for firms that are credit constrained, the optimal combination of profits and subsidies lies in the upward sloping range of the curve (Figure 4.1a), i.e. left from the point (π^*, z_2^*)

A system of input demand and output supply equations is derived from the short-term profit function (1a) using Hotelling's lemma:

$$\frac{\partial \pi_h(v, z_{1h}, z_{2h})}{\partial \mathbf{v}_i} = \mathbf{q}_{ih} \tag{3}$$

where **q** as a vector of netputs (non-negative for outputs and non-positive for inputs) with corresponding netput prices **v** and *h* as a farm index.

Shadow prices of fixed inputs and subsidies $\mathbf{s}_h(\mathbf{v}, \mathbf{z}_h)$ are determined as the first derivative of the profit function to fixed input quantities:

$$\frac{\partial \pi_h(v, z_{1h}, z_{2h})}{\partial z_h} = \mathbf{s}_h \tag{4}$$

The mathematical relation between subsidies and profit is demonstrated in Appendix 4.2 for the cases of coupled and decoupled subsidies. The shadow price of coupled subsidies ($\partial\pi / \partial z_2$) is expected to be negative for firms that are credit unconstrained and positive for firms that are credit constrained.

4.4 Empirical specification

This section develops the empirical model of Russian agricultural enterprises based on short-term profit function (3). Oude Lansink and Thijssen (1998) discussed four approaches to selecting functional forms. The majority of studies follows the strategy of estimating several functional forms chosen *a priori* and then discriminate among them upon theoretical conditions (convexity, monotonicity, invariance, etc.) and plausibility of the estimation results (significance of the coefficients, their sign, price elasticity). Literature on micro econometric modelling suggests the use of flexible functional forms since they do not impose arbitrary restrictions on the underlying technology. Commonly used flexible functional forms are the Symmetric Normalised Quadratic (SNQ) and Normalised Quadratic (NQ). These functional forms allow for both positive and negative profits and for imposing convexity in prices globally. However, the NQ functional form has a serious disadvantage compared to the SNQ, i.e. the estimates of the NQ depend on the choice of the *numeraire* (Diewert and Wales, 1987; Shumway and Gottret, 1991; Boots *et al.*, 1997). Therefore, this study uses the SNQ as a functional approximation for the profit function.

In the empirical specification of the profit function consistent with Eq. (3), three netput quantities are distinguished with *i*=1 for milk output, 2 for other output, and 3 for variable input. Three fixed factors (*j*=1…3) are labour (z_1), land (z_2) and livestock (z_3). Several studies report the technological change observed in Russian agriculture after 1998 (see Liefert and

Swinnen, 2002; Osborne and Trueblood, 2002a), therefore time-trend (z_4) is introduced. Subsidy (z_5) is included as other exogenous factor. Exogenous netput prices are v_1 to v_3.

Given the description of subsidy programs, modelling subsidies as fully coupled payments is not well justified, i.e. not all subsidies received in the current year are necessarily linked to revenues or costs of the current year because subsidies are paid *a posteriori*. This concern is addressed by introducing subsidies as an argument in the profit function without strictly assigning them as coupled or decoupled. The relation between subsidies and netputs is not modelled in this framework explicitly, but is accounted econometrically by instrumental variable estimation technique; the reason being a lack of data to separate subsidies coupled with specific outputs and inputs.

Thus, profit function depends on the prices of inputs and outputs, given quantities of fixed inputs and granted subsidies. In the empirical profit function specification there are interaction terms of profit function arguments. The interactions of subsidies with prices capture the possible relation between the level of subsidies and (possibly lower) prices. Given the social role of subsidies, that is keeping surplused labour on the farm to avoid social tension in the rural areas (see also Epstein, 2001), which is however not explicitly stated in either of the subsidy programs, it is rather reasonable to have interaction terms between subsidies and labour. Similar, since subsidies are also granted per heads of livestock (subsidies for keeping productive animals), interaction of subsidies and livestock is justified.

The SNQ profit function that incorporates subsidies in the form of fixed input for farm h in each time period t takes the form:

$$\pi_{ht} = \sum_{i=1}^{3} \eta_{ih} v_{it} + \frac{1}{2}\left(\sum_{k=1}^{3} \lambda_k v_{kt}\right)^{-1} \sum_{i=1}^{3}\sum_{j=1}^{3} \alpha_{ij} v_{it} v_{jt} + \frac{1}{2}\left(\sum_{k=1}^{3} \lambda_k v_{kt}\right) \sum_{i=1}^{5}\sum_{j=1}^{5} \beta_{ij} z_{iht} z_{jht} + \sum_{i=1}^{3}\sum_{j=1}^{5} \varphi_{ij} v_{it} z_{jht} \quad (5)$$

where η_{ih} denote farm h specific parameters. Symmetry is imposed by requiring $\alpha_{ij}=\alpha_{ji}$, $\beta_{ij}=\beta_{ji}$ for all i and j. Linear homogeneity in prices is imposed by the term $\sum_{k=1}^{3} \lambda_k v_{kt}$, where λ_k is the average share of netput k in total costs plus revenue, so $\sum_{k=1}^{3} \lambda_k = 1$. The term $\sum_{k=1}^{3} \lambda_k v_{kt}$ can be interpreted as a price index with fixed weights λ_k. In order to identify all parameters, additional restrictions have to be imposed on the profit function: $\sum_{j=1}^{3} \alpha_{ij} \bar{v}_j = 0 \quad \forall i = 1...3$,

where $\bar{v}_j$ is an arbitrary point of observation. In this study $\bar{v}_j$ equals the sample mean of price j (see also Kohli, 1993; Boots *et al.*, 1997).

Corresponding netput equations are derived using Hotelling's Lemma:

$$q_{iht} = \eta_{ih} + \left(\sum_{k=1}^{3}\lambda_k v_{kt}\right)^{-1}\sum_{j=1}^{3}\alpha_{ij}v_{jt} - \frac{1}{2}\lambda_i\left(\sum_{k=1}^{3}\lambda_k v_{kt}\right)^{-2}\sum_{i=1}^{3}\sum_{j=1}^{3}\alpha_{ij}v_{it}v_{jt} + \frac{1}{2}\lambda_i\sum_{i=1}^{5}\sum_{j=1}^{5}\beta_{ij}z_{iht}z_{jht} + \sum_{j=1}^{5}\varphi_{ij}z_{jht} \quad (6)$$

Furthermore, the shadow prices of fixed input or subsidy j on farm h in year t (s_{jht}) are derived as:

$$s_{jht} = \sum_{i=1}^{3}\varphi_{ij}v_{it} + \left(\sum_{k=1}^{3}\lambda_k v_{kt}\right)\sum_{i=1}^{5}\beta_{ij}z_{iht} \quad (7)$$

A derivation of price elasticity (e_{ij}) and elasticity of intensity for the fixed inputs (e_{iZj}) from the parameters of the Symmetric Normalised Quadratic profit function is presented under (8) and can be also found in Oude Lansink and Thijssen (1998):

$$e_{ij} = \frac{\alpha_{ij}}{\sum_{k=1}^{3}\lambda_k v_{kt}}\cdot\frac{v_j}{q_i} \;;\; e_{iZ_j} = \left(\lambda_i\left(\sum_{k=1}^{5}\beta_{kj}z_k\right) + \varphi_{ij}\right)\cdot\frac{z_j}{q_i} \quad (8)$$

Elasticity of intensity indicates the relation between netputs and fixed inputs. Price elasticity can be used to classify the netputs into substitutes and complements.

4.5 Data and estimation

Panel data of large-scale specialised dairy farms in the Moscow Region are obtained from data on Russian farms collected by the state statistical committee. The sample of specialised dairy farms includes farms for which the level of marketable milk production takes more than 2/3 of agricultural revenue. The unbalanced panel set contains 985 observations from 130-144 farms annually over the period 1995-2001. On these farms, on average 72% of revenue comes from milk and 12% from beef production. The percentages of other livestock production (egg production, pig production) and arable farming (potato, cereals, vegetables and other) are 7% and 9%, respectively.

Outputs are milk and other output (beef, pig meat, poultry meat, eggs, cereals, potato, vegetables). Variable input represents aggregated input costs for marketable output. Implicit quantities of variable input and the two outputs are obtained as the ratio of costs and revenues and their price indices. A price index for milk is derived from the enterprise-level data. A Tornqvist price index (Coelli *et al.*, 1998) is calculated for other output and for variable input

using national price indices (Goskomstat, 2002) and farm composition of aggregated categories. By using a different price index per farm, the differences in prices between farms also result from differences in quality and in the composition. Therefore, this price index becomes an endogenous variable and contradicts the assumptions made in formulating the theoretical model (Thijssen, 1992). Price indexes are averaged over farms and thus vary over years. This implies that differences in the quality and composition of inputs and outputs are reflected in the quantity (see also Cox and Wohlgenant, 1986).

Fixed inputs are labour, agricultural land (hereafter referred to as "land"), livestock and subsidies. Labour is measured as the number of agricultural workers on the farm. Available data do not allow for quality corrections of land and labour. Heads of livestock represent fixed capital invested in livestock. Subsidies are measured as the total sum of subsidies received by a farm in the current year, and are normalised by the consumer price index. More details on variables and data can be found in Appendix 4.1 and 4.3. The descriptive statistics of the variables are presented in Table 4.1.

Table 4.1 Description of data set of dairy farms in 1996-2001 (810 observations)

Variable	Dimension/base year	Symbol	Mean	Standard deviation	Min	Max
Price indexes						
Milk	Base year 1996	v_1	2.312	1.244	1.000	4.159
Other output	Base year 1996	v_2	2.438	1.426	1.000	4.773
Variable input	Base year 1996	v_3	2.021	1.014	1.000	3.581
Quantities						
Milk output	10^6 RUB of 1996	q_1	3.499	3.820	0.080	33.411
Other output	10^6 RUB of 1996	q_2	0.929	1.018	0.031	9.997
Variable input	10^6 RUB of 1996	q_3	3.434	3.923	0.130	33.541
Labour	Number of workers in agriculture	z_1	215	103	24	760
Land	Hectares	z_2	3521	1578	363	10901
Livestock	Heads	z_3	1685	954	206	7973
Other						
Technology	Trend (1996=1)	z_4	4.5	1.7	1.0	6.0
Subsidies	10^6 RUB of 1996	z_5	0.240	0.344	0	3.416

Source: own presentation.

Production on the farms is affected by a large number of farm-specific conditions. Many of these conditions remain unchanged over time (e.g. soil quality, distance to local and urban markets, availability of milk processing facilities). Also marketing channels affecting prices of outputs are constant over time. The available enterprise-level data from 1995 and aggregated data from 1999-2000 (Goskomstat, 2000a) showed that the major part of livestock and also dairy products was delivered to the state. The availability of panel data allows for introducing a farm-specific intercept in the netput equations, i.e. fixed-effect model (Baltagi, 1995) capturing differences in farm-specific conditions. The fixed-effect also captures price differences between farms due to variation in marketing channels. Potential correlation between prices and subsidies due to subsidy program conditions is addressed likewise. Estimation of the fixed-effect model is enabled by transforming all variables prior to estimation, thereby avoiding direct estimation of the farm specific intercepts (i.e. the deviation of each observation from the average over time per farm is used during estimation (see Hsiao, 1986). The system of netput equations (6) is estimated with additive error terms that may be correlated across equations.

The possible endogeneity of subsidy is addressed by applying the instrumental variable (IV) estimation method[3]. The assumption of exogenous subsidies is tested using a Hausman test. To implement a Hausman test, two estimators have to be constructed. The ITSUR estimator is consistent and efficient under the null hypothesis that subsidies are exogenous. When subsidies are endogenous, an instrumental variable estimator like Iterative 3-Stage Least Squares (IT3SLS) is consistent. The instrumental variables should explain the variation in subsidies and should be independent of the error terms in the netput equations. The instruments used are within-farm deviations from mean of single and cross-terms of fixed inputs and prices, the lagged level of subsidies in revenue, lagged within-farm deviations from mean outputs and inputs, distance to Moscow city and technical and scale efficiency scores. Both ITSUR and IT3SLS account for correlation of error terms across equations. The fixed-effect data transformation and estimation are performed using SAS statistical software (release 8.0).

[3] The problem here is rather usual for other economic models as well, e.g. consumption model where consumption is determined by the level of income, which by definition depends on consumption. The way to deal with such problem is applying IV technique (see Greene, 2000).

4.6 Results

In this section, the results of the estimation of the Symmetric Normalised Quadratic profit function are discussed. First, exogeneity of subsidies was tested using a Hausman test and the results of the ITSUR and IT3SLS estimation of the system of equations (6). The Hausman test statistic is distributed asymptotically as a χ^2 distribution with 11 degrees of freedom and the value of the test statistic is found to be 218.1. Therefore, the null hypothesis of exogenous subsidies is rejected at the critical 5% level (critical value: 4.57). The results of this test imply that subsidy is an endogenous variable in the model, i.e. subsidies are coupled to inputs and outputs, and results of the IT3SLS estimation have to be used in further assessments.

Convexity in prices of the profit function is satisfied if the Hessian matrix of second order price derivatives is positive semi-definite. This condition was assessed by calculating the Eigenvalues of the Hessian matrix and check whether they exceed zero. The values are 0.51, 0.69 and 0.0001 showing that the profit function satisfies the condition of convexity in prices. Monotonicity in prices was assessed for each observation and each netput and is satisfied for 95% of all observations. Since theoretical conditions (monotonicity and convexity) are not violated, it may be concluded that the data support the assumption that the farms in the sample were maximizing short-term (variable) profit.

The estimation results of the model are presented in Table 4.2. The t-values indicate that 52% of the parameters are significant at the critical 5% level and 61% are significant at the critical 10% level. The low significance of the estimated coefficients may be explained by a relatively short time series (6 years) and the transition process that is reflected in the data. The joint significance of the farm specific intercepts was tested using an F-test and it is found that the null hypothesis (i.e. all farm-specific intercepts are jointly zero) is rejected at the critical 5% level (F-value: 25.1, critical 5% level: 1.2). This justifies the fixed-effect specification of the model. The R^2 for the equations of milk output, other output and variable inputs are respectively 0.97, 0.81 and 0.94.

Price elasticities based on the SNQ profit function estimates were calculated at the sample mean and can be found in Table 4.3. All own price elasticities have the correct sign. The relatively small number of significant (at 10% level) price elasticities (33%) is explained by the use of year-specific prices that reduce the price variation in the data (see Oude Lansink, 2000).

Table 4.2 Parameter estimates of the SNQ function and estimated t-values (corrected for fixed effects[a])

Parameter	Value	t-value	Parameter	Value	t-value
α_{11}	0.506	1.93	φ_{11}	0.803	2.62
α_{12}	-0.506	-1.80	φ_{12}	1.018	5.14
α_{22}	1.876	3.42	φ_{13}	1.396	4.74
β_{11}	-0.681	-2.07	φ_{14}	0.214	3.76
β_{12}	-0.061	-0.54	φ_{15}	0.036	0.05
β_{13}	0.088	0.21	φ_{21}	0.335	3.13
β_{14}	0.075	1.24	φ_{22}	0.196	2.67
β_{15}	3.005	2.95	φ_{23}	-0.362	-3.09
β_{22}	-0.330	-3.34	φ_{24}	-0.144	-4.73
β_{23}	0.193	1.55	φ_{25}	0.965	4.48
β_{24}	-0.012	-0.42	φ_{31}	-0.489	-1.60
β_{25}	-0.583	-1.28	φ_{32}	-0.168	-0.83
β_{33}	0.237	0.30	φ_{33}	-2.697	-8.66
β_{34}	0.066	0.71	φ_{34}	-0.382	-6.75
β_{35}	-1.327	-1.11	φ_{35}	3.690	5.70
β_{44}	0.058	2.41	α_{13} [b)]	0.0003	0.001
β_{45}	-0.277	-1.01	α_{23} [b)]	-1.367	-3.84
β_{55}	-5.501	-4.12	α_{33} [b)]	1.369	3.89

[a)] Since the intercept is not included when using SAS regression package, correction of the standard errors should be done by multiplying them by the following coefficient: $\left(\frac{N * G - K}{N * G - H * G - K}\right)^{\frac{1}{2}}$, where N is the total number of observations, G is the number of equations in which fixed effect is included, K is the number of estimated parameters and H is the number of farms (Baltagi, 1995).

[b)] Computed.

Source: own estimation.

Milk and other outputs appeared to be substitutes. Supply of milk was not responsive to price changes, indicating that the level of milk in overall production on specialised dairy farms was rather stable over time. The rather large own price elasticity of other output, although not highly significant, is explained by the relatively small share of other output in overall production. Supply of other output was more price-responsive. Finding the low price responsiveness of dairy producers in Moscow Region in 1996-2001 fits well the observation

that farmers were still rather dependent on state support supplying a high (70%) percentage to the state (see Goskomstat, 2000a).

Table 4.3 Price elasticities and elasticities of intensity at the sample mean (t-statistics in parentheses [a])

	Price elasticity			Elasticity of intensity			Other	
	Milk	Other output	Variable input	Labour	Land	Live-stock	Trend	Subsi-dies
Milk	0.151	-0.132	<0.001	0.335	0.479	0.939	0.111	-0.002
	(0.80)	(-0.17)	(<0.01)	(1.98)	(1.24)	(10.23)	(12.65)	(-0.41)
Other output	-0.571	2.230	-1.351	0.628	0.236	-0.410	-0.109	0.246
	(-2.66)	(1.42)	(-1.74)	(3.26)	(1.08)	(-1.96)	(-3.15)	(4.55)
Variable input	<-0.001	0.441	-0.365	0.445	0.660	1.082	0.059	-0.253
	(<-0.01)	(0.57)	(-1.76)	(3.31)	(4.31)	(8.59)	(4.78)	(-8.21)

[a] T-statistics were calculated using the following formula for variance: $\sigma^2 = \mathbf{f}' \boldsymbol{\Omega} \mathbf{f}$, where **f** is a vector of partial derivatives of the variance function with respect to the parameters of the estimated profit function. $\boldsymbol{\Omega}$ is a covariance matrix of the estimated parameters (see Rao, 1973).

Source: own presentation.

Elasticities of intensity shown in Table 4.3 give the effect of increases in the quantities of non-price factors on quantities of variable inputs and outputs. Most of the elasticities of intensity are significantly different from zero at the critical 5% level. All fixed inputs (labour, land and livestock) are complements of variable inputs. Output supply and input demand are mostly affected by variations in livestock. Variations in land and labour are smaller, but overall they demonstrate significant effects on variable inputs and outputs. Technological development encourages further specialisation in milk production: milk output increases and other output decreases by 11% annually. The use of variable inputs increases at a smaller percentage (6%). The results support actual developments in Russian agriculture reflected in output growth.

An important analysis of this study infers from the elasticity of input and outputs with respect to subsidy. Half of the estimates related to subsidy are significant at 5% (Table 4.2). However, the elasticity of milk with respect to subsidy is not significantly different from zero. This implies that milk supply was as not responsive to subsidy signals as to market signals and that subsidies did not provide an incentive for (further) specialisation in milk. The finding that subsidies had a significant impact on other output and variable input supports the earlier

result that subsidies are coupled. The significantly negative impact of subsidies on input demand suggests that subsidies were not used to purchase additional variable inputs.

Table 4.4 Average shadow prices of fixed inputs and subsidies in 1996-2001 (t-statistics in parentheses)

Year / Dimension	Labour	Land	Livestock	Technology	Subsidy
	Million RUB per 100 workers	Thousand RUB per hectare of land	Thousand RUB per head of livestock	Million RUB relative to year 1995	RUB per RUB
1996	-0.007	-0.104	-0.718	-0.077	5.550
	(-0.01)	(-0.25)	(-1.25)	(-0.88)	(5.81)
1997	0.716	-0.286	-1.101	-0.101	4.438
	(1.59)	(-0.71)	(-1.91)	(-1.28)	(4.64)
1998	0.294	-0.135	-0.523	0.042	5.461
	(0.65)	(-0.33)	(-0.91)	(0.48)	(5.71)
1999	-0.118	0.475	1.376	0.613	11.847
	(-0.26)	(1.16)	(2.39)	(6.95)	(12.40)
2000	-0.040	-0.009	-0.512	0.532	14.364
	(-0.09)	(-0.02)	(-0.89)	(6.02)	(15.03)
2001	1.221	0.150	0.116	0.893	14.208
	(2.70)	(0.37)	(0.20)	(10.11)	(14.87)

Source: own presentation.

The wealth-increasing role of subsidies is strongly supported by the significantly positive values of shadow prices of subsidies in Table 4.4. Following Appendix 4.2, observing positive shadow price of subsidies can be interpreted as evidence for the presence of credit constraints on dairy farms. It is found that less than 2% of observations have negative shadow prices. Most of farms are located in the upward sloping part of profit function (see Figure 4.1a). A negative relation between subsidies and variable input together with finding the credit constraints on farms implies that farms can improve their allocative efficiency by decreasing use of variable inputs. Since variable inputs could be unofficially used in household production, this finding can be interpreted as a call for improvement of management.

The shadow prices of labour, except for year 2001, and land are not significantly different from zero. It should be noted that the shadow prices may be biased downward by using the number of workers as a proxy for labour and agricultural area in hectares as a proxy for land. Using the number of hours (actually) worked or the number of quality corrected man-

years and actual land area used in farming activities (these variables are not available in the data set) might have resulted in higher shadow prices. However, even with the present measures of these factors the conclusions on the surplus land and labour are not contradicting the findings of other studies. A similar conclusion about surplus labour in Russian agriculture is presented in Osborne and Trueblood (2001), Liefert and Swinnen (2002). Bezlepkina and Oude Lansink (2003b) found negative marginal product of agricultural land concluding about excessiveness of land in Russian agriculture in 1995-2000. Producers can dispose of land at no costs, by simply leaving a part of the land unused. The situation with excess labour in agriculture deserves a lot of attention at the policy-making level. This problem, being reported in several studies, seems to be understood but not dealt with at the policy level. Even though the labour force on sample farms has been declining the whole period 1996-2001, its shadow price became positive only in 2001.

The number of livestock in the early transition period declined by almost a half, therefore finding a positive shadow price of livestock would characterise this factor as playing a substantial role in steady raise of production. However, keeping livestock remained costly to producers, possibly that is why they were reducing the numbers. The shadow price of livestock switches from being negative in 1996-1998 (although not highly significant) to significantly positive in 1999 and not significantly different from zero thereafter. The positive change in 1999 signals that credit constrained farms could not substantially increase production because of low livestock numbers. Limited number of livestock also partly explains a low price-responsiveness of producers. According to regulations, part of subsidies is granted conditional on keeping the herd size. Having a negative relation (although not significant) between the shadow price of livestock and subsidies (see Table 4.2, β_{35}=*-1.33*), it can be concluded that herd support program contributed to a decrease in short-term profit in 1996-1998, but increased the profitability when macroeconomic situation improved in 1999. It can be concluded that although not explicitly, in the short-run subsidies are conditioned upon quasi-fixed inputs, especially labour (the relation is statistically significant). Significantly positive shadow prices of time-trend signal a noticeable technological change observed after year 1998 resulting in annual profit rise.

4.7 Discussion and conclusions

In this paper a micro-econometric model of specialised dairy farms in Russia is developed in order to analyse their economic behaviour and the effects of subsidies on profit and

input-output allocation. The model is estimated on panel data of specialised dairy farms in the Moscow region over the period 1996-2001. This research moves beyond using aggregate oblast data in empirical work on Russian transition agriculture and applies enterprise-level data. Moreover, it derives farm-level price elasticities, shadow prices of fixed inputs and subsidies that are rarely referenced in the literature on Russian agriculture.

Previous studies modelled the effect of subsidies on Russian farm performance (see Sotnikov, 1998; Sedik *et al.*, 1999; Piesse and Thirtle, 2000) using another approach than the approaches adopted in this study and concluded about a negative impact of subsidies. This study concludes that although subsidies have a distorting effect on the input-output mix, they relieve the credit constraints of dairy farms, which allows farms to improve their allocative efficiency.

Unlike the work of Arnade and Trueblood (2002), that can be referenced as most recent application of profit function estimation to Russian agriculture regional data in 1994-1995, theoretical conditions for profit maximisation were statistically assessed and empirically supported by the data in this study. Thus, it can be concluded that the short-run profit function framework can be used to describe the behaviour of Russian farms.

Since 2001 the level of direct subsidies gradually reduced; also the state shifted focus to subsidising credit interest rate rather than production itself. These support programs, which do not distort prices, are considered positive in the light of the results of this study. This policy shift motivates further research into the efficiency of such subsidy programs.

Not only the state did not initiate any changes in subsidising policy earlier years, but also dairy producers in the region appear to be slow reformers. Koester (2003) concluded that behaviour of large farms is very much determined by the institutional environment rather than market forces. The results of this study are in line with conclusions in Arnade and Trueblood (2002) who found insignificant own price elasticity of livestock and a small own price elasticity of demand for electricity and fuel. Our study finds that producers demonstrate no response to milk prices and still supply the greatest percentage of their output to the state, demonstrating that decisions of farmers are still bounded. Consistent with results of other studies (Osborne and Trueblood, 2001; Liefert and Swinnen, 2002; Bezlepkina and Oude Lansink, 2003b), it is found that dairy producers have too much labour and land, at given prices of netputs. Alternatively, the current level of production and input use is far below the level, sufficient to utilise available land and labour resources. The agricultural sector demonstrated an overall improvement after the financial crisis in 1998 that is also empirically supported for the sample of dairy producers in this study.

Appendix 4.1

Peculiarities of the data from the registry of Russian agricultural enterprises

The agricultural registry is the most comprehensive and large data set available to researchers today. The registry offers several types of production data that correspond to different farm production reports. An overview of the original reports and their correspondence to forms can be found in Minselkhoz (2000). In the forthcoming sections we discuss some peculiarities of the data in the registry with respect to sampling the observations and defining the variables for profit function analysis: inputs and outputs and their prices, subsidies and fixed inputs.

Inputs and outputs. Several reports (agricultural forms indexed with "APK"), e.g. Forms 7-APK – 9-APK and Form 13-APK provide detailed information on costs (by components) and revenues (by outputs). Form 9-APK ("Production and costs in crop activities") and 13-APK ("Production and costs in livestock activities") provide data on primal costs by type of product. Form 8-APK ("Costs of main production") includes costs of crop and livestock output, as well as costs of services provided to other firms, to housing and communal services, kindergartens, canteens, etc, in other words to social infrastructure. Costs in this form are reported in the context of elements such as labour cost, material costs (purchased concentrates and home produced forage at actual costs, energy, fuel, seeds, veterinary service, and chemicals, materials for reconstruction and other), depreciation and other.

A consistent set of inputs and outputs should refer to the same production system, either marketable production or total production. Modelling of the profit function rather should operate with marketable part of production system. Therefore, costs and revenues in Form 7-APK ("Output sales") are advisable to use. However, the decomposition of costs into labour, materials and depreciation is not presented in Form 7-APK and therefore is assessed from Form 8-APK. In our dataset the further decomposition of materials into e.g. feed, seeds, fertilisers, fuel, etc. is not available for all the years and therefore variable inputs are presented in one category. In Form 9-APK and 13-APK, the input side of crops counts all inputs for production of crops (labour, capital, variable inputs), whether the crops are sold, or used for seed, feed, given to workers as payment in kind. Similarly, milk from dairy cows maybe partly used for internal consumption in cattle breeding activity. Thus, costs reported in Form 9-APK and 13-APK are not advisable to use because of accrual counting.

Form 7-APK reports revenues by outputs and distribution channel (state and other processing companies, market, employees and barter). The data set, however, does not distinguish

output sales by different channels. The choice of using revenues and costs from Form 7-APK helps defining a consistent set of inputs and outputs of agricultural production.

Prices. Prices in the data set can be calculated from given revenues and quantities only for marketable outputs. Input prices are not given and thus have to be used from the national statistics (e.g. Goskomstat, 2002). Price index for milk is computed from the sample average milk prices. Price indices for other output and other input (aggregated categories) account for their composition.

Subsidies. Book keeping system presents the data on subsidies in both financial (Form 2 "Financial Statements") and specialised (Form 7-APK, appendix "Subsidies and Compensations") forms. In these forms the level of subsidies and compensations is balanced out with debts to the state budgets or debts to suppliers, depending on the scheme of mutual payments. The analysis of subsidies is confined only to the level of actually received subsidies.

The subsidies are presented by categories, e.g. for milk, for compensating costs of soil improvements, etc. The earlier design of subsidy reports has been significantly changed by the authorised institution, first in 1996, then in 2000, 2001 and in 2002, becoming more complete and precise. The form had been improved to accomplish twofold goal: to accelerate the control over use of state support and to increase reliability of these data. However, as follows from empirical data, the producers tend to report the support in the form of e.g. fodder costs compensations and as subsidy recalculated to specific output, e.g. milk. This required a development of annual algorithm and resulted in verified figures on received subsidies.

Fixed inputs. Data on fixed inputs in general suffer due to a lack of data for quality corrections. Labour is given in number of employees involved in agricultural activities. Land is measured in hectares of agricultural area. A great limitation of the data is that it does not have fixed assets expressed in physical quantities, e.g. number of tractors, horsepower, but only average annual value of fixed capital including livestock. The Rouble values of fixed assets are measured with errors due to annual capital revaluations. The presented values of capital are found to be overvalued and thus unreliable. The price deflators for fixed assets in agriculture are poorly provided in the national statistics, thus the appropriate capital price index is not available. Scaling fixed capital down by some numbers would be rather ad hoc. Deriving capital price indices from farm-level data would not be consistent either. It is observed that farms report not only an increase in capital stock from year to year – which implies the use of inflators from the Ministry of Finance – but also a decrease. This decrease in capital values is observed in the later years, after it has been realised that costs of capital were overinflated and therefore enterprises started to value their assets with an assistance of experts. Depreciation

costs are directly linked to the balance value of capital and thus this measure does not solve problem with measurement error in fixed assets. Therefore, given data set limitations and unresolvable problems with measurement error in fixed assets value, the most reliable proxy for assets on dairy farms is the heads of livestock.

Appendix 4.2

Shadow price of subsidies and theoretical effect of subsidies on input-output allocation

The theoretical model in section 4.3 under (1) treats subsidies as coupled. The empirical model and estimation technique allow subsidies to be treated as either coupled or decoupled. This Appendix elaborates on the two-stage model presented under (1)-(2) to demonstrate the effect of coupled subsidies on input and output and the effect of coupled and decoupled subsidies on short-term profit. The situation with coupled subsidies is considered for credit constrained and credit unconstrained producers.

The Lagrangeans of the problems (1) and (2) in section 4.3 of the paper are:

$$L = \pi(p, w, z_1, z_2) + z_2 - \lambda_4(z_2 - Z(y,x)) \qquad \text{(II.1)}$$

and

$$L = p \cdot y - w \cdot x - \lambda_1(F(y,x,z_1) - \lambda_2(w \cdot x - A(z_2)) - \lambda_3(Z(y,x) - z_2) \qquad \text{(II.2)}$$

The Kuhn-Tucker conditions of the maximisation problem (II.2) are (see Chiang, 1984, pp. 722-755):

$$p - \lambda_1 \frac{\partial F}{\partial y} - \lambda_3 \frac{\partial Z}{\partial y} = 0 \quad (II.3a)$$

$$-w - \lambda_1 \frac{\partial F}{\partial x} - \lambda_2 w - \lambda_3 \frac{\partial Z}{\partial x} = 0 \quad (II.3b)$$

$$\lambda_2 \frac{\partial A}{\partial z_2} + \lambda_3 = 0 \quad (II.3c)$$

$$y \geq 0, \quad x \geq 0, \quad z_2 \geq 0 \quad (II.3d)$$

$$y\left(p - \lambda_1 \frac{\partial F}{\partial y} - \lambda_3 \frac{\partial Z}{\partial y}\right) = 0 \quad (II.3e)$$

$$x\left(-w - \lambda_1 \frac{\partial F}{\partial x} - \lambda_2 w - \lambda_3 \frac{\partial Z}{\partial x}\right) = 0 \quad (II.3f)$$

$$z_2\left(\lambda_2 \frac{\partial A}{\partial z_2} + \lambda_3\right) = 0 \quad (II.3g)$$

$$wx - A \leq 0, \quad Z - z_2 \leq 0 \quad (II.3h)$$

$$\lambda_1, \lambda_2, \lambda_3 \geq 0 \quad (II.3i)$$

$$\lambda_1 F = 0, \quad \lambda_2(wx - A) = 0, \quad \lambda_3(Z - z_2) = 0 \quad (II.3j)$$

The optimal allocation of output is determined by condition (II.3a). Coupled subsidies affect the optimal allocation of outputs through the relation $\partial Z / \partial y$, which is zero for decoupled subsidies. The optimal allocation of inputs is affected by subsidies through the shadow

price of the credit constraint (λ_2) and the degree to which subsidies are coupled to inputs ($\partial Z/\partial x$). Subsidies do not affect input allocation if firms are not credit constrained (i.e. $\lambda_2=0$) and if subsidies are decoupled from inputs ($\partial Z/\partial x=0$).

Next, we turn to the conditions of optimal allocation of subsidies, i.e. to the shadow price of subsidies. Two situations with respect to the degree of credit constraint are considered. Condition (II.3c) shows that the shadow price of the subsidy *equality* constraint is zero if the firm is not credit constrained *($\lambda_2=0$)* and is larger than or equal to zero for firms that are credit constrained (since it is assumed that $\partial A/\partial z_2 \geq 0$). Therefore, the optimal allocation of coupled subsidies depends on the degree to which firms are credit constrained. Decoupled subsidies introduced in function *G*(.) are allocated optimally only in case input output mix remains constant, short-term profit remains constant, so the shadow price is zero, but the *overall* profit increases by the level of subsidies. This situation is plausible for the case of no liquidity constraint.

Assuming producers maximise short-term profit (1a)-(1d), an expression for the value of shadow price of subsidies ($\partial \pi/\partial z_2$) is found by differentiating (II.1) to z_2:

$$\frac{\partial \pi(\cdot)}{\partial z_2} = \frac{\partial L}{\partial z_2} = \lambda_2 \frac{\partial A(\cdot)}{\partial z_2} + \lambda_3 \qquad \text{(II.4)}$$

Note that the shadow price of subsidies determined by (II.4) is zero if (a) firms are not credit constrained and, (b) *y* and *x* are at their profit maximising values, i.e. λ_3 equals zero.

The Kuhn-Tucker conditions of the maximisation problem in (1a)-(1b) are:

$$\frac{\partial \pi}{\partial z_2} + 1 - \lambda_4 \leq 0 \quad (II.5a)$$

$$z_2 \geq 0 \quad (II.5b)$$

$$z_2 \left(\frac{\partial \pi}{\partial z_2} + 1 + -\lambda_4\right) = 0 \quad (II.5c)$$

$$z_2 - Z = 0 \quad (II.5d)$$

$$\lambda_4 \geq 0 \quad (II.5e)$$

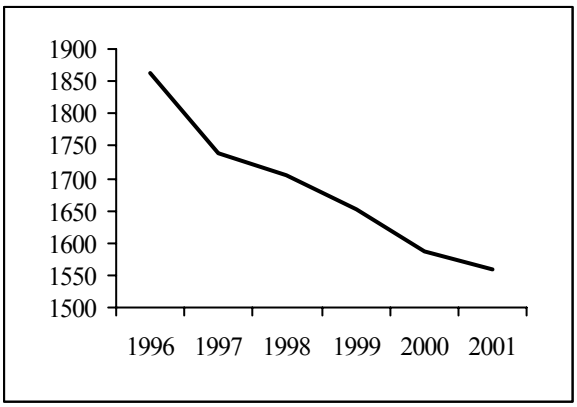
$$\lambda_4 (z_2 - Z) = 0 \quad (II.5f)$$

Conditions (II.5) determine the optimal allocation of subsidies and show that, in the optimum for $G(\cdot)$, and consequently for $\pi(\cdot)$, the shadow price of subsidies $\partial \pi/\partial z_2$ is minus one

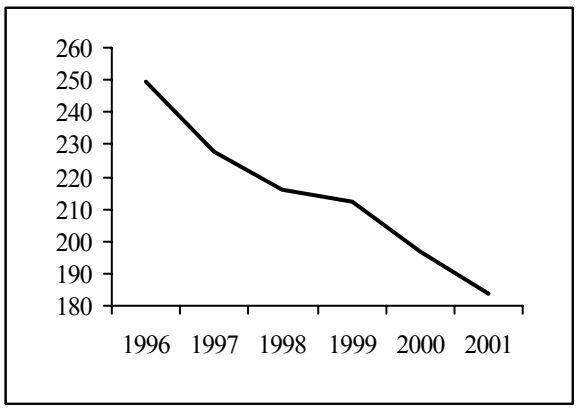
if (a) the firm is not credit constrained and (b) if subsidies can be obtained without any (e.g. maximum) constraint (λ_4=0). However, under the administrative conditions of the subsidy program the subsidies cannot be generated without any restriction by the farms. Given the fact that subsidies depend on quantities of *x* and *y*, the value of λ_4 is expected to be one, i.e. each additional unit of subsidy increases overall profit $G(\cdot)$ by one unit. Consequently, under the conditions of the subsidy programs in Russia, optimal allocation of coupled subsidies results in a shadow price of subsidies $\partial\pi/\partial z_2 \leq 0$ for firms that are not credit constrained. If the assumption that firms are credit constrained is true, the optimal allocation of inputs and outputs will be at the point where shadow price of subsidies is positive.

Appendix 4.3

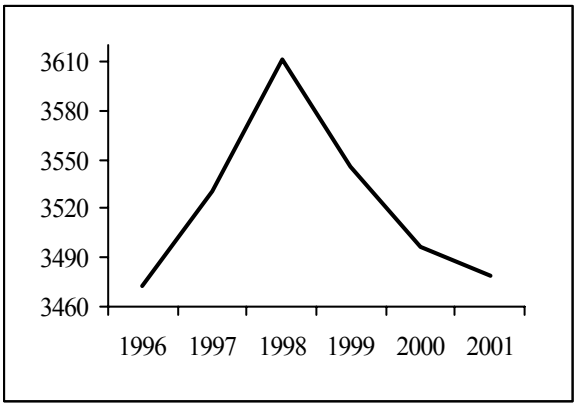
Graph A4.1 Data for the average specialised dairy farm (yearly weighted averages)



(a) livestock, standardised heads

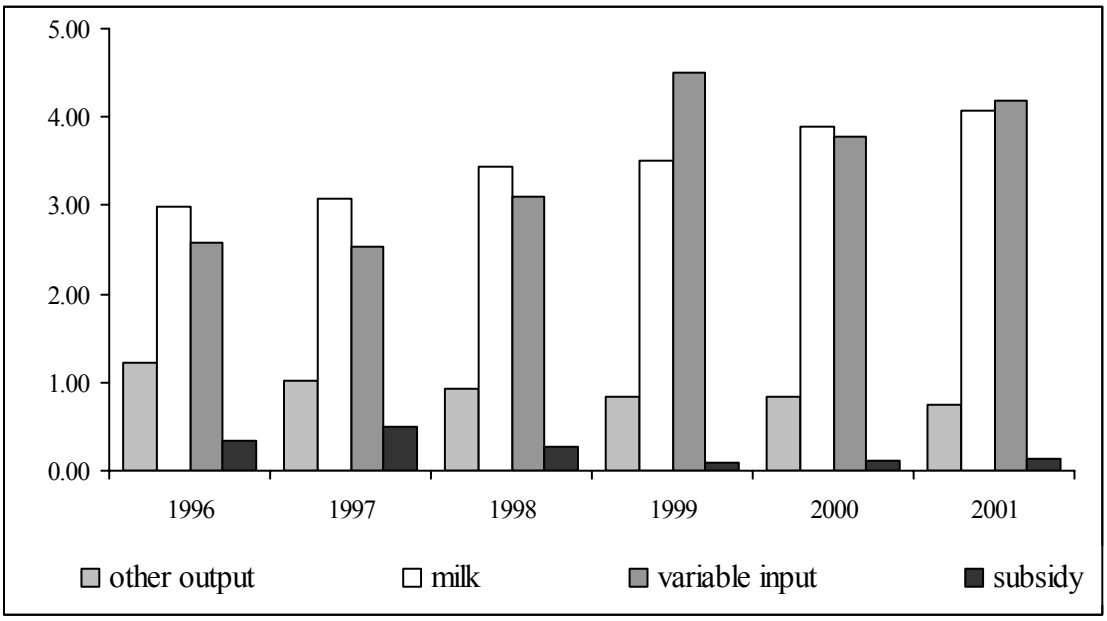


(b) labour, agricultural workers

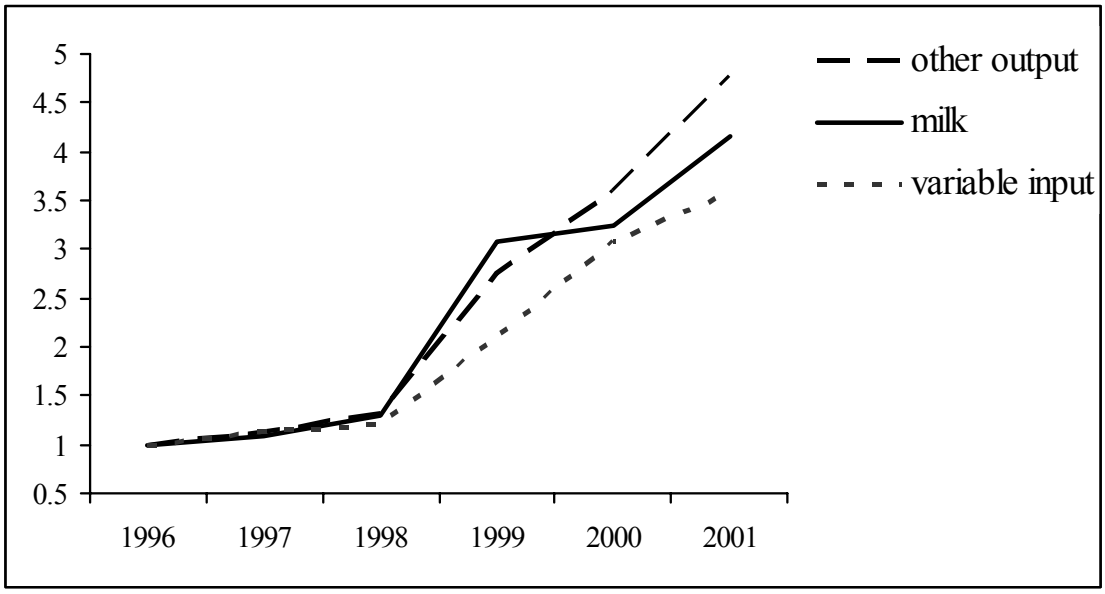


(c) agricultural land, ha

Graph A4.2 Means of milk and other output, variable input and subsidy, in 10^6 RUB of year 1996



Graph A4.3 Price indices development (year 1996=1.0)



Chapter 5
Effects of debt on Moscow-region dairy farm performance, 1996-2000

Abstract

To study the impact of debts on the performance of Moscow-area dairy enterprises, some concepts of finance theory were adjusted to the different structure of debts in Russia and to the presence of soft budget constraints (SBCs). A two-stage approach was used: technical efficiency scores from Data Envelopment Analysis were regressed on financial characteristics, the presence of SBCs, and a set of socio-economic factors, using a truncated regression model. The results suggested that SBCs have a negative, and accounts payable, a positive impact on performance.

Bezlepkina, I., A. Oude Lansink, and R. Huirne. Impact of debts in Russian agriculture: Application to Moscow region dairy enterprises, 1996-2000. Submitted to the *Agricultural Finance Review*.

5.1 Introduction

The reform of Russian agriculture begun in the early 1990s resulted in a substantial decline of agricultural production and productivity in the years thereafter (Osborne and Trueblood, 2002a; Svetlov, 2002a). Due to low profits (negative in 1996-1998), about 88% of agricultural enterprises accumulated outstanding debts in the period 1995-2000. The high indebtedness of agriculture is one of the main problems needing government action in Russia (see Federal law 83-F3 and 127-F3, Anonymous, 2002b, 2002a).

Despite mounting debts and blocked bank accounts of indebted farms (see Manellya, 2002) limiting regular activities[1], producers continue dealing with suppliers and even credit providers. This paradox is closely linked to the presence of soft budget constraints (SBCs) i.e. routine loan forgiveness (see Kornai, 2001). It remains an open question whether the accumulation of debts is a problem in itself or affects the performance of agricultural producers under debt-restructuring and subsidy programs. Highly indebted farms may not be aware of the impact of debt burden, since they are mostly concerned with their current problem of low (negative) profits. It is important to discover whether farm management plays a more decisive role in solving the debt problem than governmental action does (e.g. debt restructuring, subsidizing). If so, policy-makers should approach the problem through improving farm management.

In examining the impact of debts on performance, this paper considered different sources of debts (banks, state, suppliers), the differential role of debts in poorly and well performing enterprises, as well as the role of SBCs. Since the financial theories used in this study to explain the debt-performance relation mainly refer to corporate management, the degree of pure technical efficiency (PTE), an indicator of managerial efficiency, was used as the performance indicator. In transition economies the positive relation between farm size and performance is related to the quality of management rather than to the relationship between size and performance *per se* (Gorton and Davidova, 2004). Therefore the PTE, which is free of inefficiency due to non-optimal scale, was preferred. Moreover, unlike other profitability measures, PTE has the advantage of being independent of the market environment (i.e. prices) which is beyond the control of management. In addition, technical efficiency analysis provided more insight into overall performance of farm enterprises than did other regional studies[2]. The em-

[1] The utility monopolies (e.g. electricity, gas companies) apply "cut-off" strategy until the bills are paid (see Yastrebova, 2002).

[2] Much of the work on efficiency in Russian agriculture has been limited to the analysis of aggregate regional data (Sotnikov, 1998; Sedik *et al.*, 1999; Arnade and Gopinath, 2000; Voigt and Uvarovsky, 2001).

pirical analysis focused on panel data from dairy enterprises in the Moscow region over the period 1996-2000.

The paper is organized as follows. The next section reviews theoretical financial concepts (agency cost, free cash flow, credit evaluation concept and adjustment concept). Referring to developments in Russian agriculture, Section 5.3 shows how financial concepts should be adjusted for the case of agriculture in Russia. The methodological approach of two-stage modelling is presented in Section 5.4. Section 5.5 summarizes the data and presents the description of variables. Section 5.6 presents the research findings. Conclusions are found in Section 5.7.

5.2 Financial concepts and firm performance: theoretical background

Many studies of debt structure and its relevance to performance (or conversely) are found in the empirical corporate finance literature (see for example McConnell and Servaes, 1995; Hovakimian *et al.*, 2004). The seminal work of Modigliani and Miller (1958) on the irrelevance of debt structure to firm value has prompted numerous continuations in the literature addressing its strong assumption of perfect capital markets. Economics literature provides arguments for a negative as well as positive impact of high indebtedness on firm performance. Empirical evidence on the relation between debt and various performance measures is summarized alphabetically in Table 5.1.

The costs associated with debts provide an explanation for the debt-performance relation. The negative relation is associated with inefficiency due to increased costs. The agency cost concept originated by (Jensen and Meckling, 1976) hypothesises that monitoring, bonding, and adverse incentive costs are incurred in a borrower-lender relationship in order to resolve problems of asymmetric information between the two parties (see also Barry *et al.*, 1995). An increase of debts also results in an increased probability of bankruptcy, which is costly to firms (Baxter, 1967), and in higher interest costs. However, the costs are lower due to the tax benefit from the tax-deductible interest (see Graham, 2000), suggesting a positive effect of debts on performance.

A firm's investment opportunity and managerial effort offer an alternative interpretation of the relation between debt and performance. When firms have a few positive net present value projects, i.e. have lower investment opportunity, debt prevents managers from starting projects with a negative net present value (McConnell and Servaes, 1995). This concept, known as "free cash flow" (Jensen, 1986) posits a disciplining role for debts, and also sug-

gests a *positive* impact of debt on performance in case a firm has low investment opportunities, and a negative one in case there are many investment opportunities. Harvey *et al.* (2004) argued that the separation of insider control and ownership, rather than the investment opportunity, is the root of the agency problem. These authors stress that actively monitored debt creates value for shareholders of firms that face potentially extreme agency costs associated with misaligned managerial incentives and overinvestment.

Table 5.1 Overview of debt-performance relation

Study	Country, period	Sector	Performance measure	Effect of debts
Fu *et al.* (2002)	Taiwan, 1992-1997	small business	profitability	negative
Hadley *et al.* (2001)	England and Wales, 1984-1997	agriculture	technical efficiency	negative
Harvey *et al.* (2004)	18 countries in emerging markets	non-financial firms	value of firm	positive for firms with potentially high managerial agency costs
Holz (2002)	China, 1993-1999	industry	profitability	positive
Konings *et al.* (2002)	Bulgaria	industry	total factor productivity	negative
McConnell and Servaes (1995)	USA, 1976-1988	industry	value of firm	negative for firms with potentially high growth opportunities
Nasr *et al.* (1998)	USA, 1988-1994	agriculture	technical efficiency	positive
Paul *et al.* (2000)	New Zealand, 1969-1991	agriculture	technical efficiency	negative
Schulze *et al.* (2001)	Russia, 1999	agriculture	profitability	no effect
Sotnikov (1998)	Russia, 1990-1995	agriculture	technical efficiency	negative
Whittaker and Morehart (1991)	USA, 1987	agriculture	cost efficiency	no effect or small negative

Source: own presentation.

Agricultural bankers often use efficiency variables (i.e. operating costs per acre, yield per acre, profit per cow, etc.) along with various financial variables in evaluating creditworthiness (Barry *et al.*, 1995). The "credit evaluation" concept suggests that lenders prefer to finance more efficient farmers because these borrowers are lower credit risks (Ellinger *et al.*,

1992; Nasr *et al.*, 1998). Thus this concept entails a *positive* relationship between debt and performance, although the underlying causal relation may be the opposite of that.

Paul *et al.* (2000) hypothesised that under reforms and a transition to a less subsidized agriculture, farmers with a low debt-to-asset ratio more easily adjust the farm operation and are more efficient. This adjustment concept suggests a *negative* debt-performance relation.

Following these theories, different relations between debt and performance of firms can be expected. However, the hypotheses themselves are not mutually exclusive and lead to difficulty in pinpointing the exact relation between debt and efficiency (Hadley *et al.*, 2001). Various studies use the value of a firm (Tobin's Q), profitability or technical efficiency as performance indicators.

5.3 Application of financial concepts to Russian agriculture

This section raises a number of issues that are relevant to the application of financial theories to Russian agriculture under the condition of soft budget constraints.

The indebtedness of enterprises has been a problem from the beginning of reforms in many sectors of the Russian economy, and was particularly severe in the farming sector (Manellya, 2002; Yastrebova, 2002).

Table 5.2 Debts in agriculture (at the economy level, i.e. including services)[1)]

	1995	1996	1997	1998	1999	2000	2001
Total debts to pay, 10^9 RUB of 2001	262	341	438	515	316	287	278
Total debts to receive, 10^9 RUB of 2001	61	60	64	73	54	48	49
Total net profit, 10^9 RUB of 2001	14	-92	-100	-131	26	21	26
Percentage in total debts to pay[2)], %							
on short- and long-term credits and loans	40	31	23	18	16	16	19
to suppliers	18	20	21	23	22	21	19
to the budget (taxes) and off-budget funds (social security payments)	8	20	27	34	37	37	35
Percentage of enterprises with outstanding (> 3 months) debts in total number of enterprises in agriculture, %	89	87	89	90	90	89	n.a.

[1)] National statistics provides data on debts only for the aggregated category of agricultural enterprises and service providers.

[2)] Debts on wages, promissory notes, to other providers of short- and long-term loans add up to 100%.

Source: own calculations based on Goskomstat (2002) and Manellya (2002).

Table 5.2 presents several variables illustrating the debt situation in Russian agriculture. On average, agricultural enterprises failed to collect approximately 32% of their revenues from customers in the period 1995-2001, which suggest that farms have severe problems in managing their debts. Nevertheless, it does not explain the high level of farm debts (to banks, suppliers, state), exceeding the level of debts from buyers 4-7 times. Having no resources to repay debts due to low profits (losses in 1996-1998), the enterprises encountered solvency problems. A low debt repayment capacity resulted in accumulation of large amounts of outstanding debts.

It is remarkable that the type of debt differs from that in Western agriculture where most debts are owed to commercial (agricultural) banks. Starting in 1996, when agricultural enterprises in Russia experienced losses for the second time since the beginning of reforms, the proportion of debts to the state increased. Creditors cannot determine the creditworthiness of a borrower having a high debt-to-asset ratio, since it indicates large debts to suppliers and the state, rather than to banks (Table 5.2 and 5.4). However, debts to banks in Russia are not similar to the type of debts analyzed in financial theories. This is because credit relations in Russia are established with agro-banks, which are appointed by the government and issue loans from state funds often on softer conditions[3] (see also Yastrebova, 2002; Serova, 2003a).

That the largest part of debts in Russian agriculture is owed to the state signals the presence of soft budget constraints (SBCs) that are often imposed by tax authorities in transition countries (see Schaffer, 1998). The presence of SBCs is also confirmed by the fact that non-profitable activities are also subsidized (see Bezlepkina *et al.*, 2004b) and that, on average in the period 1997-1999, worse performing farms received more subsidies (Uzun, 2002). This is in line with the concept of Kornai-type subsidies, i.e. granting subsidies to loss-making firms in order to guarantee their survival[4]. Debt restructuring programs have been due since 1994 (see Serova, 2003a). It may be assumed that the decline in net debts by 10 billion RUB in

[3] Despite their indebtedness, the regional administrations grant credits also to indebted farms to use the regional quota for credit resources available from the Special Credit Fund established in 1997 (Yanbykh and Yastrebova, 2002).

[4] The subsidy is paid ex post, after the state observes the firm's losses, and can take a variety of forms, e.g. direct budgetary subsidy, an injection of credit from the state or another institution, or a reduction in tax rates (Schaffer, 1998). In Kornai's analysis, the cause of the SBC is state "paternalism". The state will rescue a failing firm because it is unable to accept the social consequences (e.g. unemployment) of its closure.

2001 was also largely due to writing off debts, as profits increased by only 5 billion RUB (see Table 5.2).

Although Russian agricultural enterprises are categorized as corporate firms, typical characteristics of Russian agriculture render financial theories developed and tested for market economies. These characteristics are (a) poor credit market institutions; (b) excessive debt and prevalence of non-bank debts (see Table 5.2); (c) weak bankruptcy procedures; (d) Kornai-type subsidies and (e) soft budget constraints. Absence of bankruptcy threat[5] and the possibility of renegotiating debts or receiving subsidies are effects of SBCs which loosen financial discipline and lower firm competitiveness (Kornai, 2001). Therefore it is important to take SBCs into account in studying the debt-performance relation in Russian agriculture.

Since the application of financial theories to Russian agriculture is so difficult, *a priori* expectations as to the effect of debts on performance are unclear. Different sources of debt might reveal different ways of influencing managerial efforts. Apart from there being different groups of creditors, debt structure involves the distinction between short-term obligations (to finance production and marketing) and long-term obligations (to finance fixed assets). It is expected that short-term debts are more strongly related to performance because they are related to production and finance decisions (Nasr *et al.*, 1998). Thus, it is reasonable to discriminate between debts to different creditors and take into account short-term versus long-term debts.

5.4 Methodology

5.4.1 Managerial performance: DEA pure technical efficiency

Data Envelopment Analysis (DEA) is a non-parametric method that uses a piece-wise linear convex hull approach for frontier estimation. A firm is fully efficient if it lies on the frontier. Various efficiency measures can be derived from linear programming (LP) models. Since the financial theories used in this study to explain the debt-performance relation mainly refer to corporate management, the degree of pure technical efficiency (PTE), as managerial efficiency, is used as the performance indicator. The value of PTE for each farm can be com-

[5] Prior to enactment of the federal law "On bankruptcy" (Anonymous, 2002a) and "On financial recovery" (Anonymous, 2002a), only about 5% of agricultural enterprises were bankrupt at the end of 2000, 58% of which were declared bankruptcies (Minselkhoz, 2004b), while in 1999-2000 about 25% of all Russian farms were close to bankruptcy (Uzun, 2002).

puted from a standard LP model, assuming variable return to scale (see e.g. Fare *et al.*, 1994). Agricultural enterprises in Russia inherited their large scale from the pre-reform period and were not able to adjust their scale to optimal size due to social reasons (for example, to avoid social conflicts when reducing the labour force). Therefore PTE is more appropriate for the purposes of the analysis because it is free of inefficiency due to non-optimal scale (scale inefficiency).

The linear programming problem must be solved for each firm in the sample. The DEA technique allows for both input and output orientation. In this study an input- oriented model with the objective of producing the observed outputs with as little inputs as possible is used (Fare *et al.*, 1994). This is because under the planned economy, agricultural enterprises had to comply with output targets even at the cost of inefficient use of resources. Often the current situation is therefore compared to the pre-reform period.

With limited options of state support in input supply it can be assumed that enterprises will try to minimize costs to achieve pre-reform output levels. Earlier studies of Russian agriculture point to overuse of fixed inputs such as land and workers (e.g. Sedik *et al.*, 1999; Liefert and Swinnen, 2002). Using an input orientation makes allowance for input slacks caused by slow adjustment of inputs.

5.4.2 Two-Step Empirical Model

In the second stage, the pure technical efficiency is regressed on financial characteristics such as debt-to-asset ratio (with total debts broken down by creditor), soft budget constraints, and other socio-economic farm characteristics. Non-parametric DEA efficiency analysis only recently gained some statistical inference by means of smooth bootstrapping (Simar and Wilson, 2000), which in practice is not yet widely applied due to its burdensome calculation. This study primarily focuses on the second-stage regression using efficiency analysis as an instrument for determining the level of managerial efforts. Therefore the lack of statistical inference for efficiency scores is not considered a problem. A problem arises with this approach in the second-stage regression, because the efficiency scores lie in the boundary (0; 1]. Thus, ordinary least square estimates are inconsistent. To overcome the problems of data censoring (Greene, 2000), a Tobit regression model is used extensively (see Nasr *et al.*, 1998). However, more recently it has been argued that the problem in the second-stage regression is a truncation rather than censoring problem (Simar and Wilson, 2003). The censoring problem is that some data are not observed, whereas in case of DEA efficiency scores, the observations

with negative values and values greater than 1 do not exist. This study employs the truncated regression model (see Greene, 2000). The choice of socio-economic indicators is explained in Section 5.5.2.

5.5 Data

5.5.1 Data source

Panel data of large-scale specialized dairy farms in the Moscow region were obtained from data on Russian farms collected by the State Statistical Committee (*Goskomstat*)[6]. The sample of specialized dairy farms included farms for which marketable milk production made up more than 2/3 of agricultural revenue. The unbalanced panel set contained 688 annual observations from 130-144 farms over the period 1996-2000.

On average, in the sample agricultural land amounted to about 3200 ha, the average number of employees per enterprise was 250 and there were about 800 dairy cows. On these farms, on average 72% of revenue came from milk and 12% from beef production. The amounts of other livestock production (egg, pork production) and cultivation (potato, grain, vegetables and other) were 7% and 9%, respectively.

5.5.2 First-stage variables

Five inputs and two outputs were distinguished in the first stage calculation of technical efficiency. Outputs were milk and others (beef, pork, poultry meat, eggs, cereals, potato, vegetables). Variable input represented aggregated input costs for marketable output. Implicit quantities of variable input and the two outputs were obtained as the ratio of costs and revenues and their price indices. Price indices for milk and variable inputs were taken from national statistics (Goskomstat, 2002). The Tornqvist price index (Coelli *et al.*, 1998) was calculated for other output category on the basis of national price indices and composition of this category on individual farms. Price indices varied over years but not among farms, implying that differences in the quality and composition of inputs and outputs were reflected in the quantity. Other inputs in the first stage were labour, land, capital, and livestock.

[6] The description of data collection can be found in Goskomstat (1996). The complete overview of farm accounting forms and the correspondence of variables among the forms can be found in Minselkhoz (2000).

Land was measured in hectares of sown land, labour as the number of farm employees in agricultural production, capital as the value of depreciation[7]. The livestock head-count complemented the measure of capital. The depreciation value was normalized by the regional consumer price index. Descriptive characteristics are presented in Table 5.3.

Table 5.3 Descriptive statistics of DEA-model variables

Variable	Mean	Std Dev	Minimum	Maximum
Milk, 10^3 RUB of 1996	3170	3435	148	29072
Other output, 10^3 RUB of 1996	949	1058	22	10005
Variable input, 10^3 RUB of 1996	3179	3683	153	33565
Labour, number of workers in agriculture	220	104	24	760
Sown and, hectares	2501	1234	138	9136
Depreciation, 10^3 RUB of 1996	446	491	15	5560
Heads of livestock	1687	928	237	7357

Source: own presentation.

5.5.3 Second-stage variables

Financial characteristics. This section presents measures of debt structure and defines a proxy for SBC. The data from balance sheets on debts were available in differing degrees of detail for the period 1996-2000. Debts were disaggregated by their maturity and creditors (see Table 5.4). The dynamics of debt composition (debts to the state, debts on loans to banks and others) was similar to the dynamics observed for all Russian farms (see Table 5.2). As seen in Table 5.4, short-term debts prevailed over long-term debts, with debt to suppliers being the largest component.

[7] This variable cannot fully resolve the potential problems with overvalued fixed capital widely discussed in the literature (for example see Lissitsa and Odening, 2001; Voigt and Uvarovsky, 2001), but has the advantage of reflecting the costs of fixed capital involved in the production of the earlier- defined marketed outputs.

Table 5.4 Debt structure of Moscow region dairy enterprises in 1996 and 2000

	In % to total debts		In % to each subcategory	
	1996	2000	1996	2000
Total debts:	100	100		
Long-term debt:	18	10	100	100
to banks	17	7	96	66
on other loans	1	3	4	34
Short-term debts:	82	90	100	100
to banks	3	2	17	25
on other loans	15	4	83	75
Accounts payable:	64	84	100	100
to suppliers	33	43	53	52
to employees	8	4	12	4
to social funds	5	13	8	15
on tax	9	19	14	23
to others	8	5	13	6

Source: own presentation.

In finance literature, debt structure is usually represented by the ratio of total debt and total assets (total debt ratio) or current debts to total assets (current debt ratio) (see e.g. Barry *et al.*, 1995). The problem of different repricing methods for different assets is noted in Pederson *et al.* (1998) for the earlier period 1993-1994. As follows from Table 5.5, current and fixed assets depict different development in the period 1996-2000 when the Consumer Price Index is used as a deflator. This is because current assets (accounts receivable and inventories) were valued at current prices, whereas fixed assets are restated using other pricing methods (historical or book). Due to this it has been observed that farms reported not only increases in capital stock from year to year – which implies the use of inflators from the Ministry of Finance (see Goskomstat, 2004b) – but also decreases. This decrease in capital values was observed in the later years, after it was realized that costs of capital were overinflated and therefore enterprises started to evaluate their assets with the help of experts. The inconsistency in total assets among enterprise balance sheets could also be due to incomplete reporting of the values of leased land, since it was noted in the data that only a few farms reported the values of their land on the balance sheet. Table 5.5 presents values of debts, assets and debt-asset ratios.

Table 5.5 Assets and liabilities (beginning year) of sample enterprises

	1996		2000	
	Average	St.dev.	Average	St.dev.
Total liabilities, 10^6 RUB of 1996	1813	1301	2027	2536
Total assets, 10^6 RUB of 1996[1)] :	81020	45781	17083	14680
fixed	77729	44395	13417	11302
current	3291	2132	3666	5798
Profit before tax, 10^6 RUB of 1996	-815	2374	969	2482
Liabilities to total assets	0.03	0.02	0.15	0.14
Liabilities to current assets	0.60	0.38	0.76	0.65
Liabilities to total sales	0.63	0.72	0.71	0.91

[1)] The national average index for fixed assets in agriculture is not available. Consumer Price Index (CPI) is used to deflate the assets. The enterprises used other indices differentiated by categories of assets, purchase year, etc. (see Goskomstat, 2004b).

Source: own calculation.

Although the average total debt ratio was relatively low, debt management and repayment problems existed for some enterprises. This is revealed by the total debt-to-sales ratio, indicating the number of years required to repay the existing debt, based on current sales. Total liabilities-to-net profits ratio is also often used in finance literature (Barry *et al.*, 1995), but is less applicable to Russian farms that are frequently characterised by negative ratios. A negative debt-to-profit ratio implies that given current profits, the farms are never able to repay their liabilities (Pederson *et al.*, 1998). Ratios of debt to current assets or to total sales indicated a growth of debts in the period 1996-2000, although the growth was smaller than when total assets are used. Current debt ratio was measured more accurately than total debt ratio and was therefore used in the further analysis.

Accounting for the presence of SBCs was necessary to separate their effect from the effect of debt structure. Following (Schaffer, 1998), one cannot conclude that firms have SBCs simply because they continue to make losses, even several years in a row, or because they have large overdue debts. Firms can make losses, or have large debts in arrears, and still have hard budget constraints as long as neither their creditors nor the state rescue them with continual injections of cash or subsidies.

Following (Schaffer, 1998), we defined farms in *economic* distress as farms with a negative value of sales profit plus depreciation, whereas farms in *financial* distress were those with a negative value of profit before tax (*PBT*). A dummy variable indicating the presence of

SBC was constructed in such a way that it took value 1 if a farm found itself in both financial and economic distress and if the inflow of total debts, corrected for accounts receivable, exceeded the outflow of debts. Implicitly, the state subsidy policy was taken into account by the SBC dummy, because the *PBT* accounts for subsidies (except those granted due to extraordinary situations such as weather or pest disasters). Therefore, it is assumed here that under SBC the subsidies are granted to loss-making farms. For Moscow region dairy farms, this assumption is justified because (a) the main part of subsidies is granted to livestock production, which is unprofitable; (b) about 80% of subsidies came from regional budgets, so they were more likely the subject of negotiations between managers of loss-making farms and regional government; and (c) the average ratio of subsidies to revenue was approximately twice as high for economically (financially) distressed farms as it is for other farms. About 65% of dairy farms in the sample were operating under SBCs in 1996-1998. In 1999, this percentage dropped substantially, to 10%.

Socio-economic farm characteristics. While this study focuses on the relationship between farm efficiency and financial indicators, it is important to account for the potential effects of other factors on efficiency (see also Sotnikov, 1998; Sedik *et al.*, 1999; Voigt and Uvarovsky, 2001). Efficiency is likely to be determined by the degree of employee motivation and effort, which can be measured indirectly via the level of wages[8]. Having recognised that wages in Russian agriculture are very low, different studies argued that increasing wages could provide the necessary incentive for employees to improve their productivity (Schulze *et al.*, 2001; Voigt and Uvarovsky, 2001; Bezlepkina *et al.*, 2004a). *Wages per worker* corrected for wage arrears partly accounted for employee effort. *Soil rating* delineated soil qualities in the Moscow region as to differences in soil typography, uniformity, drainage, fertility and other attributes. It is likely that farms with a higher soil rating also exhibit a higher level of efficiency, which however could partly reflect only the use of better production methods. The *distance from the city of Moscow to farms* reflects access to urban markets. In this study it was hypothesized that farms located closer to urban Moscow were more efficient (the farthest farm is located 163 km away) because they have lower transport/transaction costs[9]. Following (Voigt and Uvarovsky, 2001; Bezlepkina *et al.*, 2004a), the number of employees in agricul-

[8] It is widely acknowledged that farm employees enjoy other benefits resulting from the relation between subsidiary households and enterprises (Pallot and Nefedova, 2003b), such as inputs from the mother-enterprise at lower cost.

[9] For the sample farms, cost of fuel contributes 12% on average to variable inputs cost (data of 1995).

ture was used as a size variable. In this study, a negative relation between size and managerial efficiency was expected, implying difficulties in managing large enterprises.

About 20% of the farms in the sample had milk processing facilities (often pasteurization). It was expected that farms having processing facilities at their disposal would be more flexible in choosing marketing strategy and thereby be more efficient. Therefore, *percentage of processed milk* (in kg of raw milk) was introduced as a farm characteristic. Dummy variable for *ownership* type had a value 1 for farms in private ownership and 0 otherwise (municipal, state, mixed). It was expected that farms in private ownership would be more efficient because shareholders might make more effort to discipline farm management. On the other hand, noting that ownership regulations hardly function in Russia (Liefert and Swinnen, 2002), shareholders "on paper" may not make any such efforts but rather only exploit the opportunistic behaviour of management.

5.6 Results

Pure technical efficiency was calculated using OnFront 2.0 (Fare and Grosskopf, 2000) for each year and each farm, assuming a separate frontier for each year. Other measures such as overall technical efficiency at various returns-to-scale and scale efficiency are presented in Appendix (Table A5.1 and A5.2).

To summarize the results of technical efficiency analysis, it could be concluded that even though the efficiency scores were relatively high due to homogeneity of the sample, the percentage of farms with efficiency scores of unity was rather low (see Table A5.1 in Appendix). Evolution of efficiency scores for the period 1996-2000 reflected efficiency improvement after the financial crisis of year 1998. Since the scale efficiency (SE) was higher than pure technical efficiency (PTE), it indicated that it was poor management which lowered overall technical efficiency rather than operation at inefficient scale. Over the whole period the farms mostly operated at increasing returns-to-scale (IRS). A decreasing fraction of farms operating under decreasing returns-to-scale (DRS) indicated that the farms were becoming bigger. However, since the farms actually continued declining in size, finding fewer farms under DRS implied that over time the optimal size of the enterprises was getting smaller. Enterprises were not adjusting their size accordingly with respect to these changes in optimal size.

The benchmark truncated regression model included the financial ratios derived relative to current assets with the nominators being debts by the type of credit provider and by debt

term (see Table 5.4). The estimates of financial ratios were not significant for either of the ratios and are not reported here. Instead of omitting any insignificant financial variable, aggregated ratios were used. The nominators of several financial ratios were aggregated resulting in an aggregate of long-term debts, short-term debts to credit institutions and accounts payable. This resulted in the estimates reported in Table 5.6. To account for the panel data, year dummy variables were introduced.

Table 5.6 Truncated regression: PTE as dependent variable

	Model I		Model II	
	coefficient	t-value	coefficient	t-value
Total debts to current assets			0.054	4.22
Long-term debt on loans to current assets	0.202	3.36		
Short-term debt on loans to current assets	-0.039	-0.58		
Accounts payable to current assets	0.041	3.04		
Dummy SBC	-0.032	-2.38	-0.033	-2.40
Wages	0.032	10.28	0.033	10.24
Percentage of processed milk	0.094	2.53	0.088	2.34
Soil quality	0.049	1.68	0.050	1.67
Distance	-0.062	-4.15	-0.060	-3.99
Size	-0.116	-2.20	-0.116	-2.16
Dummy ownership	0.004	0.23	0.005	0.34
Dummy year 1997	0.049	2.75	0.046	2.54
Dummy year 1998	0.027	1.50	0.025	1.43
Dummy year 1999	0.070	3.32	0.067	3.23
Dummy year 2000	0.061	2.96	0.058	2.89
Constant	0.715	15.37	0.711	15.33
Number of observations	688		688	
Log likelihood	979		974	

Source: own presentation.

Two models are presented, with the total debts-to-current assets ratio[10] (Model II) and by its decomposition (Model I). The presence of SBCs negatively influenced managerial per-

[10] The models with alternative debt ratios, namely debts-to-total-sales ratios, produced similar estimates, giving extra solidity to the results.

formance. That is, receiving external finance (including subsidies) while having negative profits was not conducive to managerial incentive in the enterprise. The results of both models suggested that debts, which were mainly the loans from suppliers in the form of trade credit (see Table 5.4), were positively related to managerial efficiency. If management had a relatively good reputation suppliers would usually continue to provide inputs in spite of existing debt levels being high at the beginning of a year relative to current assets. In addition, the positive estimate of accounts payable can be observed in case the debts to suppliers have a "hard" nature and thus discipline the management. This result is in line with the studies advocating Jensen's free cash flow concept and its modifications (McConnell and Servaes, 1995; Nasr *et al.*, 1998; Harvey *et al.*, 2004). In other words, it might be more harmful for enterprises to lose their suppliers in case they have a poor reputation, than to have no access to bank loans. This explanation is valid since the nature of debts ("bad" or "commercial") was accounted for under the SBCs dummy variable.

The significantly positive relation between long-term debts and managerial efficiency was interpreted in a similar way, although long-term debts likely served as investments rather than to finance current production. The parameter estimate associated with indebtedness on short-term loans was not significant at the critical 5% level.

The wage coefficient corrected for wage arrears was positive in both model specifications. Average national wages in agriculture in 1996-2000 were slightly more than 50% below the average wage level in the Russian economy and almost 70% below the level in industry (Goskomstat, 2002). Although employee incentive was also determined by other benefits besides wages (see Pallot and Nefedova, 2003b; Gorton and Davidova, 2004), the results showed that higher wages and/or lower wage arrears improved the performance of employees.

The percentage of processed milk and soil quality had a significant and positive effect (at the 10% significance level for soil quality) on performance. Better soil quality resulted in better performance through higher quality of grazing pastures, which are important in dairy production. As the results demonstrated, access to processing facilities helped operators improve their performance by lowering costs of transportation of milk to dairies or more attractive urban markets. The negative impact on performance of transport distances to Moscow was directly explained by higher transport costs. Indirectly, it could be a result of less beneficial relations between the farm managers and regional authorities where farms are further away from Moscow. This is because land in remote areas has lower opportunity costs in comparison with land near Moscow.

The parameter associated with size was significant (at 5%) and negative in all regressions, implying that farm management was more efficient on smaller farms. This means that farms with a smaller number of workers showed better performance. The finding that some dairy farms were too large, or used resources less than optimally to be able to enjoy the benefits of economies of scale was supported by the results for scale efficiency (see Table A5.2 in the Appendix 5.1).

The most noticeable change in the distribution of farms by returns-to-scale was observed after 1998, the year of financial crisis. The results for the year dummies indicated a significant positive impact of financial crisis on efficiency. The ownership dummy estimate was not significant (at 5%), possibly due to unsuccessful restructuring that failed to change the internal farm organization (Macours and Swinnen, 2000a; Liefert and Swinnen, 2002).

5.7 Discussion and conclusions

This paper analysed the role of debts on farm performance for a sample of dairy enterprises in the Moscow region over the period 1996-2000. Studying the impact of debt on firm performance in a transition economy was complicated by the existence of soft budget constraints and the different nature of debts there. Unlike in western economies, in Russia the main (trade) credit providers are suppliers and the state. While the negative impact of debts on efficiency in other studies is explained by the negative role of the SBCs (for example see Sotnikov, 1998; Konings *et al.*, 2002), their presence was directly revealed in the empirical analysis in this paper by introducing a SBC dummy variable. Unlike in the study by Nasr *et al.* (1998), debt was reflected by the ratio of debt to current assets (and total sales) rather than to total assets. This was meant to provide a more accurate reflection of the debt situation in the enterprises, since fixed assets were poorly measured in Russian agriculture.

A positive effect of debt payables on managerial performance was observed. Since the relation between suppliers and producers seemed vital to farming, the positive relation between debts and performance might be explained by a stronger discipline imposed by the suppliers. In other words, it might be more harmful for the enterprises to lose their suppliers because of a poor reputation rather than to lose access to bank loans. This finding coincided with arguments provided in finance literature, where debts exhibit a positive effect when high (agency) costs are expected due to missing managerial incentives (see Harvey *et al.*, 2004). The positive impact of accounts payable on performance was eliminated from the overall

negative impact of the SBCs, which revealed in the significantly negative estimate of the SBC dummy variable.

One of the policy implications for finding the negative role of excessive financing of loss-making farms, i.e. of SBCs, is that the state should define measures for improving farm governance. Hardening SBCs would imply fewer and smaller subsidies to highly indebted farms, strengthening the threat of bankruptcy, and eliminating soft bank loans and soft taxation. Removing soft budget constraints or even bankrupting highly insolvent enterprises would require state support to accommodate the redundant labour force (see also Serova, 2003a).

The managerial efficiency of dairy enterprises was positively affected by the working environment, defined in this study as higher wages and lower wage arrears. This potential key to efficiency improvement should not be overlooked by either farm managers or policy-makers. A remote enterprise location (possibly due to lower opportunity costs of land) and large scale negatively contributed to managerial performance. The calculations of technical efficiency measures at different returns-to-scale assumptions resulted in finding fewer farms with DRS. Even though enterprises continued declining in size in the period 1996-2000, over time the optimal size of enterprises also became smaller, so enterprises were not adjusting their size accordingly, given the change in optimal size.

In transition economies, the positive impact of farm size on performance is related to the quality of the management rather than to the relationship between size and efficiency *per se* (Gorton and Davidova, 2004). Therefore using the PTE measure, which was adjusted for the inefficiency caused by size effect, is preferred. The results suggested that, ceteris paribus, larger enterprises were more difficult to manage. It should be noted that the different indicators of technical efficiency presented in this study may be overstated because only the marketable part of production is analysed. It is rather likely that farms market outputs of better quality and thus enjoy higher revenues per unit. This overvaluation of output can, however, cancel out non-reported values of output exchanged in barter transactions[11].

The sample of farms used in this study was rather homogeneous by construction, so it was not surprising to find higher efficiency scores here in comparison to studies performed at the regional level (for example see Sotnikov, 1998; Sedik *et al.*, 1999; Arnade and Gopinath, 2000). Although the PTE was rather high for most dairy enterprises, the results were consistent with other studies of dairy farms in the Moscow region. By means of cluster analysis,

[11] The percentage of barter became much smaller in the later years of transition.

Bezlepkina *et al.* (2004a) classified 10% of these farms as successful in 2001. In this study, overall technical efficiency (TE) classified 16% of the dairy farms as overall technically efficient in the period 1996-2000. Both methods, cluster analysis and TE, accounted for scale inefficiency.

Although the PTE is less applicable in real life (for example in bank-borrower relations), unlike widely available profitability measures, it has the advantage of being independent of the market environment which is beyond the control of management. For example, price variability due to output quality or marketing channel has a direct impact on revenues and costs, and thus on profitability, which therefore does not fully indicate managerial effort. Using profitability measures in debt-performance analysis, Holz (2002) showed the disadvantage of this measure as an accounting concept, in that it does not necessarily reflect efficiency levels as much as economic or redistributive policies, and this suggests therefore the wisdom of using efficiency instead. Moreover, the PTE is an alternative to a "financial index of well-being" (see Anonymous, 2003), which was introduced in all Russian agricultural enterprises in 2003 following the implementation of the Federal law "On financial recovery of agricultural enterprises" (Anonymous, 2002b). The financial index is limited only to the accounting data and signals liquidity problems, whereas technical efficiency measures also account for technical relations.

Appendix 5.1

Table A5.1 Breakdown of technical efficiency and percentage of fully efficient farms

Year	Overall technical efficiency[1)] TE			Pure technical efficiency PTE			Scale efficiency SE		
	Mean	St.dev.	% of farms with TE=1	Mean	St.dev.	% of farms with PTE=1	Mean	St.dev.	% of farms with SE=1
1996	0.85	0.10	18	0.88	0.09	58	0.97	0.05	19
1997	0.86	0.09	16	0.90	0.08	66	0.96	0.06	18
1998	0.81	0.10	10	0.85	0.10	60	0.95	0.06	11
1999	0.84	0.11	18	0.90	0.09	64	0.95	0.06	22
2000	0.88	0.09	18	0.91	0.08	72	0.97	0.04	20

[1)] TE=PTE*SE. Overall technical efficiency is a product of pure technical efficiency and scale efficiency (Fare *et al.*, 1994).

Source: own presentation.

Table A5.2 Number of farms at CRS (scale efficient), IRS and DRS (%)

Year	Farms at CRS	Farms at DRS	Farms at IRS	Total
1996	19	8	73	100
1997	18	14	67	100
1998	11	11	79	100
1999	22	25	53	100
2000	20	41	39	100

Source: own presentation.

Chapter 6
Analysing variation in Russian dairy farms, 1990-2001

Abstract

Russian dairy enterprises underwent dramatic changes during 1990-2001. Not much is known about the position of these enterprises under the new conditions. This study examined a sample group of dairy enterprises in the Moscow region to identify similarities and divergences in historical background, performance, managerial and structural characteristics. A unique farm-level data set from 1990-2001 was used. Assessment of historical characteristics revealed that the currently most successful enterprises were those which in pre-reform years had already shown better economic performance. These farms also had, for the period studied, smaller percentages of reduced resources, no severe debt problems, and better overall management.

Bezlepkina, I., R. Huirne, A. Oude Lansink, and A. J. Oskam. Analysing variation in Russian dairy farms, 1990-2001. Submitted to the *Journal of Agricultural Economics*.

6.1 Introduction

In the past decade, Russian agriculture has undergone transformations having an important impact on current settings in agriculture. Of particular interest are agricultural enterprises, *i.e.,* former collective (*kolkhoz*) and state (*sovkhoz*) enterprises (in contrast to other agricultural producers such as family farms or households). After reorganisation in 1992-95, there were still more than 24,500 agricultural enterprises (2001 data). The period 1990-2001 brought numerous changes, which in national statistics are averaged and do not reveal variations between enterprises.

A large body of literature focuses on the relation between the performance of Russian agricultural enterprises and their size (Epstein, 2001; Schulze *et al.*, 2001; Koester, 2003; Visser, 2003), debts, restructuring (Pederson *et al.*, 1998) and relations with state and urban service providers (Zeddies, 2000). Davidova *et al.* (2003) stress the need to identify long-lasting phenomena determining the current performance of farms in Central and Eastern European countries. The apparent importance of initial, *i.e.* pre-reform conditions has been investigated so far in multi-country studies (Macours and Swinnen, 2000a) and for Czech crop producers (Curtiss, 2002).

It is a well-established fact that economic performance can differ considerably between farms[1], even under more or less similar production conditions. Uzun (2002) found substantial differences in solvency of Russian agricultural enterprises. In general, this can be due to differences in management, which can be considered the fourth major factor in production, in addition to the traditional factors land, labour and capital (Rougoor *et al.*, 1998). There has been no study of variation in enterprise performance in relation to historical conditions and management in Russia, because of (a) the difficulty of quantifying managerial abilities, and (b) the absence of reporting such managerial characteristics as age, education, experience, etc., which are usually studied. In this study unobservable management was assessed through various performance-related characteristics over time.

Our approach to this research problem was, in a sample of dairy enterprises for empirical investigation, first to determine *which farm characteristics exhibited the most dramatic changes in 1990-2001*. The second objective was to find out whether the current dairy sector in the region was *homogeneous, or whether producers differed substantially*. Linking the historical and present farm characteristics provided the third objective: *to determine the impact*

[1] The terms "agricultural enterprise" and "farm" are equivalent in this paper.

of initial conditions on current performance, structure and management. Addressing these objectives contributes to (a) understanding the development of dairy enterprises in the last decade, with the aim of (b) projecting future developments in regional producers' structure and performance and (c) determining priorities in agricultural policies regarding different groups of producers.

To assess the variation among dairy enterprises, several characteristics were employed in cluster analysis for 2001 data (for example, Epstein, 2001; Uzun, 2002 used only financial indicators). Historical characteristics for 1990 were assessed for each cluster. The pre-reform data gave insight into initial farm conditions; more recent data revealed the performance of Russian agricultural enterprises after the 1998 financial crisis.

The remainder of the paper is organised as follows: the next section is a literature review that helped build the research hypothesis on the relation between management, agricultural enterprise characteristics and performance; Section 6.3 describes the research method and data; Section 6.4 presents the results ordered by the three research objectives, while a discussion of conclusions in Section 6.5 finalises the paper.

6.2 Conceptual framework: Farm environment, structure, management and performance

Various indicators of farm results are used in empirical analyses (see also Rougoor *et al.*, 1998): economic indicators (profitability, income), plain financial parameters (debt ratios) or technical performance (milk production and quality, disease rates). In empirical studies the farm result is often related to management[2]. Farm managers perform their tasks in a dynamic environment, in which Boehlje and Eidman (1984) distinguished four major dimensions: 1) the physical, such as seasonal weather conditions and their variability; 2) the economic, determining the relative as well as the absolute level of input and output prices; 3) the social, prescribing labour conditions and social networks; and 4) the institutional, prescribing (a) rules for the use of debt capital, (b) rules for payment of taxes, (c) legal rights and obligations, (d) relations between the state, institutions and producers.

Figure 1 presents the static state of a farm, its management and four-dimensional environment. The rapidly changing economic conditions experienced by Russian enterprises in

[2] A one-sentence definition of management is difficult to formulate; in this study the concept of management is derived from Boehlje and Eidman (1984), who discuss the tasks and extent of farm management.

1991-2001 can perhaps be visualized dynamically after Fig.1 to perceive the impact of this history on its current and future state. Following the literature review, several elements of each dimension and their hypothetical impact are defined. Often one element is associated with more than one dimension, since there are many linkages among them.

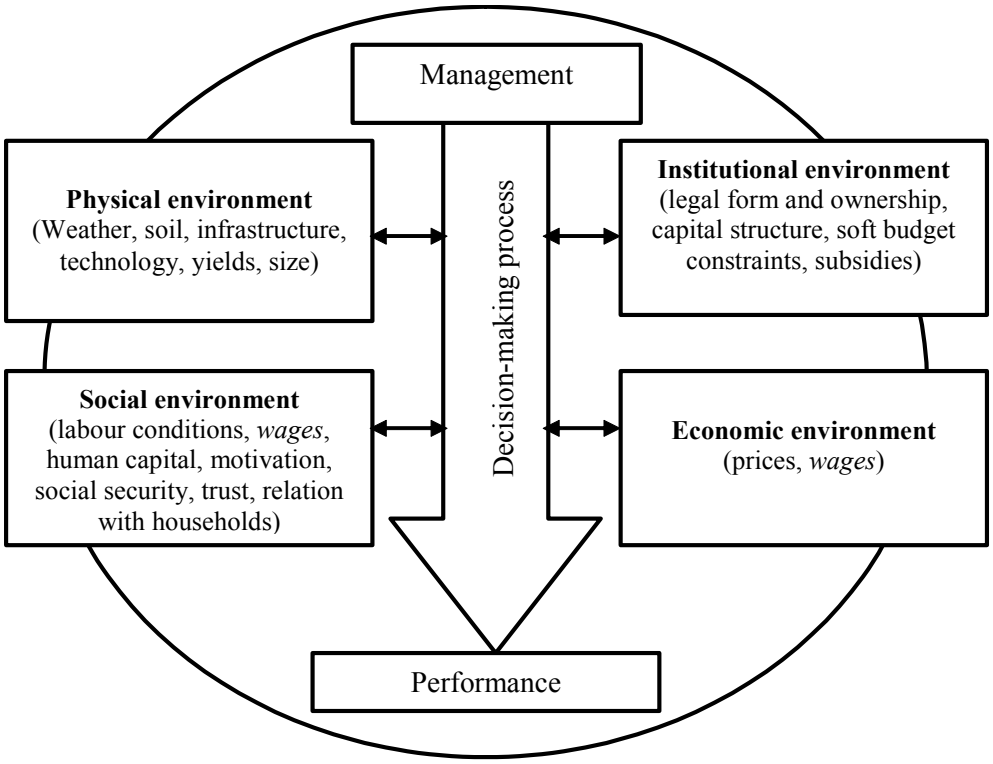


Figure 6.1 Relation between farm performance and environment

Physical environment refers to the farm's structural characteristics, predetermined by natural and physical conditions (weather, soils, and infrastructure). The most intriguing and debatable farm characteristic in transition countries in the last decade has been farm size. Curtiss (2002) reviewed the relationship between farm size and efficiency in agriculture concluding that there is no harmonious position among economists as to whether the small, large or both firm organisations are economically optimal. Visser (2003) elaborated on the Russian ideology of "big is beautiful" and concluded that larger agricultural enterprises in the Rostov region (famous for agriculture) had a higher profitability, which was consistent with Epstein's findings (Epstein, 2001) for enterprises in the St.-Petersburg region. Schulze *et al.* (2001) concluded the opposite, that the smaller agricultural enterprises of the Volgograd region had higher profitability. Large enterprise size may have a positive or negative effect on performance; a positive effect follows from economies of scale, whereas a negative effect is increased

complexity of management and thus higher transaction costs (see also Curtiss, 2002). The definition of size, always relative, has to be expressed by those variables (hectares, workers, livestock head, sales, or assets) most relevant to the research question. The choice of size variables is discussed in Section 6.4.1.

The physical environment, through technology, also defines such parameters as yields, intensity and specialisation, which also impact on farm performance. For example, on dairy farms a higher productivity of cows means greater technical efficiency (Ondersteijn, 2002) and bigger gross margin per kg of milk (Rougoor *et al.*, 1997). Thus, farm structural characteristics (size, productivity, specialisation and intensity) reflect the physical dimension of its environment.

The institutional environment determines the capital structure and the way the financial obligations are dealt with. One frequently-studied institutional element of transition economies is "soft budget constraint" (SBC), *i.e.* routine loan forgiveness. According to Schaffer (1998), transition states often soften liquidity constraints by allowing enterprises to generate tax arrears. In contrast, Schulze *et al.* (2001) found no statistically significant relation between profitability and level of accounts payable. However, accounts payable are influenced by the discipline of customers, *i.e.* by the level of accounts receivable. High accounts receivable likely signal weak customer management or poor farm financial performance, preventing it from attracting reliable customers. In the earlier years 1993-1994 high debt had a negative impact on profitability and farm restructuring (Pederson *et al.*, 1998). Unprofitable farms often rely on state support in the form of subsidies. The relation between subsidies and performance on Russian farms can be twofold. On the one hand, the theory of SBC predicts that poorly performing farms will have a high percentage of revenue from subsidies (Osborne and Trueblood, 2002). On the other, better managers are likely to be more efficient in getting subsidies, which requires the completion of applications; they may also have better relations with regional authorities (more than 70% of subsidies came from regional[3] budgets). A positive relation between subsidy and farm size could be expected, since (a) subsidies are coupled to inputs and outputs; and (b) lower per-unit transaction costs of acquiring subsidies on larger farms.

[3] Visser (2003) found that an enterprise managed by the same person for 39 years was highly successful, which signals that experience and possibly strong relations with community and regional administrations played an important role.

The legal form and type of ownership also belong to the *institutional environment*. Surveys in the Ukraine and Russia showed that about half of farm employees reported no real changes had taken place on the "reorganised" farms (Lerman, 2001; Liefert and Swinnen, 2002). Schulze *et al.* (2001) studied the variability of farm characteristics between groups of farms with different legal forms and concluded that in the Volgograd region limited liability and joint-stock companies had most successfully adapted to economic conditions. The new legal form was chosen by the reforming *kolkhozes* and *sovkhozes* rather randomly, with the exception of the poorest performing farms, restructured by splitting up (Svetlov, 2000; Visser, 2003). Therefore, the relation between ownership type (private, municipal, state), legal form (co-operative, joint stock, limited liability company, state enterprise) and performance is not unambiguous.

The social environment comprises characteristics of human capital, labour conditions and social security, factors also closely related to the *economic* and *institutional environment*. Zeddies (2000), Koester (2003) and Visser (2003) concluded that a lack of human capital and employee motivation was a result of low wages. Bezlepkina and Oude Lansink (2003) found wages, corrected for wage arrears, a motivating factor in the improvement of the technical efficiency of Russian dairy farms. Sedik *et al.* (1999) concluded that the diversion of resources from corporate farms to private household production negatively affected crop output on the corporate farms. That households can officially or unofficially use resources of agricultural enterprises to lower private production expenses (Ovchintceva, 2000; Pallot and Nefedova, 2003a), relies on an institutional environment that allows such relations and an economic environment that motivates them[4]. It can be assumed that higher wages improve farm workers' economic incentives (see Koester, 2003). The level of wages is a managerial lever on the farm social (and economic) environment.

Economic environment refers to the level of input and output prices, interest rates and wages, and is closely related to the other dimensions. Declining terms of trade for agricultural producers is named as one major reason for the current unfavourable situation in Russian agriculture (Strokov *et al.*, 2000; Varshavsky, 2000). At the producer level, the deviation of enterprise-level price from the average price may signal superior quality of output, or special agreements with suppliers made possible by advanced management.

[4] "Unpaid workers were pilfering everything from milk to gasoline to tractor parts, and many of the ablest were migrating to the cities" (Tavernise, 2001). Zeddies (2000) assessed the level of theft on farms in the Moscow region at about 5-7% for grain, 15-20% of potatoes, 3-5% of milk.

While the list of elements of the farm environment could be broadly extended depending on research interests, availability of enterprise-level data and the research questions in this paper have resulted in the following list of key farm environment characteristics: (a) size, farm location and dairy productivity (Physical); (b) legal form and ownership type, debts (Institutional); (c) milk price (Economic) and (d) wages (Social and Economic). Farm management could not be measured in this study directly. Good management can be observed in economic (high profitability) and financial (low debt ratios) performance, high dairy productivity, better quality of milk, higher prices, higher subsidies per unit of production, and a better social environment evidenced by higher wages and lower wage arrears. Farm history is related to time-variant farm characteristics such as performance, structure (size, specialisation, intensity) and management (productivity, wages).

6.3 Materials and methods

6.3.1 Analytical Procedure

Two kinds of information were necessary to the analysis of Russian farms: current farm characteristics in 2001, and their history back to 1990. To address the first objective, the performance, structure and management of dairy farms were analysed separately for the years 1990 and 2001. This contributed to understanding the population of dairy farms at present and a decade ago. A higher coefficient of variation (standard-deviation-to-mean ratio) indicated a greater variability in certain farm parameters between the two years.

Cluster analysis was used to address the second objective: sources of variability between dairy farms under current conditions. It distinguishes groups of farms on the basis of the selected characteristics so that there is the greatest possible similarity within a group, and greatest possible difference between groups. In this study, to ensure the stability of clusters, (a) both hierarchical and non-hierarchical methods were used (Hair *et al.*, 1998); (b) cluster membership was tested for sensitivity to omitting the variables and to replacing the variables (*e.g.* arable land versus agricultural land; total workers *vs.* agricultural workers) and to omitting observations and (c) clustering was performed with data from 2001 and averages from the period 1999-2001. The final number of clusters used for further analysis was determined by analysis of the agglomeration coefficient, the levels of significance comparing the differences between group means of cluster variables, the possibility of interpreting the clusters by focusing on variables with significant differences, and the possibility of profiling the clusters

by using variables not included in the cluster solution. Depending on the outcome of the test for homogeneity of variances between groups, the Sidak test for equal variances or the Games-Howell test for unequal variances (Post Hoc tests, see SPSS, 2002) were used to test the significance of differences between paired groups. The effect of the farm environment was cleared of stochastic elements (*e.g.* weather, price fluctuations) by analysing farm characteristics averaged over the years 1999-2001.

To address the third objective, farm characteristics in 1990 and their development over the period 1990-2001 were assessed for each cluster. Spearman's rank correlation coefficient was computed for farms observed both in 1990 and 2001 to test whether the ranking for farm characteristics were the same. If farms kept their ranking over the years, the coefficient was close to 1, implying that farms experienced similar changes, or that the situation in 1990 determined the outcome in 2001.

6.3.2 Dairy farms in the regional agriculture and clustering variables

Historically farms in the Moscow region specialise in livestock production, since natural conditions in the region are unfavourable to cultivation, which largely consists of forage crops (70% of arable land). The area under marketable crops is limited: 20% cereals, 3-4% potatoes and about 2% vegetables. The major products of the enterprises are milk, meat and eggs. A few farms specialise in pork and poultry production, but the majority have a differentiated output of milk, beef and forage crops.

Farm data from large-scale specialised dairy farms in the Moscow region were obtained from data on Russian farms collected by the State Statistical Committee. The sample of 154 specialised dairy farms included only farms for which marketable milk production amounted to more than 2/3 of total revenue in 2001. Seven farms did not have balance sheet data and were omitted from the analysis. Of the remaining 147 farms, on average 80% of agricultural revenue came from milk and 10% from beef production. The amounts of other livestock production and arable farming were minor. Out of 147 farms, 90 farms existed in 1990 and 57 farms were newly established[5] sometime during 1991-2000.

[5] Total number of farms in the region did not increase by more than 5% during restructuring in 1991-94, nor by more than 3-4% during 1995-2001 (Kuleshov, 2000), implying there was only a small percentage of truly new farms. About 12% of all farms in 1990 could not be identified; probably more than 90 of them were such farms.

Preliminary analysis of selected farm characteristics identified a unique profile for 2 farms considered outliers[6].

Dairy producers in the region as well as in Russia have experienced a dramatic fall in profitability. Milk production was unprofitable in 1994-1998 and beef remained unprofitable up to 2001. Therefore, focusing on dairy producers in the region allowed investigating the weak and strong points of management in rather similar and economically more advanced conditions due to the overall better development of the Moscow region as compared to Russia (see Kuleshov, 2000).

6.4 Results and discussion

6.4.1 Dairy farms in 1990 and in 2001

Table 6.1 presents selected environment characteristics of dairy farms in 2001 and 1990. The panel was reduced to 88 farms to enable a direct comparison between the two years. Farms in 1990 in general can be characterised as mixed farms. Only 8 of them had more than 2/3 of revenue from milk. The average values from 88 farms in existence till 2001 were not greatly different from those which would have emerged if the specialised dairy farms in 1990 had been selected[7]. This selection procedure enabled comparative analysis of the dairy farm populations.

As to the possible measures of farm characteristics named in Section 6.2, their choice was decided by a review of the literature, and their number kept low to ensure sufficient freedom of analysis. Net profit was selected as a measure of farm *performance* as it represents the final account of agricultural and non-agricultural activities as well as the level of received subsidies. This measure was not available in 1990, therefore Table 6.1 presents several alternatives.

The *physical environment* was given by agricultural land area, number of workers in agricultural activities, head of livestock, distance to Moscow and dairy cow productivity. Changes from 1990 to 2001 (see Table 6.1) and correlation coefficients between different size

[6] Analysis of residuals in linear regression of farm characteristics (size, productivity) on profitability indicated these outliers. The three-cluster solution (see Section 4.2) remained consistent in omitting the outliers.

[7] The averages of farms in 1990 with more than 50% (110 observations), and with more than 60% (28 observations) of revenues earned from milk were computed. The difference in means remained within +/-10%.

measures in 2001 (Table 6.1 in Appendix) were assessed to select size measures. The above-mentioned number of *agricultural workers*, hectares of *agricultural land* and *livestock* were selected as measures of size because (a) land (<0.6) and labour (>0.9) had different correlation coefficients with other size measures and had substantially different percentage reductions in 1990-2001; (b) fixed assets were measured rather poorly (Voigt and Uvarovsky, 2001); (c) revenues are related to prices; (d) the number of cows and milk output are related to dairy productivity.

The price of milk was taken as indicator of farm marketing strategy and milk quality. Input prices (*e.g.* purchased feed, fertilisers, seeds, etc.) were not available from the farm data. Wages corrected for wage arrears were considered an indicator of both labour input costs and motivation, characteristics of the *economic* and *social environment*. The level of accounts payable, accounts receivable and the percentage of outstanding accounts payable, standing for the *institutional environment*, are not reported in Table 6.1 due to no data for 1990. Instead the percentages of farm legal form and private ownership are presented.

As seen from Table 6.1, dairy farms have changed a great deal during the last decade, becoming smaller in area, with fewer workers and livestock, and somewhat worse in economic performance. About 20% of them in 2001 had losses, whereas in 1990 all farms had positive net profits. The restructuring of 1991-1994 resulted in dairy farms in 5 different legal forms by 2001, the major part (50%) being joint-stock companies. Privatisation has resulted in the prevalence of private ownership (84%) over municipal, federal and mixed ownership types.

The coefficient of variation for all reported characteristics except milk price was smaller in 1990 than in 2001. This implies that earlier the farms were more homogeneous in size and performance, and less homogeneous in terms of specialisation. The criterion of 2/3 of milk revenues was checked for sensitivity by comparing the averages of 145 dairy farms in 2001 to the averages of 110 dairy farms (with >50% milk revenues) in 1990. The percentage change (last column of Table 6.1) remained within +/-5% for alternative calculation, confirming the conclusion of increasing variation in dairy farm size and performance.

Thus the dramatic changes in the environment of dairy farms in the region led to substantial changes in their structure and performance in 1990-2001.

Table 6.1 Characteristics of dairy farms in 2001 and 1990 (n=88)

Environment	Farm characteristic	1990				2001				2001 in % to 1990
		mean	min	max	coefficient of variation	mean	min	max	coefficient of variation	
Performance	Profit before tax	10378	723	30678	0.50	4254	-3996	35313	1.75	-59
	Gross margin milk per kg, 10^3 RUB of 2001	0.14	0.02	0.44	0.52	0.12	-0.18	0.36	0.91	-14
	Profit before tax per hectare, 10^3 RUB of 2001	2.37	0.24	7.12	0.52	1.15	-1.31	7.94	1.66	-52
	costs to sales ratio	0.78	0.61	0.99	0.09	0.95	0.57	1.87	0.25	21
Physical	Total farm workers	552	268	913	0.28	209	36	811	0.61	-62
	incl. workers in agriculture, man	431	134	705	0.28	190	35	753	0.59	-56
	Agricultural land, ha	4673	1256	10209	0.34	3674	682	10899	0.47	-21
	incl. sown land, ha	3514	612	7182	0.36	2965	576	9570	0.49	-16
	Livestock, heads	3077	655	7313	0.34	1615	189	7973	0.72	-48
	incl. cows, heads	1488	130	3500	0.42	745	102	3200	0.70	-50
	Milk output, 1000 kg	54465	5188	144777	0.46	29689	2957	178240	0.95	-45
	Dairy productivity, 100 kg per head	39.7	25.8	77.5	0.20	40.1	18.4	77.7	0.30	1
Institutional	Percentage of kolkhozes, %	100				8				
	Percentage of joint stock companies, %	0				53				
	Percentage of cooperatives, %	0				27				
	Percentage of limited liability companies	0				2				
	Percentage of state companies, %	0				10				
	Percentage[1)] of farms with private ownership, %	0				84				
Social and economic	Wage annual, 10^3 RUB of 2001	33.7	6.4	57.8	0.19	31.8	8.3	67.1	0.41	-6
Economic	Milk price, RUB per kg	0.41	0.30	0.68	0.18	0.56	0.39	0.81	0.16	37

[1)] The remaining percentage of farms has municipal, federal or mixed ownership.

6.4.2 Variation between dairy farms in 2001: Current sources

The more specialised dairy farms in 2001 demonstrated quite great variations in their structure and performance than in 1990, implying the existence of different groups of farms. The two- (17 and 128 farms), three- (88, 42 and 15 farms) and four-cluster solutions (68, 43, 9 and 25 farms) from the non-hierarchical K-means method were analysed. All three solutions formed a cluster with large and well-performing farms. The remaining clusters consisted of smaller farms with relatively similar size characteristics. Between the clusters of smaller farms for three- and four-cluster solutions, only the means of profitability and debt-structure were significantly different at the 5% level. For two-cluster solutions the difference between debts became less significant, while other cluster variables (except for wages) kept their significance at the 1% level. Going from three- to four-cluster solutions, the differences between clusters became less significant. This reasoning favours the three-cluster solution presented in Table 6.2. Table A6.2 in Appendix 6.1 presents the analysis of agglomeration coefficients for hierarchical cluster analysis. The percentage increase in the coefficient of agglomeration for Ward's method occurs in the shift from three to two clusters, thereby also supporting the three-cluster solution[8].

With the exception of wages, the means of all clustering variables were significantly different (at the 1% level) between the clusters with the lowest (42 farms) and highest (15 farms) performance indicators, *i.e.* between marginal groups. The producers were divided into farms with performance and structure smaller than or close to average, located farther away from Moscow (cluster 1 and 2), and farms of larger size, higher productivity and performance indicators, and located closer to Moscow (cluster 3). Given these differences, the marginal clusters were named "average farms with low profitability and debt problems" and "large well-performing farms". The remaining cluster with the majority of farms, also large in terms of percentages of revenue, land, workers and livestock (see Table 6.3), consisted of rather "average farms". To stress the differences, the comparison was further continued between the marginal clusters (cluster 2 and 3). The three-cluster solution based on averages of 1999-2001 was very similar and thus is not reported, since the implication is that stochastic elements such as weather or prices did not affect the clustering of groups.

[8] Other methods such as linkage between and within groups inconclusively indicated the existence of two to four groups.

Table 6.2 Average characteristics of clustering variables (2001)

Environment / Variables		Average farms	Farms with poor performance and debt problems	Large well performing farms	Average values
		N=88	N=42	N=15	N=145
Performance	net profit, 10^3 RUB	2426	-289	18590	3311
Physical	agricultural workers, man	154[A]	163[A]	375	179
	agricultural land, ha	3248[A]	3456[A]	4744	3463
	livestock, heads	1303[A]	1215[A]	3507	1505
	distance to Moscow, km	88[A]	73[A,B]	53[B]	80
	milk per cow, 100 kg	40[A]	38[A]	58	41
Institutional	debt payables, 10^3 RUB	4293	13126[A]	11519[A]	7600
	debt receivables, 10^3 RUB	886[A]	1327[A]	5719	1423
	percentage outstanding debt payables, %	27[A]	37[A]	7	27
Social (and Economic)	annual wage corrected for wage arrears, 10^3 RUB	30[A]	27[A]	37[A]	30
Economic	milk price, RUB per kg	5.3[A]	5.6[A]	6.6	5.5

[A, B]: All differences in means are significantly different between the groups at the 5% level, except for when they have identical upper scripts. For example, the first and the second, the second and the last groups have no significant difference in distance to Moscow, but the first and the last group have.

Source: own presentation.

Testing the difference in means of net profit per hectare, profit before tax per hectare, gross margin per kg of milk, cost-to-sale ratio (not reported) confirmed the significant difference for all groups at the 5% level. Significant variation in debts between clusters of similar structure motivated the more detailed analysis of debt structure in Table 6.3. Significantly different between all groups, the ratio of total liabilities to total assets was less indicative than current-liabilities-to-current-assets ratio of the debt problem in farms with poor performance. However, they had the highest (a) number of farms under SBCs, (b) percentage of debts to the state (taxes and payments to social funds), and (c) level of overdue debts[9] (Table 6.2). Although all farms accumulated high debts, the nature of the debt problem varied: well-

[9] The level of overdue debts for such categories as short-term loans and long-term debts was not available from balance sheets, but from their appendices (see Minselkhoz, 2000).

performing farms were involved in credit programmes, and had large turnovers with suppliers, whereas farms with low performance often failed to pay taxes, social security and wages.

Table 6.3 Other average characteristics of the clusters in 2001

		Average farms	Farms with poor performance and debt problems	Large well performing farms	Average values
		N=88	N=42	N=15	N=145
Debts	Total debt to total asset ratio	0.14	0.25	0.14	0.17
	Current debt to current asset ratio	0.56	1.17	0.33	0.71
	Debts on borrowings, % to short-term debts	8[A]	6[A]	28	9
	Debt to the state, % to short-term debts	40[A]	46[A]	15	39
	Debt to workers per worker, RUB	1530[A]	3070	1520[A]	1980
	Debt payables to debt receivables ratio	10	39	4	18
SBC	Percentage of farms with debts exceeding profit before tax plus depreciation, %	23	64	0	32
Subsidy	Subsidy to agricultural revenue, %	2.4 [B,C]	1.6 [A,B]	2.8 [A,C]	2.2
	Subsidy per worker, RUB	2220[A]	1450[A]	4940	2270
	Subsidy per head of livestock, RUB	280[A]	190[A]	540	280
Intensity	Livestock per worker	8.4[A,B]	7.6[A]	9.3[B]	8.3
	Workers per hectare, man per 10 ha	5[A]	5[A]	9	6
Relative importance of cluster	In total revenue	45	20	35	100
	In employment	51	26	22	100
	In agricultural land use	57	29	14	100
	in total debts	34	50	16	100
	In total subsidies	44	15	41	100

[A, B, C]: All differences between the means are significantly different between the groups at the 5% level, except for when they have identical upper scripts.

Source: own presentation.

Table 6.3 also presents other characteristics relevant to the clusters. Insignificant between all groups were: (a) the availability of processing facilities and the portion of processed milk (on average 5% on each seventh farm); (b) percentage of farms with private ownership and percentage of farms with a specific legal form (joint-stock and limited liabilities compa-

nies, co-operatives, collective and state companies); (c) degree of specialisation in milk production; and (d) subsidies in agricultural revenue. Co-operatives prevailed over other forms in the cluster with the most successful farms. However, this finding was not supported statistically.

Substantial variation in the intensity of farming confirmed that large and better-performing farms had higher intensity of production.

The share of subsidies in revenues was twice as high on the large and best-performing farms (but not statistically significant between groups). This weakly supported the a priori expectation that stronger managements were probably more efficient at getting subsidies. A high variability of subsidies calculated per worker and per unit of livestock between clusters with large and average size was a result of the differentiated subsidy programmes[10] (depending in some regions, for example, on livestock numbers, see Borkhunov and Nazarenko, 2000). Most subsidies were received by better-performing farms, indicating that the state, having reduced overall direct support, was not overspending budget money on loss-making farms.

Since many producers in the region delivered their milk to Moscow dairies (Kuleshov, 2000), the weak performance of farms could be partly due to locations distant from Moscow causing higher transport costs. There being no significant relation between on-farm processing and performance, these producers would be better advised to invest in improvement of milk quality, which should result in higher milk prices.

To summarise, a great variation between dairy producers in 2001 resulted in distinguishing three clusters which served the second research objective. The clustering depended upon size, location and such characteristics as profitability, level of wages, milk prices and subsidies, management of debts and dairy productivity. Availability of processing facilities, type of ownership and legal form, and the degree of dairy specialisation did not contribute to explaining the variation between dairy farms in the region. Assessment of the relative importance of each cluster in regional dairy farming confirmed the difficulties for cluster 2 farms, which contributed the most to debts, the least to revenue, and used more labour and land resources than the best farms.

[10] This however was not stated in legislative acts available to the authors (see for example Anonymous, 1999, 2000).

6.4.3 Variation between dairy farms in 2001: Historical sources

This section analyses the impact of farm characteristics in 1990 on the structure and performance of the same farms in 2001. Adding to the discussion of the development of farms between 1990 and 2001 (see Section 6.4.1 and footnote 5), 67 out of 98 dairy farms (with more than 50% of revenue from milk) continued their activities up to 2001 and the majority (48 farms) remained dairy specialised. The percentage of farms that continued to exist over the 11 years is highest (75%) in the group of well-performing farms[11]. A possible explanation for this is that better farms experienced less restructuring and splitting up their assets (see Visser, 2003) and thus maintained their size and identity.

Table 6.4 Historical characteristics (year 1990) of the clusters

Variables	Average farms	Average farms with poor performance and debt problems	Large well performing farms	Spearman's rank correlation coefficient for 1990 and 2001
	N=51	N=26	N=11	N=88
Profit before tax, 10^3 RUB of 2001	9546 ^{C}	9405 ^{C}	16533 $^{C, D}$	0.235*
Profit before tax per ha, 10^3 RUB of 2001	2.28^{D}	2.14^{C}	3.35$^{C, D}$	0.237*
Cost to sales ratio	0.78	0.80	0.75	0.100
Agricultural workers, man	405 ^{C}	450	504^{C}	0.479*
Agricultural land, ha	4655	4554	5040	0.874*
Livestock, heads	2842^{D}	3148^{C}	3999$^{C, D}$	0.317*
Milk per cow, 100 kg	39.8	39.0	41.4	0.323*
Annual wage, 10^3 RUB of 2001	33.3	34.1	34.8	0.124
Milk price, RUB of 2001 per kg	4.1	4.3	3.8	-0.123

$^{C, D}$: All differences between the means are *not* significantly different between the groups at the 5% level, except for when they have identical upper scripts (interpretation is opposite in Tables 6.2 and 6.3).

* Correlation coefficient is significant at the 5% level.

Source: own presentation.

Table 6.4 presents the characteristics of the earlier-defined clusters for 1990. Only profit before tax (per hectare) and livestock numbers were significantly different between the marginal clusters. Dairy cow productivity, milk price, wages, gross margin per kg of milk and

11 However, this percentage could be underestimated due to unidentified farms (see footnote 5).

livestock per worker (neither presented) did not vary at the 5% level of significance. Variance in prices and wages was rather not expected in pre-reform conditions of strict state regulation. Spearman's rank correlation coefficient indicated a large difference in farm structure (except for agricultural land) and performance in 1990 and 2001. Larger farms with higher performance in 2001 (cluster 3) were better in the pre-reform period at generating profits before tax per hectare and slightly better in cost-to-sales ratio (although not significant at 5%). Farms in the third cluster were historically larger in number of workers and head of livestock, and reduced such resources as land, workers and livestock by lower percentages (13%, 26% and 6%, resp.) than other dairy farms (25%, 62% and 55%, resp.). Similarly, Curtiss (2002) found a strong relation of efficiency to pre-transition technological equipment, experience, and market network relationships for Czech crop producers.

Since in pre-reform times the size did not vary significantly between the marginal clusters (land and workers, see Table 6.4) and the size measures had a smaller variability (see Table 6.1), it can be concluded that more advanced economic performance, rather than initial farm structure, complement the explanation of the variation between dairy farms in 2001. This conclusion addresses the third research objective.

6.5 Conclusions and outlook

By following the three research questions regarding the variation between dairy farms and their historical structure and performance, the following conclusions are possible:

By 2001, as compared to 1990, dairy farms had become more specialised in their activities as well as more diverse in their structure and performance. The significant differences in performance between farms in 2001 was mainly due to individual farm management, reflecting changes in farm environment in such farm-specific characteristics as dairy productivity (livestock management), wages (social management), debt structure (debt management), etc.

A more advanced economic performance already in 1990 implying stronger management rather than initial farm structure, helped explain the variation between dairy farms.

Well-performing farms (cluster 3) evidenced better managerial characteristics observable in their performance.

The future development of the dairy sector in the region should rely on individual management, a decisive factor for farm development. The regional government should be aware that the largest share of subsidies (in 2001) was received by the best-performing farms. In contrast, average enterprises with low (negative) profits (cluster 1 and 2) should be a concern

for policy-makers. The managers of these heavily indebted farms fear creditors, bankruptcy procedures and replacement of personnel consequences. The problem of farm debts has been recognised at the policy level: before bankruptcy procedure is applied, insolvent farms are given the opportunity to participate in a program of debt-restructuring supervised by federal and regional authorities. Starting in 2003 enterprises have been helped to review their financial performance on the basis of financial coefficients computed from balance sheets and income statements. Thus, there is a certain educational process taking place to inform farm managers about their financial performance. The state should continue training and education programmes for farm managers. The enactment of a new bankruptcy law has put the position of farm workers however in question. Since a group of farms with poor performance employs a quarter of all workers in the dairy sector, government assistance (social security support) should be guaranteed in case of farm liquidation.

Appendix 6.1

Table A6.1 Correlation coefficient among size measures in 2001

	total revenue	agricultural revenue	total workers	agricultural workers	agricultural land	arable land	livestock	cows	fixed assets	total costs in agriculture	kg of milk output
total revenue	1	1.00	0.91	0.89	*0.47*	*0.52*	0.93	0.91	*0.60*	0.98	0.98
agricultural revenue		1	0.92	0.90	*0.46*	*0.51*	0.93	0.92	*0.59*	0.98	0.98
total workers			1	0.98	*0.57*	*0.61*	0.94	0.93	*0.63*	0.92	0.91
agricultural workers				1	*0.58*	*0.62*	0.94	0.93	*0.62*	0.91	0.90
agricultural land					1	0.96	0.60	0.60	*0.41*	0.51	0.48
arable land						1	0.63	0.63	*0.44*	0.55	0.53
livestock							1	0.99	*0.58*	0.94	0.95
cows								1	*0.59*	0.92	0.94
fixed assets									1	0.63	*0.57*
total costs in agriculture										1	0.96
kg of milk produced											1

Source: own presentation.

Table A6.2 Analysis of agglomeration coefficient (AC) for hierarchical cluster (n=145)

Number of clusters	Ward's method		Between group linkage		Within group linkage		Median linkage	
	AC	%[1)]	AC	%[1)]	AC	%[1)]	AC	%[1)]
10	20.5	5.4	0.50	4.0	0.34	5.5	0.44	-17.2
9	21.6	7.5	0.52	8.3	0.36	1.7	0.36	42.6
8	23.2	8.4	0.56	25.0	0.36	7.2	0.52	5.6
7	25.2	8.6	0.71	2.5	0.39	2.7	0.54	44.8
6	27.4	9.7	0.72	21.5	0.40	11.5	0.79	1.9
5	30.0	10.8	0.88	15.3	0.44	10.5	0.80	13.4
4	33.3	13.8	1.01	34.4	0.49	12.3	0.91	-4.4
3	37.8	15.2	1.36	24.8	0.55	4.9	0.87	48.4
2	43.6	32.0	1.70	43.9	0.58	29.1	1.29	111.1
1	57.6	-	2.44		0.75		2.73	

[1)] The percentage change of agglomeration coefficient to the next level.

Source: own presentation.

Chapter 7
General Discussion and Conclusions

7.1 Introduction

The overall objective of this thesis, as described in Chapter 1, was to perform a micro-economic analysis to get more insight into the impact of debts and subsidies on input-output allocation and performance of agricultural enterprises in Russia in the past 10 years. Special reference was made to the impact of debts and subsidies because of severe problems of low profitability, increasing debts and reduced subsidies in agriculture. The research objective was approached using concepts of neoclassical theory and two sets of enterprise-level data.

This final chapter forms a synthesis of preceding chapters and contains a discussion of caveats and advantages of the data (7.2.1) and methods (7.2.2) used. It also presents the synthesis of results (7.3). The future research outlook (7.4) and the list of main conclusions (7.5) finalise the thesis.

7.2 Data and methods

7.2.1 Data issues

This research used aggregated data from statistical yearbooks and two sets of enterprise-level data (agricultural registries). The descriptive analysis at the level of Russia as a whole in Chapter 2 indicated that some performance and finance-related measures were difficult to obtain from statistical yearbooks due to the different degree of aggregation for various variables (over all agricultural producers or by categories). Therefore, the enterprise-level data were a sound choice for the economic analysis presented in the later chapters. The first data set covered agricultural enterprises in a large number of regions in Russia in the period 1995-2000 and the second covered specialised dairy enterprises in the Moscow region mainly in the period 1995-2001 and the year 1990.

Both samples contain variables from agricultural registries containing data from enterprise book-keeping reports submitted to local statistical offices. These book-keeping reports correspond to other forms submitted to tax offices and thus are the only official farm-level data available. Common problems of overstated costs, understated revenues and overstated values of fixed capital mentioned in the literature (Voigt and Uvarovsky, 2001; Osborne and

Trueblood, 2002a; Yastrebova, 2002) are present in both samples. Problems of this kind were not possible to remedy, but they were accounted for while interpreting the results.

The data set on Russian enterprises from 61 regions cover more than 70% of all agricultural enterprises, more than 70% of land and labour involved in agricultural enterprises, and allowed generating conclusions at the country-level. The influence of the capital city distinguishes Moscow region from the rest of the Russian Federation (Pallot and Nefedova, 2003b) and limits the degree to which results are applicable to enterprises in other regions. The advantages of using a smaller sample of specialised farms were that (a) the sample was more homogeneous, as is desirable for microeconomic modelling; (b) it had a greater number of financial variables; (c) it enabled studying the historical performance of producers due to data available from 1990; and (d) it enabled performing different cross-checks to verify the data. The change in a definition of a sample of large and medium-size agricultural enterprises in 2001 by the state statistical committee (*Goskomstat*, see Goskomstat, 2002) was not relevant for the large data set that covered the period 1995-2000. The dairy farms recorded in 1995-2000 were also present in 2001; thus the change in the definition did not cause problems in sampling.

Data on inputs and outputs formed the basis for applications in the empirical Chapters 3-6. Changes in farm reports in 1996, 2000 and 2001 were taken into account to derive consistent measures over different years. In this study, the measures refer to the marketed part of output and the related variable inputs. Although it cut off part of the activities (for example, production of intermediate inputs) and could have resulted in overstating performance, this was the only possibility because otherwise the measure of farm output would not have been available from the data. Computing the value of output from produced (marketed and non-marketed) quantities and average prices would not account properly for quality and price difference between marketing channels and costs of intermediate consumption. Other limitations of the data were that subsidies were balanced out with trade credits (see Minselkhoz, 2000); thus the actually granted subsidies could be higher, thereby underestimating the effect of subsidies. Absence of data on the flow of debts (mostly stocks at the end of the year were known) has limited the analysis of financial relations in agricultural enterprises. The data from 1990 became available only at the latest stage of research, restricting analysis of the pre-reform position of the enterprises in Chapters 4 and 5. Use of pre-reform data would have strengthened the instrumental variable estimations in Chapters 3 and 4, providing new instruments (see 7.2.2).

Although the data sets were unique and sufficiently large, they mirrored the deficiencies of the data in farm reports and lacked information on the quality of outputs and inputs and also on managerial characteristics. After 2006 at the earliest the first set of data will become available – the year when *Goskomstat* is planning a census of agricultural producers that should include more qualitative data (Goskomstat, 2004c). Presently, surveys seem to be the only possible way to enrich the currently available data sets with qualitative data.

This critical evaluation of the data used in this thesis underlines difficulties that empirical research encounters when dealing with data from transition economies. Nevertheless, an agricultural registry is the most comprehensive and large data set available to researchers currently. The availability of enterprise-level data is a requirement in microeconomic modelling.

This thesis used the same dataset available for analysis at the policy-making level. Eighteen large dairy enterprises from all over Russia with positive profits in the period 2000-2002 (see VIAPI and RosAgroFond, 2003) were present in the sample of about 150 dairy enterprises analysed in this thesis. The analysis of dairy enterprises from the Moscow region confirmed, by their better performance, that it corresponded to the method of ranking the top hundred large and successful dairy enterprises.

7.2.2 Methodological issues

Theoretical framework. The analysis in this thesis was focused on the impact of debts and subsidies on enterprise performance using a neoclassical theory approach. Overall, the thesis confirmed the usefulness of neoclassical models in studying the relations between debts and subsidies, performance and other enterprise characteristics in Russian agriculture under transition. Since theoretical conditions (monotonicity and convexity in prices) were not violated by the data (Chapter 4), the data supported the assumption that dairy enterprises were maximising short-term (variable) profit. Finding negative marginal products for some agricultural inputs (Chapter 3), negative elasticity of variable inputs with respect to subsidies and negative shadow prices (Chapter 4) on the one hand conflict with studies of market economies. On the other hand, these results can be explained by conditions in Russian agriculture and are consistent with conclusions of studies at the regional level (see for example Sotnikov, 1998; Voigt and Uvarovsky, 2001; Osborne and Trueblood, 2002b).

Descriptive method with aggregated data. Several methods and various performance measures were used. Chapter 2 used the aggregated national data in the descriptive analysis to investigate the developments of such performance indicators as the number of unprofitable

enterprises in the agricultural sector, net profits, total debts, profitability ratios, current-debts-to-current-assets ratios, and partial productivity measures. Since the farm-level data were available only for a group of agricultural enterprises, the aggregated data enabled positioning different groups of agricultural producers within the sector. The time series for the period 1990-2001 allowed analysing the developments in terms of organisation, structure, performance and policies in agriculture. However, aggregated data on subsidies and debts, inputs and outputs, widely available to researchers (see 7.2.1), were of limited value in addressing the research questions. These data were aggregated at different levels (including all agricultural enterprises or only large ones), were incomplete and often presented as ratios and coefficients that made it impossible to compute other ratios.

Parametric versus non-parametric. Furthermore, parametric and non-parametric methods were employed. Parametric methods focused on modelling the effects of subsidies and debts on productivity (Chapter 3) and profits (Chapter 4). Data Envelopment Analysis (DEA, non-parametric), with the focus on pure technical efficiency, allowed for studying managerial performance (Chapter 5). The ongoing discussion in the literature about the choice of parametric or non-parametric methods for applications in transition countries has been summarised in Gorton and Davidova (2004). Most of the empirical research is done by means of the non-parametric method. This is because of computational ease in handling multiple-inputs and multiple-outputs and the possibility of isolating scale efficiency from technical and allocative efficiency. In this thesis, the choice of DEA was also based on its computational ease in deriving the pure technical efficiency (PTE) measure and flexibility in accommodating multiple inputs and multiple outputs. In transition economies the impact of farm size on performance is related to the quality of the management rather than to the relationship between size and efficiency *per se* (Gorton and Davidova, 2004). Using the PTE measure, which is freed from the inefficiency caused by suboptimal size, is advocated in this thesis (see also Nasr *et al.*, 1998). The disadvantage of DEA, such as sensitivity to errors in the data, was dealt with by thoroughly checking the data for errors and outliers. The limitation of DEA as to the production of statistical inference of technical efficiency, which has been only recently dealt with in theory and practice (see Simar and Wilson, 2000; Simar and Wilson, 2003), was not a severe problem. This is because this research is mainly interested in the relation between performance and debts, which was derived by means of econometric analysis at the second stage.

Panel data. This thesis benefited from the availability of panel data. As follows from Baltagi (1995), panel data allow controlling for individual heterogeneity, give more informative data, variability, a greater degree of freedom and more efficiency. In this thesis panel data

enabled cross-checking of data for missing values and obvious typing errors. Panel data also allowed for dynamic elements in the analysis such as incorporating time-trend in Chapters 3-5 and enterprise development over a decade in Chapter 6. The properties of panel data in the parametric models in Chapter 3 and 4 were accounted for using a fixed-effect estimation for panel data (see Baltagi, 1995). Fixed-effect estimation allows the panel to be unbalanced and accounts for time-invariant farm-specific effects such as location, climate, specialisation, price differences between farms due to variation in marketing channels, as long as there are more than two observations per enterprise. The panel data properties of non-parametric DEA in Chapter 5 were accounted for only at the second stage in regression analysis by year dummies. Cluster analysis in Chapter 6 was also available to account for panel data by performing analysis of the same enterprises in 2001 and 1990 (balanced panel). In general, the limitation of the panel data used in this thesis is short time-series dimension. This caused low significance of price-related estimates of profit function in Chapter 4. Nevertheless, the use of panel properties of the data is advocated.

Primal versus dual approach. Subsidies and debts were modelled as factors influencing the production technology, i.e. within the primal approach framework (Chapter 3). The primal approach enabled studying the technical relations between inputs and outputs such as substitutability and complementarity (Chapter 3). Availability of prices and utilising a profit function modelling within a dual approach (Chapter 4) allowed for expanding the analysis to price responsiveness of the milk supply and demand for variable inputs. Applying Hotelling's lemma to profit function in the dual approach allowed deriving input demand and output supply functions to determine technical input-output relations. This also enabled obtaining shadow prices of fixed inputs (land, labour, and livestock) which are comparable to values of marginal products presented in Chapter 3.

Causality issues in regression and cluster analysis. The reverse causality problem between subsidies and performance or, in other words, the problem that subsidies may go to worse farms (Uzun, 2002), or, by contrast, be accumulated by more active managers, causes endogeneity of subsidies. Possible endogeneity of subsidies had to be accounted for properly in the econometric analysis in Chapters 3 and 4. Endogeneity of debts was ruled out since debts represented the initial debt situation at the beginning of a year, which was exogenous to the input-output allocation decisions in a current year. Fixed-effects estimation technique and instrumental variable technique allowed accounting for the possible endogeneity of subsidies. Finding appropriate instruments was problematic and resulted in the failure to estimate of a full Translog specification for the production function in Chapter 3. The availability of pre-

reform data would provide good instruments, but this option would be very costly for the sample of all Russian agricultural enterprises, because the farm identification numbers have changed during the period of restructuring. The reverse causality was not a problem in the cluster analysis in Chapter 6. The cluster and correlation analysis in Chapter 6 enabled distinguishing the groups of well and poorly performing dairy enterprises on the basis of several elements of physical, institutional, economic and social dimensions of the farm environment. Although cluster analysis does not explain the causality of relationships, it complemented the analysis in Chapters 3-5 and avoided complexity caused by endogeneity of subsidies and performance. Unlike in regression analysis, which was an alternative method for studying the impact of historical performance on current performance in Chapter 6, cluster analysis is not sensitive to high correlation between various size or performance measures. It allowed for a joint use of correlated dairy productivity and performance, level of debts and share of outstanding debts, subsidies per worker, per livestock head and per revenue.

Modelling subsidies and debts. In modelling the effect of subsidies, the first question to answer was whether subsidies directly influence the quantity of input or output, i.e., whether they are coupled. Decoupled subsidies are defined as subsidies that do not affect short-run production decisions (Moro and Sckokai, 1999). Many studies including those for Russian agriculture (e.g. Sotnikov, 1998; Sedik *et al.*, 1999) implicitly modelled subsidies as explanatory factors for technical inefficiencies. Thus, in these studies subsidies are implicitly considered coupled, because they influence the input-output composition and affect efficiency. It was not possible *a priori* to categorise subsidies as fully decoupled or fully coupled. Aggregated level data on subsidies (see Manellya, 2002) signalled that degree and conditions of coupling differs by sector: for livestock, subsidies are mainly granted as price premiums, whereas in crop production, subsidies are mainly granted as compensation for costs. In this thesis incorporating the level of subsidies into the production and profit function allowed testing whether subsidies are coupled or decoupled. Endogeneity of subsidies, or in other words, their coupling, was handled using instrumental variables in Chapters 3 and 4. The tests rejected the assumption that subsidies are fully decoupled. In efficiency analysis (Chapter 5) subsidies were also implicitly treated as coupled, since they were used in constructing the soft budget constraint variable that in turn influenced the efficiency, i.e. input-output relations. The limitation of modelling of subsidies in Chapter 5 is that they were *a priori* assumed to be a Kornai-type (granted to loss-making enterprises). Modelling in Chapter 3 and 4 was not limited by the assumption that subsidies were Kornai-type.

The idea of modelling the effect of debts on performance (Chapter 3 and 5) was similar to that for subsidies. Technically it was implemented in a slightly different way in the efficiency study (Chapter 5), where debt ratios were explicitly introduced into the regression. Since debt flows were not available from the data, the ratios (also absolute level in Chapter 3) were derived at the beginning of a year.

7.3 Synthesis of results

The consistency of results is analysed in terms of assumptions, data and methodology applied. Table 7.1 summarises the research in Chapters 2-6 in relation to the research questions presented in Chapter 1. Since the impact of subsidies and debts was studied using production economics, input-output relations are summarised first.

Input-output relation. Negative marginal products for land, capital and livestock in Chapter 3 correspond to low (negative) shadow prices of such inputs as land, labour, livestock and capital in Chapter 4 and suggest that enterprises are oversized. This is consistent with the negative impact of large size on pure technical efficiency as seen in Chapter 5. Low and decreasing returns to scale (0.51) follows from the production function of Russian agricultural enterprises in Chapter 3 and is also consistent with the presence of oversized enterprises. Although dairy farms in the Moscow region before 1999 mostly operated at increasing returns to scale (Chapter 5), the results on returns to scale over the whole period 1996-2000 are inconclusive. This is because the optimal size was defined for each year separately using the DEA model and thus cannot be directly compared across the years. In 2000, 41% of enterprises operated under decreasing, and 39% under increasing returns to scale. This implies that enterprises could improve their technical efficiency by decreasing or increasing the scale of their operations. The negative impact of size on pure technical efficiency combined with the conclusion of oversized Russian enterprises suggests that agricultural enterprises did not adjust their size and structure accordingly. The results of cluster analysis (Chapter 6) are not in complete agreement with the negative size-performance relation because better performing enterprises were larger. This is explained by the difference in methods and complexity caused by quality of the management rather than by the relationship between size and performance *per se* (see also Gorton and Davidova, 2004). The relationship between management, size and economic performance was not fully accounted for in the empirical chapters due to difficulties in quantifying management, and was only accounted for as a management-size relationship in Chapter 5.

Table 7.1 Summary of results by chapters

Chapter	Data	Performance measure	Method	Impact on performance		Adjustment to new economic environment
				Debts	Subsidies	
2	Aggregated (sector level), 1990-2001	profitability, debt-to-asset ratio, input-output ratio	Descriptive	Large debts-to-assets, improvement in debt situation after 1998, debt payables as the major part of total debt	Subsidies declined, unclear subsidy programs	Improvement of performance after 1998, incompleteness of reforms, insufficient adjustment of organisation and structure
3	European and west-Siberian Russia, enterprise-level, 1995-2000	Productivity	Production function model	Positive	Negative	DRS[1)], insufficient adjustment of structure, productivity improved after 1998
4	Moscow region, dairy farms, 1995-2001	Profit	Profit function model	Not studied	Positive	Low response to price signals, insufficient adjustment to optimal size, improvement in technology after 1998
5	Moscow region, dairy farms, 1996-2000	Pure technical efficiency	DEA[2)] and regression	Positive	Studied indirectly through negative influence of SBC	IRS[1)], improvement in efficiency after 1998, negative impact of number of workers (size)
6	Moscow region, dairy farms, 1990 and 1999-2001	Net profit	Cluster analysis	Negative (no causality)	Inconclusive (no causality)	Adjustment is more effective on larger and better performing farms

[1)] IRS, DRS are increasing and decreasing returns to scale.

[2)] DEA is Data Envelopment Analysis.

Source: own presentation.

Subsidies. The results of Chapters 3 and 5 as well as Chapters 4 and 6 demonstrate opposing impacts of subsidies on performance. The impact of subsidies on production and productivity is strongly negative and rather small for a large sample of Russian agricultural enterprises, which contrasts with the highly significant positive impact of subsidies on the profits of dairy enterprises in the Moscow region. Several factors explain the opposite results in Chapter 3 and 4. First, the approach of Chapter 4 accounts for prices of inputs and outputs, whereas the approach of Chapter 3 accounts for quantities of inputs and outputs. Moreover, as follows from the profit function in Chapter 4, subsidies have a negative impact on milk supply, which is consistent with the negative impact of subsidies on production in Chapter 3. Secondly, since subsidy programs differ between Russian regions, this can influence the impact of subsidy programs. Subsidy programs can positively influence the performance of dairy farms in the Moscow region – a region that has better managerial practices, higher demand for land and labour, and overall better technical efficiency in agriculture, as documented in Voigt and Uvarovsky (2001), Osborne and Trueblood (2002b).

The negative impact of subsidies in Chapter 5 is obtained under the *a priori* assumption that subsidies are granted to loss-making enterprises (Kornai-type). This assumption was made in constructing the soft budget constraint (SBC) dummy variable to account for "good" and "bad" debt. This assumption is limiting in the analysis of subsidies. Nevertheless, the negative effect of SBC corresponds to the results in Chapter 3 and to the theoretical expectations outlined in Chapter 5. As follows from Chapter 4, under the current subsidy program the producer uses fewer variable inputs, which is output elastic (Chapter 3 and 4). As follows from Chapter 5, the overall technical efficiency did not improve (before 1999). Altogether, this implies that output under current subsidy programs should decline, which follows from Chapter 3.

The results of cluster analysis in Chapter 6 are inconclusive with respect to impact of subsidies on performance. The subsidy-to-revenue ratio does not differ significantly between the clusters. Cluster analysis suggests rather that the impact of subsidies is dependent on managerial abilities, since farms with better managerial characteristics (higher dairy productivity, wages, economic performance) mainly receive subsidies.

Concluding, even though unclear subsidy policies distort incentives of producers and cause misallocation of inputs and outputs, subsidies can contribute to a more efficient performance by relieving credit constraint.

Debts. The results of the positive impact of debts on performance are consistent over the chapters and also with other findings in this thesis, with the exception of those in Chapter 6.

Cluster analysis of dairy farms in Chapter 6 suggests a negative relation between debts and performance. This is because the relations between other farm characteristics are not modelled in the way it is done in regression analysis. Moreover, the various sources of debts indicate different relations to performance. Well performing farms accumulate high debts on bank loans and to suppliers (part of which is paid with a delay). Farms with a weak performance fail to pay taxes and social security, have higher debts to their employees and have large amounts of overdue debts. Finding a positive effect of debt on performance corresponds to the positive influence of additional finance from creditors when the negative side of excessive debts, i.e. the presence of soft budget constraints (SBCs) is accounted for. The presence of SBCs is accounted for through a dummy variable in Chapter 5.

As the results of cluster analysis in Chapter 6 suggest, when management has a relatively good reputation, its suppliers continue to provide inputs even though the level of existing debts at the beginning of year may be high relative to current assets. Managerial abilities, which are difficult to observe, seem vital in acquiring (trade) credits, and contribute to the complexity of the debt-performance relation. After having received (trade) credit from suppliers and delaying or not repaying it implies that costs of materials acquired through trade credit are lower than those given in statistical yearbooks. By acquiring materials at lower cost, enterprises use the inputs inefficiently, for example by overusing them explicitly or implicitly (theft). Managerial effort, which could have retained its capability of acquiring inputs from suppliers from the pre-reform time, appears inefficient in input-output allocation.

Adjustment to a new economic environment. The degree of adjustment of agricultural enterprises to reforms in agriculture is assessed in relation to the adjustment of farm structure, organisation, efficiency of input-output allocation and performance. As follows from the descriptive analysis in Chapter 2, agricultural enterprises in Russia restructured their organisational type for legal reasons rather than economic ones. The conclusion as to the superiority of one legal type remains open. Chapter 4 finds that producers demonstrate no response to milk prices and still supply the greatest share of their output to the state, demonstrating that the decisions of producers are still bounded. Agricultural producers appear to be slow reformers. This is determined by their internal management (Chapter 6), but also by the development of the macroeconomic environment: positive changes are observed after the financial crisis of 1998. The oversizing of agricultural enterprises (Chapters 3-5) also suggests slow adjustment to more efficient operational size. Having been large in Soviet times, agricultural enterprises tend to use as much resources as they used to previously, at the cost of their productivity,

profitability and efficiency. The underdevelopment of markets for labour and land slow down effective adjustments in the farming sector.

7.4 Research outlook

This section addresses issues with a view to the future. Consideration of theoretical issues, current results and future conditions with respect to debts and subsidies indicates several possibilities for future research.

The WTO requirements on the classification of agricultural support in Russian agriculture, and the non-transparency of support programs, has already compelled the Ministry of Finance in Russia to work on improving the budget expenditure classification (see Shick and Karlova, 2003). Studying the impact of subsidies on resource allocation at the micro-level should be complemented by studying the macro-economic effect of subsidies on Russian agriculture. The welfare scenarios possible under various subsidy rates would reveal the effects of policy changes not only for producers but also for consumers and the government.

Subsidising interest has become a practice in Russian agriculture since 2001 and has already gained positive assessments (Serova, 2003a). An empirical analysis of the efficiency of subsidising interest would be highly relevant. Such research will be possible when subsidies for interest are made distinguishable from other subsidies. In 2001, the data on the level of subsidies granted in crop and livestock production were made available. A system of profit function with credit constraint (see also Lee and Chambers, 1986) would be suitable for accommodating the modelling approach, where coupled subsidies and credit constraint determines the level of profit, and where credit constraint is simultaneously determined by the decoupled subsidies for interest. Since subsidies for interest are rather decoupled, and other subsidies were confirmed to be coupled (Chapter 4), their impact could be modelled as subsidy rates (subsidy per unit of input or output), that is, similar to prices (see also Moro and Sckokai, 1999). Subsidy for interest can be modelled as a lump sum, as was also done in Chapter 4.

The literature provided evidence for the sense of removing SBCs to improve performance (for example Schaffer, 1998; Kornai, 2001). This thesis also concluded that soft budget constraints *per se* limited improvements in enterprise performance. However, the presence of SBCs is often unobservable from the data. Therefore employing latent class models is proposed. Recent studies (see for example Orea and Kumbhakar, 2003) derive parametric efficiency measures for different classes of business units determined by unobservable character-

istics. This approach fits well in studying the performance of groups of Russian producers functioning under and without soft budget constraints, which are unobservable. Since governmental actions in Russia seem to address the problem of the high level of debts and not the presence of SBCs, more insight is needed to derive the relation between SBCs, the composition of debts in Russian enterprises (to banks, suppliers, state) and the impact of SBCs on performance in the long-run.

The reform of Russian agriculture is incomplete (see also Csaki, 2002; Liefert *et al.*, 2003b) and has not completely resolved the problems of farm restructuring. It has been concluded that agricultural enterprises tend to use as much resources as they used to in the Soviet times at the cost of their productivity, profitability and efficiency. Underdeveloped markets for labour and land have slowed down effective adjustments in the farming sector. Policies likely differently influence the performance of enterprises with different structures. Due to large variation in enterprise performance, studying the impact of various elements on performance should be done in relation to enterprise structure, size and specialisation. To get more insight into problems of farm restructuring, more in-depth analysis is needed to see how limitations of labour, capital, credit markets and subsidy policies influence performance through the elements of farm structure. Approaches used in this thesis can address this research question by (a) distinguishing between various farm structures with respect to several size and specialisation variables (cluster analysis) and (b) by accounting for certain types of farm structures in further regression analysis through the use of dummies.

This thesis indicates that subsidy programs and thus the allocation of inputs and outputs depend on marketing channels that bring different returns. Following Gow and Swinnen (1998), in agriculture the failure of contracts (or complete absence of those) is often observed in the form of delayed payments by processors for delivered products (one third of the revenues in the period 1995-2001, see Manellya, 2002). Further elaboration of the performance of agricultural enterprises could move towards studying the efficiency of various marketing channels, and their relation to subsidies and contracts. Use of contract theory would complement the theoretical background provided by this thesis. Case-studies of contracts between agricultural enterprises, buyers and suppliers should precede further analysis and modelling of the relations between contracts, subsidies and performance. Additional data are required on revenues and costs of output by various sale channels and their contracting. As transition continues creating supporting market infrastructure, one would expect a shift from state contracts to contracts with other parties, which would also follow, or necessitate, changes in subsidy policies.

Complementing the neoclassical models with concepts of institutional economics – which argue that firm behaviour and performance is shaped by institutions (formal and informal rules, regulations and laws, see Williamson, 2000) – would contribute to a better understanding of the current profile of agricultural enterprises. It has been underlined that the performance of agricultural enterprises has a close link with the relations between enterprise and households, since workers are not only wage earners but also receive other benefits from this symbiotic relation, which is difficult to assess. One indication is the overuse of materials – possibly diverted for household production – on agricultural enterprises. It is also expected that some enterprises were acting as part of vertically integrated companies (agroholdings), at least in the years 2000-2001. Accounting for a symbiotic relationship between households and enterprises, and for enterprise identity as a part of an agroholding, would enrich the analysis of enterprise performance. Such an analysis would investigate whether agricultural enterprises act as intermediaries between the market and family farms or semi-commercial households, thereby facilitating their relations with suppliers and buyers –an issue closely linked to the nature of contracts in agriculture. The difficulty of access to data on agroholdings may however form an obstacle to this direction of research.

7.5 Principal conclusions

Despite differences in data and the various methods used in the course of this study, a precise summation of its principal conclusions is nonetheless possible.

1. During the last ten years, the farming environment has changed enormously under reforms that, overall, were insufficient to effectively adjust the behaviour of agricultural enterprises to the new economic and institutional environment. Agricultural enterprises in Russia – rather than newly established family farms or previously existing households – kept their leading role in supplying the major part of agricultural output.
2. Even though unclear subsidy policies distorted the incentives of producers and caused misallocation of inputs and outputs, subsidies contributed to a more efficient performance by relieving credit constraint.
3. Although total debts in the Russian agricultural sector exceeded the profits tenfold, debts and in particular debt payables positively influenced performance of agricultural enterprises by acting as a source of finance coming from input suppliers.

4. Debts and subsidies as soft budget constraints have a negative impact on performance, i.e., when debts are excessive and subsidies granted to loss-making enterprises.
5. Oversizing of agricultural enterprises and weak response of dairy farms to prices suggested a slow adjustment of agricultural enterprises to the market environment.
6. More advanced economic and managerial performance of enterprises before reforms have ensured better performance of dairy enterprises after reforms.
7. Higher wages have improved the performance of agricultural enterprises. This can be explained by improved motivation of employees and an accompanying reduction in the pilfering of inputs and outputs.
8. The profit function approach was useful in modelling the impact of subsidies on performance because it included the price-subsidy relation.
9. Confirmation of the results with regard to: (a) oversizing of agricultural enterprises, (b) the positive role of debts in performance, and (c) the improvement in performance after 1998 (revealed by higher efficiency scores, increasing shadow prices for fixed inputs, and positive productivity growth), which have been obtained using the different methods and samples in the study, strengthen the conclusions of this thesis.

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Summary

The Russian agricultural sector today is characterised by three categories of producers, i.e. agricultural enterprises, household plots and family farms. Even though many problems are common to all categories of producers, the development of agricultural enterprises – the main category of producers during the Soviet period – deserves special attention. These producers experienced a dramatic fall in output and subsidy cuts and accumulated large debts. Nevertheless only a very small fraction of them stopped farming. In Russian agriculture, it remains an unanswered question whether the performance of producers can be improved under the current debt and subsidy policies. The objective of this research was to carry out a microeconomic analysis of the impact of debts and subsidies on input-output allocation and the performance of agricultural enterprises in Russia in the period 1990-2001.

This research used aggregated data from statistical yearbooks and two sets of enterprise-level data (from agricultural registries). Neoclassical theory provided the theoretical framework for analysing the effect of subsidies and debts on input-output allocation and performance. The performance of agricultural enterprises was assessed by measures of technical efficiency, partial and overall productivity and various profitability measures.

Chapter 2 helps to acquaint readers with current developments in Russian agriculture. Using the country-level national data and a descriptive approach, it reviews changes in agriculture in the period 1990-2001. This chapter discusses the economic and institutional role of different types of agricultural producers. It also reviews organisational and structural changes in agricultural enterprises in the period studied, and their economic and financial performance. The analysis showed that during the last ten years, the agricultural sector went through enormous transformations that overall were insufficient to effectively adjust to the new economic and institutional environment. Nevertheless, agricultural enterprises in Russia, rather than newly established family farms or previously existing household plots, kept their leading role in supplying the major part of agricultural output. The declining economic and financial performance of agricultural enterprises up to 1998 was partly a result of worsened terms of trade at the beginning of reforms, and a lack of economic incentives in enterprise restructuring. The impact of enterprise downsizing on performance was inconclusive. Aggregated data on subsidies signalled that the degree and conditions of coupling differed by sector: for livestock, subsidies were mainly granted as price premiums, whereas for crop production subsidies were mainly granted as compensation for costs. Since the changes in the composition of subsidies in 1996-2000 were rather non-systematic, their contribution to performance was dif-

ficult to assess. The low debt-repayment capacity of the enterprises resulted in an accumulation of overdue debts by almost 90% in agricultural enterprises. Their performance, determined by the percentage of loss-making enterprises, profitability and debt-to-current-asset ratio, improved after the financial crisis of 1998. Chapter 2 also concluded that aggregate data on subsidies and debts, inputs and outputs were of limited value in addressing the research questions.

The empirical Chapters 3-6 draw upon neoclassical economic theory and enterprise-level data. **Chapter 3** analyses the impact of subsidies and debts on the production levels of 19,000 agricultural enterprises in 61 Russian regions in the period 1995-2000. The production function modelling approach allows debts and subsidies to affect the level of production through the production technology. It also allows for deriving the technical relations between inputs and output and for assessing the values of marginal products, in order to give insight into the degree of over- or underuse of resources. Regional differences and farm-specific characteristics are accounted for by using fixed-effect estimation.

The results showed that subsidies negatively influence performance (with rather small marginal effect), which implies the presence of soft budget constraints. A positive relation between debts and production suggested that the more debts (to suppliers) the enterprise was able to generate, the more secure its production would be. Having inherited their large size from Soviet times, agricultural enterprises did not sufficiently reduce the size of quasi-fixed inputs, in particular land, labour, livestock, which results in low productivity. This means that such inputs as labour, land, livestock, capital and variable inputs were overused. Low and decreasing returns to scale of 0.51 were also consistent with the finding of oversized enterprises. The complementarity of labour and other inputs, except for land, signalled that the enterprises used labour-intensive technologies. Calculations showed that the worst performing enterprises received subsidies equivalent to 2.8 months of farm wages. Paying subsidies to poorly performing enterprises allowed workers to receive more from wages than they would have from benefits, if the operations had been closed down. Whether paying subsidies is a good alternative to creating unemployed farm workers remains an open question.

After Chapter 3, the studies are based on a smaller sample, of dairy enterprises in the Moscow region. **Chapter 4** continues with modelling the effect of subsidies on profitability in a more explicit way. This chapter develops a microeconometric model of specialised dairy enterprises in the Moscow region using panel data over the period 1995-2001. Starting from a discussion on the degree of coupling of subsidies, Chapter 4 presents the modelling of subsidies as a component of a short-term profit function. This modelling framework keeps the op-

tion open for treating subsidies coupled or decoupled and allows testing it empirically. The model is used to analyse the impact of subsidies on profit and on allocation of variable inputs, land, labour, livestock, milk and other outputs. The profit function approach also permits estimates of input and output elasticities at the enterprise level. Theoretical conditions (monotonicity and convexity in prices) were not violated by the data, thereby supporting the assumption that dairy enterprises were maximising short-term (variable) profit. The fixed-effect estimation accounted for price differences between enterprises due to variation in marketing channels, and for differences in location, soil quality, and management.

The results showed that an enterprise's own milk elasticity as well as the elasticity of milk with respect to subsidy was insignificantly different from zero. This implied that the milk supply was not as responsive to subsidy signals as to market signals and that subsidies did not provide an incentive for (further) specialisation in milk. Although subsidies had a distorting effect on the input-output mix, this chapter shows they relieved the credit constraints on dairy enterprises and had a positive influence on enterprise profit. Labour, land and livestock had low (negative) shadow prices that increased after 1998, which also corresponded to finding a noticeable technological change, observed in increased shadow prices of time-trend. This chapter also points to the problem of surplus land and labour in dairy enterprises. A negative relation between subsidies and variable input, together with finding credit constraints, implies that enterprises could improve their allocative efficiency by decreasing variable inputs.

Chapter 5 focuses in more detail on the structure of debts and their impact on performance. To study the impact of debts on the performance of Moscow-area dairy enterprises, some concepts of finance theory were adjusted to the different structure of debts prevalent there, and to the presence of soft budget constraints (SBCs). A two-stage approach was used: technical efficiency scores from Data Envelopment Analysis were regressed on financial characteristics, the presence of SBCs, and a set of socioeconomic factors, using a truncated regression model.

The results suggested that SBCs have a negative, and accounts payable, a positive impact on performance. An *a priori* assumption made to construct the soft budget constraint (SBC) dummy variable, that subsidies were granted to loss-making enterprises (Kornai-type), implicitly resulted in the negative impact of subsidies on performance. The positive relation between accounts payable and performance implied that stronger and more efficient management was able to maintain production under a lack of financing by acquiring external finance resources from suppliers. The managerial efficiency of dairy enterprises was positively af-

fected by the working environment, defined in this chapter as higher wages and lower wage arrears. A remote enterprise location (possibly due to lower opportunity costs of land) and large scale negatively contributed to managerial performance. The results for the year dummies indicated a significant positive impact of financial crisis on efficiency. The ownership dummy estimate was not significant (at 5%), possibly due to unsuccessful restructuring that failed to change the internal farm organisation. The percentage of processed milk as well as soil quality had a significant and positive effect (at the 10% significance level for soil quality) on performance. As the results demonstrated, access to processing facilities helped operators improve their performance by lowering costs of transportation of milk to dairies or more attractive urban markets. The negative impact on performance of transport distances to Moscow was directly explained by higher transport costs. Indirectly, it could be a result of less beneficial relations between the enterprise managers and regional authorities where enterprises are further away from Moscow. This is because land in remote areas has lower opportunity costs in comparison with land near Moscow. Although dairy enterprises in the Moscow region before 1999 mostly operated at increasing returns to scale, the results on returns to scale over the whole period 1996-2000 are inconclusive, because the optimal size was defined for each year separately using the DEA model and thus results across years could not be directly compared. In 2000, 41% of enterprises operated to a smaller or larger extent at decreasing and 39% at increasing returns to scale. This implied that enterprises could improve their technical efficiency by decreasing or increasing the scale of their operations.

The final, empirical, **Chapter 6** focuses on dairy enterprises in the Moscow region to identify the similarities and divergences of producers by their performance, managerial and structural characteristics. Chapter 6 differs from Chapters 4 and 5 by using pre-reform data from 1990. This allows analysing the impact of historical performance on current performance. The theoretical concept of the four-dimensional farming environment (institutional, social, economic and physical) that influences farm performance characteristics (see Boehlje and Eidman, 1984) was used to determine the characteristics of an enterprise, its past and present performance. Cluster analysis was used to differentiate between groups of well and poorly performing enterprises on the basis of the selected characteristics of performance and the four-dimensional environment.

Results showed that variation between dairy producers in 2001 gave rise to three clusters. The clustering depended upon size, location and such characteristics as profitability, level of wages, milk prices and subsidies, management of debts and dairy productivity. Availability of processing facilities, type of ownership and legal form, and the degree of dairy spe-

cialisation did not contribute to explaining the variation between dairy enterprises in the region. The results of cluster analysis with respect to the impact of subsidies on performance were inconclusive. The subsidy-to-revenue ratio did not differ significantly between the clusters. Cluster analysis suggested rather that the impact of subsidies was dependent on managerial abilities, since mainly enterprises with better managerial characteristics (higher dairy productivity, wages, economic performance) received subsidies. The results also signalled that managerial abilities, which were difficult to observe directly, presumably were vital in acquiring the (trade) credits and contributed to the complexity of the debt-performance relation: when management had a relatively good reputation (measured as higher profits, wages, dairy productivity and subsidies), suppliers continued providing loans in the form of input supplies. The assessment of the enterprises' historical characteristics revealed that the smallest group, the most successful enterprises, consisted of producers that in pre-reform years had better economic performance. These enterprises also reduced their resources by a smaller percentage and did not have a severe debt problem.

Together, Chapters 2-6 give a picture of the effect of subsidies and debts on allocation of inputs and outputs and on the performance of agricultural enterprises in Russia. **Chapter 7** discusses caveats and advantages of the data and methods used in the thesis, presents a synthesis of results, outlines future research and lists the main conclusions. Critical evaluation of the data used in the thesis emphasized the difficulties of empirical research in transition economies. Profit function approach was acknowledged useful in modelling the impact of subsidies on performance because it accounted for the price-subsidy relation. The sample of dairy enterprises in the Moscow region was not representative, being an atypical regional environment caused by its proximity to Moscow (affecting subsidy policy, availability of output markets, employment possibilities, demand for agricultural land). The difference in the impact of subsidies on performance obtained in Chapters 3-6 was explained by the different farming environment in the Moscow area, and by the methodology. Confirmation of the (a) oversizing of agricultural enterprises, (b) positive role of debts on performance and (c) improvement of performance after 1998, obtained from different methods and different samples, strengthened the conclusions surrounding the positive impact of debts on performance. Oversizing of agricultural enterprises and the lack of response of dairy producers to milk prices suggested that producers were only slowly adjusting their structure and behaviour to the new market environment.

Samenvatting (Summary in Dutch)

In de Russische agrarische sector kunnen drie categorieën van bedrijven worden onderscheiden, te weten: grootschalige landbouwondernemingen, huishoudpercelen en gezinsbedrijven. Alhoewel alle bedrijfstypen veel problemen hebben ondervonden tijdens de transformatie, is het gerechtvaardigd om speciale aandacht te schenken aan de grootschalige ondernemingen, die in de Sovjet tijd ook de dominante bedrijfsvorm waren. Deze groep van bedrijven heeft haar productie scherp zien dalen en kreeg te maken met verlagingen van subsidies en een sterke toename van schulden. Desalniettemin is slechts een klein deel van de bedrijven gestopt. Het is de vraag of de landbouwondernemingen onder het huidige beleid en hun huidige schuldenlast hun financiële prestaties kunnen verbeteren. Het doel van dit onderzoek was om een micro economische analyse uit te voeren van het effect van schulden en subsidies op de input-output allocatie en de financiële prestaties van grootschalige landbouwondernemingen in Rusland in de periode 1990-2001.

Dit onderzoek heeft gebruik gemaakt van data uit jaarstatistieken en twee data sets van bedrijfseconomische gegevens. De Neoklassieke productietheorie geeft het theoretische kader voor de analyse van de effecten van subsidies en schulden op input-output allocatie en performance. De performance van landbouwondernemingen werd bepaald als de technische efficiëntie, partiële en totale productiviteit en door middel van verschillende winstmaatstaven.

Hoofdstuk 2 maakt de lezer vertrouwd met de huidige ontwikkelingen in de Russische landbouw. Met behulp van regionale en nationale data wordt een beschrijving gegeven van veranderingen in de landbouw in de periode 1990-2001. Dit hoofdstuk beschrijft voorts de economische en institutionele rol van verschillende typen van landbouwbedrijven. Verder beschrijft het de organisationele en structurele veranderingen in landbouwondernemingen en hun economische en financiële performance. De analyse laat zien dat de landbouw in de afgelopen tien jaar enorme veranderingen heeft ondergaan, die al met al onvoldoende waren om tot een volledige aanpassing tot de nieuwe economische en institutionele omgeving te komen. De landbouwondernemingen hebben desondanks hun leidende rol behouden in de Russische landbouwproductie; deze rol is niet overgenomen door de nieuwe gezinsbedrijven. De slechtere economische en financiële performance tot 1998 waren deels een gevolg van de minder gunstige ontwikkeling van de terms of trade sinds het begin van de hervormingen. De invloed van de kleinere omvang van de ondernemingen op de performance kwam niet duidelijk uit de analyse naar voren. De geaggregeerde gegevens over subsidies laten zien dat de mate van, en de voorwaarden voor koppeling tussen productie en subsidie verschilden per sector. In de

veehouderij worden subsidies gegeven als prijsopslagen, terwijl ze in de akkerbouw worden gegeven als compensatie voor gemaakte kosten. De veranderingen in de samenstelling van de subsidies waren niet systematisch en de bijdrage van subsidies aan de performance was dan ook moeilijk vast te stellen. De lage betalingscapaciteit van de ondernemingen heeft geresulteerd in een toename van schulden met bijna 90%. De performance, gemeten als het percentage bedrijven dat met verliezen draait, het winstpercentage en de ratio van schuld en activa verbeterde na de financiële crisis van 1998. Hoofdstuk 2 laat tenslotte zien dat geaggregeerde gegevens over subsidies, schulden, input en output een beperkte waarde hebben voor het beantwoorden van de onderzoeksvragen. Deze gegevens zijn geaggregeerd op verschillende niveaus (over alle bedrijven of over alleen de grote bedrijven); de gegevens zijn verder incompleet en worden vaak gepubliceerd in de statistieken als ratio's en coëfficiënten, waardoor bewerkingen problematisch zijn.

De empirische hoofdstukken 3-6 maken gebruik van de Neoklassieke productietheorie en bedrijfseconomische data. **Hoofdstuk 3** analyseert de invloed van subsidies en schulden op de productie van 19,000 landbouwondernemingen in 61 Russische regio's gedurende de periode 1995-2000. De productiefunctie benadering maakt het mogelijk om het effect te bepalen van schulden en subsidies op de output. Verder is het met deze benadering mogelijk om de technische relaties tussen inputs en output te bepalen en om onderbenutting of overmatig gebruik van inputs vast te stellen aan de hand van de marginale producten. Regionale verschillen en bedrijfsspecifieke karakteristieken worden meegenomen in het model via de zogenaamde fixed effects.

De resultaten laten zien dat subsidies een negatieve invloed hebben op de performance, wat impliceert dat soft budget beperkingen een rol spelen. Het positieve effect van schulden op de productie suggereert dat een toename van de schulden (aan toeleveranciers) leidt tot een hogere productie. De landbouwondernemingen hebben in onvoldoende mate de omvang van hun quasi-vaste inputs als grond, arbeid en veestapel verkleind, wat resulteert in een lagere productiviteit. Dit betekent dat het gebruik van arbeid, grond, kapitaal en variabele inputs en de omvang van de veestapel te hoog zijn. Deze observatie is consistent met de lage score voor de meeropbrengsten van 0.51, die in dit onderzoek werd berekend. Complementariteit van arbeid en andere inputs (behalve grond) laat zien dat de ondernemingen gebruik maken van arbeidsintensieve technologieën. Berekeningen laten verder zien dat de slechtst presterende bedrijven een equivalent van 2.8 maanden aan arbeidslonen hebben ontvangen. Het betalen van subsidies aan slecht presterende bedrijven genereert voor de werknemers een hoger loon dan ze in de vorm van een werkloosheidsuitkering hadden ontvangen indien de bedrijven wa-

ren gesloten. Het blijft echter een open vraag of het betalen van subsidies een goed alternatief is voor het betalen van een uitkering aan werkloze werknemers.

Vanaf hoofdstuk 3 zijn de studies gebaseerd op een kleinere data set van melkveebedrijven in de regio Moskou. **Hoofdstuk 4** modelleert het effect van subsidies op winstgevendheid op een meer expliciete manier. Dit hoofdstuk ontwikkelt een microeconometrisch model van gespecialiseerde melkveebedrijven, met behulp van panel data over de periode 1995-2001. Na een discussie over de mate waarin subsidies gekoppeld zijn aan de productie presenteert dit hoofdstuk het model. Het model maakt het mogelijk om te testen of subsidies gekoppeld of niet gekoppeld zijn en wordt gebruikt om het effect van subsidies op de allocatie van variabele inputs, grond, arbeid, veestapel en andere outputs te analyseren. Theoretische condities (monotoniciteit en convexiteit in prijzen) werden niet verworpen door de data, wat de veronderstelling dat de bedrijven de korte termijn winst maximaliseren, ondersteunt. De fixed effect schattingsmethode houdt rekening met verschillen (b.v. in prijzen) tussen bedrijven die worden veroorzaakt door variatie in marketing kanalen, locatie, kwaliteit van de grond en management.

De resultaten laten zien dat de eigen prijselasticiteit en de elasticiteit van melk met betrekking tot subsidies niet significant verschillen van nul. Dit impliceert dat het aanbod van melk niet reageert op marktsignalen en dat subsidies geen prikkel geven voor verdere specialisatie in melkproductie. Alhoewel subsidies een verstorend effect hadden op de input-output mix, hebben ze wel een positief effect op de winst en verkleinen ze ook de mate waarin kredieten een beperking zijn voor de bedrijven. Arbeid, grond en de veestapel hadden lage (negatieve) schaduwprijzen, die toenamen na 1998. Ook de technische verandering nam in opmerkelijke mate toe, alsmede de schaduwprijs van de technische verandering. Dit hoofdstuk laat verder zien dat de melkveebedrijven kampen met een overschot aan grond en arbeid. De negatieve relatie tussen subsidies en variabele inputs, tezamen met de aanwezigheid van kredietbeperkingen laat zien dat de ondernemingen in deze data set hun allocatieve efficiëntie kunnen verbeteren door het gebruik van variabele inputs te verlagen.

Hoofdstuk 5 focust in meer detail op de structuur van schulden en hun invloed op de performance. Om de invloed van schulden op de performance te bestuderen, werden sommige concepten uit de finance theorie aangepast aan de specifieke situatie op de bedrijven in de regio Moskou en aan de aanwezigheid van soft budget beperkingen (SBCs). Een twee-fase benadering werd gebruikt waarbij in de tweede fase een regressie werd uitgevoerd van de (eerste fase) resultaten van DEA op karakteristieken van bedrijven, de aanwezigheid van SBCs, en een set van socio-economische factoren.

De resultaten suggereren dat de SBCs een negatief, en openstaande rekeningen, een positief effect hadden op de performance. A *priori* werd de veronderstelling gemaakt bij de constructie van de SBC dummy variabele, dat subsidies werden toegekend aan verliesgevende bedrijven (Kornai-type subsidies). Dit betekent impliciet dat subsidies een negatief effect hebben op performance. De positieve relatie tussen openstaande rekeningen en performance impliceert dat sterkere en meer efficiënt managers in staat was om de productie op niveau te houden door externe financiering te verkrijgen van toeleveranciers. De efficiëntie van het management werd positief beïnvloed door de omgeving. Ondernemingen gelegen op afgelegen locaties en ondernemingen met een grotere bedrijfsomvang hadden een minder goede management performance. De resultaten van de jaar dummy laten een significant en positief effect zien van de financiële crisis op de efficiëntie. De dummy 'eigenaar' was niet significant en het percentage verwerkte melk en de kwaliteit van de grond hadden een significant en positief effect op de performance. Toegang tot verwerkingsfaciliteiten hielp de bedrijven om hun eigen performance te verbeteren, bijvoorbeeld via lagere transportkosten. Het negatieve effect van afstand tot Moskou stad op de performance wordt verklaard door de hogere transportkosten. Indirect kan het ook een gevolg zijn van minder goede relaties van het bedrijfsmanagement met locale autoriteiten. De bedrijven in de regio Moskou opereerden over het algemeen onder toenemende schaalopbrengsten vóór 1999. De resultaten voor returns to scale geven echter geen duidelijke richting aan omdat de optimale bedrijfsomvang per jaar wordt bepaald in de DEA methode, zodat resultaten niet over de jaren heen met elkaar kunnen worden vergeleken. In 2000 opereerde 41% van de bedrijven onder afnemende meeropbrengsten en 39% onder toenemende meeropbrengsten. Dit impliceert dat de bedrijven hun technische efficiëntie kunnen verbeteren door de schaal aan te passen.

Het laatste empirische **Hoofdstuk 6** focust op melkveebedrijven in de regio Moskou en analyseert verschillen en overeenkomsten tussen bedrijven in termen van hun performance en karakteristieken van het bedrijf en management. Hoofdstuk 6 verschilt van de Hoofdstukken 4 en 5 door het gebruik van pre-reform data van het jaar 1990. Dit maakt het mogelijk om de impact van de historische performance op de huidige performance te analyseren. Het theoretische concept van de vier dimensionale bedrijfsomgeving (institutioneel, sociaal, economisch and fysisch) die een invloed hebben op de performance werd gebruikt om de karakteristieken van een onderneming, de historische en huidige performance te bepalen. Cluster analyse werd gebruikt om groepen met verschillende karakteristieken te bepalen.

De resultaten laten zien dat er drie clusters van bedrijven zijn in het jaar 2000. De clusters verschillen qua omvang, locatie, winstgevendheid, loonniveau, melkprijzen, subsidies,

management van schulden en productiviteit. Beschikbaarheid van verwerkingsfaciliteiten, eigendomsvorm, juridische vorm en mate van specialisatie verschilden niet tussen de clusters. De ratio van subsidie en revenuen verschilde eveneens niet significant tussen clusters. De resultaten suggereerden echter wel dat de invloed van subsidies afhing van management capaciteiten, aangezien de bedrijven met een beter management meer subsidies ontvingen. De resultaten laten ook zien dat management capaciteiten erg belangrijk zijn in het verkrijgen van (handels) kredieten. Ook laten de resultaten zien dat een goede reputatie van het management er toe leidt dat toeleveranciers meer leningen willen verstrekken. De analyse van de historische karakteristieken suggereert dat groep van de best presterende bedrijven bestaat uit bedrijven die ook in de pre-reform periode al goed presteerden. Deze ondernemingen hebben hun bedrijfsomvang in geringere mate verkleind en hebben minder problemen met schulden.

Tezamen geven de Hoofdstukken 2-6 een beeld van het effect van subsidies en schulden op de allocatie van inputs en outputs en op de performance van landbouwondernemingen in Rusland. **Hoofdstuk 7** geeft een discussie van de sterke en zwakken kanten van de data en methoden die zijn gebruikt in dit proefschrift. Verder geeft dit hoofdstuk een samenvatting van de resultaten en de voornaamste conclusies. De evaluatie van de data die zijn gebruikt in dit proefschrift benadrukt de problemen van empirisch onderzoek in transitie economieën. De winstfunctie benadering bleek bruikbaar in het modelleren van het effect van subsidies op de performance omdat het de controleert voor de relatie tussen prijzen en subsidies. De data set van melkveebedrijven in de regio Moskou was niet representatief en is atypisch voor de rest van Rusland vanwege de nabijheid van Moskou (invloed op subsidie, vraag naar land, nabijheid output markten en werkgelegenheid). De verschillen die in de hoofdstukken 3-6 worden gevonden in termen van de impact van subsidies op performance worden verklaard door verschillen in omgevingsfactoren en methode. Overall laten de resultaten in de Hoofdstukken 3-6 zien dat (a) de ondernemingen te groot zijn, (b) het effect van schulden op performance is positief en (c) de performance van de bedrijven is verbeterd na 1998. Het feit dat de landbouwondernemingen te groot zijn en de geringe response van melkveebedrijven op prijssignalen suggereren dat de producenten langzaam hun gedrag en bedrijfsstructuur aanpassen aan de nieuwe marktomgeving.

Краткий автореферат диссертации (Summary in Russian)

на тему: ″Микроэкономический анализ деятельности сельскохозяйственных предприятий России с учётом эффектов субсидий и задолженности″

В сельском хозяйстве России на современном этапе можно выделить три категории производителей: сельскохозяйственные предприятия, домашние хозяйства и семейные хозяйства. Численность сельскохозяйственных предприятий после реорганизации в секторе по-прежнему составляет свыше 25 тыс. хозяйств, у которых доля сельскохозяйственных угодий в среднем за период 1990-2001 гг. составляла свыше 80% сельхозугодий России. За период 1992-2001 гг. объемы производства на сельскохозяйственных предприятиях сократились на 60%; на 93% снизилась выплата субсидий, а сами предприятия накопили огромные долги, которые в 2001г. в десять раз превышали уровень прибыли в секторе. Вопросы микроэкономического анализа деятельности сельскохозяйственных предприятий России с учётом эффектов субсидий и задолженности остаются слабо изученными. Целью данной работы является изучение влияния субсидий и задолженности на экономическую и технологическую эффективность сельскохозяйственных предприятий в период 1990-2001 гг.

Данная цель обусловила постановку следующих исследовательских задач, представленных **в первой главе**:

1. Описать изменения в структуре, организации, эффективности и аграрной политике российского сельского хозяйства за период 1990-2001 гг.
2. Определить влияние субсидий на эффективность использования ресурсов и производства продукции на сельскохозяйственных предприятиях.
3. Установить, как повлияли долги предприятий на эффективность использования ресурсов и производства продукции на сельскохозяйственных предприятиях.
4. Выявить влияние дореформенных характеристик деятельности сельскохозяйственных предприятий на их современное экономическое состояние.
5. Сделать заключение о степени адаптации сельскохозяйственных предприятий к новым экономическим условиям переходного периода.

Также в первой главе кратко представлены объект исследования, методология и исходные данные. Объектом исследования стали крупные и средние предприятия аграрного сектора России, и в частности молочные хозяйства Московской области. Информационную базу исследования составили нормативно-справочная информация, от-

четы и аналитические материалы Министерств сельского хозяйства Российской Федерации и Московской области; печатные издания Госкомстата России; а также база данных по сельскохозяйственным предприятиям России и Московской области (регистры сельскохозяйственных предприятий). Неоклассическая экономическая теория, изложенная в учебниках Т. Коелли и соавторов, Р. Чэмберса, работы В. Грина, К. Хсяо и С. Рао по проблемам эконометрического моделирования, Дж. Хеира и соавторов по методике кластерного анализа, а также эмпирические исследования деятельности сельхозтоваропроизводителей, представленные в статьях И. Свиннена, В. Лифферта, В. Диеверта и Т. Уолса, К. Арнадэ и М. Трублуда, С. Осборна, Ц. Лермана, С. Сотникова, Е.В. Серовой, В.Я. Узуна и других, послужили теоретической базой исследования влияния субсидий и задолженности на эффективность сельскохозяйственных предприятий. При определении эффективности предприятий использовались такие характеристики их деятельности, как технологическая эффективность, частные и общие показатели производительности ресурсов и различные показатели рентабельности.

Вторая глава описывает организационные и структурные изменения, произошедшие на сельскохозяйственных предприятиях, а также в их финансово-экономическом положении, с начала 90-х гг. В противовес новообразованным семейным хозяйствам, сельскохозяйственные предприятия сохранили свои позиции в производстве основной доли товарной сельскохозяйственной продукции. Однако их финансово-экономическое состояние ухудшалось вплоть до 1999 г., что частично было вызвано диспаритетом цен, особенно в 1991-1994 гг. Анализ, в котором использовались данные, агрегированные по сельхозпредприятиям страны, показал, что за последнее десятилетие сектор испытал серьезные изменения, которые, однако, не привели к адаптации к рыночным условиям.

Низкая кредитоспособность предприятий привела к накоплению просроченных долгов почти у 90% сельскохозяйственных предприятий. Лишь после финансового кризиса 1998 г. процент убыточных предприятий сократился, а показатели рентабельности и платежеспособности улучшились. Анализ данных по субсидиям указал на существование следующих различий в секторе. В животноводстве субсидии в значительной степени выделялись в качестве надбавки к цене, в то время как в растениеводстве в основном компенсировались материальные затраты. В структуре субсидий в 1996-2000 гг. наблюдались крайне несистематические изменения, зачастую несогласованные на федеральном и региональном уровне, что охарактеризовало нечеткость политики субсидирования.

Результаты эконометрического моделирования исследуемых предприятий представлены в главах 3-6. **Третья глава** представляет результаты анализа влияния задолженности и субсидий на объем производства 19000 предприятий по 61 региону России за период 1995-2000 гг. Метод производственных функций, использованный в данной главе, позволяет моделировать эффект задолженности и субсидий на технологию производства, а также выявить технологические связи между использованием ресурсов и производством продукции. Это, в свою очередь, позволяет определить степень чрезмерного или недостаточного использования конкретных ресурсов.

При выполнении эконометрического анализа производственной функции по более чем 77000 наблюдений были учтены межрегиональные различия и индивидуальные характеристики предприятий посредством использования метода фиксированного эффекта. Результаты показали отрицательный (невысокий по абсолютной величине) эффект субсидий на выпуск продукции и на совокупную эффективность факторов производства. Это может свидетельствовать о наличии мягких бюджетных ограничений (МБО), то есть являться проявлением государственного субсидирования неэффективных хозяйств. Расчеты показали, что в среднем за 1995-2000 гг. предприятия с самыми низкими экономическими показателями получили субсидий в эквиваленте зарплаты среднего уровня за 2,8 месяца. Иными словами, при прочих равных условиях, субсидирование отстающих предприятий позволяло государству обеспечивать рабочие места сельскохозяйственным жителям в течение 12 месяцев. Однако данные расчеты не являются основанием для принятия решений о субсидировании как способе предотвращения безработицы на селе, так как не приняты во внимание прочие факторы. Положительное влияние задолженности на производство привело к выводу, что чем больше долгов образует предприятие, тем более устойчиво производство и выше эффективность. Таким образом, высокая задолженность в секторе не является причиной снижения эффективности.

Результаты также позволили сделать вывод о влиянии размеров предприятий на эффективность их производства. Подтвердилось, что предприятия, обладая сверхкрупными размерами в советский период, не смогли достаточным образом сократить использование земли, труда, крупного рогатого скота. Анализ показал, что труд, земля, скот, капитал, а также материальные средства использовались с избытком для наблюдаемого объема производства, а отдача от масштаба была довольно низкой (0,51). Снижение показателей производительности на предприятиях, наблюдаемое в сводных данных по сельхозпредприятиям, подтвердилось в оценивании производственной функ-

ции, выполненном по отдельным предприятиям. Результаты показали, что труд является взаимодополняющим фактором всех ресурсов, кроме земли. Это свидетельствует об использовании трудоемких технологий.

Для анализа, представленного в последующих главах, были использованы данные молочных хозяйств Московской области.

В главе 4 представлена микроэкономическая модель, использованная для определения влияния субсидий на прибыль. Оценка модели выполнена на панельных данных по специализированным молочным хозяйствам за период 1995-2001 гг. При моделировании использован подход, учитывающий связь субсидий с объемом продукции и величиной материальных затрат. Субсидии введены в функцию краткосрочной прибыли в качестве аргумента, что позволяет не судить изначально о субсидиях как о напрямую связанных или не связанных с объемами производства, а протестировать это на конкретных данных. Модель также позволила провести анализ влияния субсидий на выбор и сочетание таких ресурсов, как источники финансирования материальных затрат, посевная площадь, труд, поголовье крупного рогатого скота. Также были определены эластичности цен на ресурсы и продукцию.

Результаты показали, что теоретические требования к модели (монотонность и выпуклость функции по ценам) оказались выполненными для использованной совокупности. Это укрепило предположение о том, что в краткосрочном периоде поведение молочных хозяйств было нацелено на максимизацию прибыли. Как и в третьей главе, различия, обусловленные разными каналами сбыта продукции, местоположением хозяйств, качеством почв и управления, были учтены с помощью метода фиксированного эффекта, который использовался для оценивания параметров функции прибыли. По результатам было выявлено, что эластичности молока по ценам на молоко, а также по субсидиям оказались статистически близкими к нулю. Это свидетельствует о том, что предложение молока на рынке не реагировало на субсидирование и на ценовые сигналы, а также о том, что субсидии не способствовали усилению молочной специализации. Выплата субсидий привела к уменьшению использования материальных ресурсов на предприятии. В силу того, что субсидии (компенсации) выплачиваются после осуществления затрат, полученные субсидии не были использованы на приобретение дополнительных материальных ресурсов. Хотя субсидии не содействовали выбору оптимального сочетания материальных ресурсов и объемов производства молока, их положительный эффект проявился в том, что они в краткосрочном периоде ослабляли бюджетные ограничения посредством эффекта дополнительного источника финансирования. Двой-

ственные оценки по земле, труду, капиталу и крупному рогатому скоту оказались низкими по сравнению со стоимостью данных ресурсов (отрицательными в некоторых случаях) и увеличились незначительно после 1998 г. Подтвердился положительный тренд в технологии (увеличивающаяся двойственная оценка по фиктивной переменной года в1997-2001 гг.). Модель подтвердила наличие проблемы избытка трудовых и земельных ресурсов на предприятиях. Иными словами, объем производства и использование материальных ресурсов диспропорциональны земельным и трудовым ресурсам на предприятиях.

В пятой главе детально рассмотрена структура задолженности молочных хозяйств Московской области за период 1996-2000 гг. и ее влияние на технологическую эффективность. Под технологической эффективностью в этой главе понимается степень использования предприятием его технологических возможностей. Рассмотрены теоретические концепции М. Дженсен, В. Меклинга, П. Эллинджера и П. Бэрри, широко используемые в теории корпоративных финансов и финансовом анализе, и проведена аналогия с российской действительностью. В частности, проанализирована возможность использования западных финансовых концепций в условиях специфической структуры задолженности в российских хозяйствах и при наличии мягких бюджетных ограничений (МБО). Для изучения влияния задолженности на эффективность использован двухступенчатый подход. На первом этапе посредством метода оболочки данных (data envelopment analysis) определена чистая технологическая эффективность (ЧТЭ) каждого хозяйства, то есть технологическая эффективность, рассчитанная при условии переменной отдачи от масштаба. На втором этапе в линейной регрессионной модели чистой технологической эффективности в качестве факторов, влияющих на ЧТЭ, использован набор соотношений различных типов задолженности к текущим активам и социально-экономических характеристик хозяйств.

Результаты показали, что МБО оказывали отрицательное, а кредиторская задолженность – положительное влияние на эффективность управления. Наличие МБО отражалось в модели на основе предположения о том, что субсидии выделялись преимущественно убыточным предприятиям, то есть субсидии имели тип Корнаи. Это привело к выводу об отрицательном влиянии субсидий на эффективность. Положительная связь между кредиторской задолженностью и эффективностью показала, что более сильное и эффективное управление способно поддерживать производство в условиях недостатка финансовых средств путем привлечения внешних источников финансирования, в частности от поставщиков. Регрессионная модель зависимости ЧТЭ от различных факторов

подтвердила существование положительной связи между эффективностью молочных хозяйств и более высокой зарплатой (скорректированной на уровень задолженности по зарплате). Более удаленное местоположение хозяйств от Москвы и больший размер хозяйства отрицательно сказались на эффективности управления. Отрицательная связь между расстоянием до Москвы и эффективностью напрямую была объяснена более высокими транспортными издержками. Косвенно такая связь могла быть результатом менее налаженных отношений между предприятиями и региональными властями вследствие менее выраженных выгод от наличия земельных угодий у сельхозпредприятий, отдаленных от Москвы (низкая альтернативная стоимость земли). Оценки при фиктивных переменных года засвидетельствовали положительный эффект кризисного 1998 г. на ЧТЭ. Оценка при фиктивной переменной частной формы собственности оказалась статистически незначимой. Это обозначило недостаточность реорганизации хозяйств, а именно их внутренней системы управления, либо стало проявлением несоответствия зарегистрированной формы собственности и действительной, тем самым ограничивая достоверность анализа. Доля молока, переработанного на предприятиях, а также качество земельных угодий оказались в положительной связи с эффективностью. Несмотря на то, что до 1999 г. молочные хозяйства функционировали в условиях увеличивающейся экономии на масштабе, результаты по отдаче от масштаба за весь изучаемый период 1996-2000 гг. недостаточно ясные. Это связано с издержками метода оболочки данных, в соответствии с которым оптимальный масштаб предприятия определялся для конкретного года, а потому сравнение по годам невозможно. Согласно расчетам по этому методу, в 2001 г. 41% предприятий находились в условиях уменьшающейся, а 39% - увеличивающейся отдачи от масштаба. Таким образом, одним из резервов улучшения эффективности производства является варьирование размеров предприятий.

В **шестой главе,** завершающей эмпирическую часть диссертации, исследуются различия в управлении, экономическом состоянии и структуре среди молочных предприятий Московской области. Использование данных 1990 г. позволило провести анализ влияния начальных условий на эффективность предприятий в 2001 г. Для выявления характеристик деятельности предприятий, влияющих на их прежнее, современное и будущее положение, использована теоретическая концепция четырехмерной среды (институциональная, социальная, экономическая и физическая), предложенная М. Боехлье и В. Эйдман. С целью определения различий между группами успешных и отстающих предприятий использован кластерный анализ. В качестве переменных для

кластерного анализа выбраны характеристики предприятий, отражающие четырехмерную внешнюю среду их деятельности.

Результаты показали, что в 2001 г. в совокупности молочных хозяйств выделяются 3 кластера, различающиеся по уровню прибыли, зарплаты, цен на молоко, полученных субсидий, управления задолженностью и по молочной продуктивности. Наличие перерабатывающих мощностей на предприятиях, форма организации и собственности, а также степень молочной специализации оказались несущественными для объяснения вариации среди молочных хозяйств. Не удалось выявить влияние субсидирования на деятельность хозяйств. Это связано с тем, что вариация доли субсидий в выручке среди кластеров оказалась статистически невысокой. В силу того, что субсидии были получены в основном предприятиями с высокими показателями эффективности (молочной продуктивностью, заработной платой и рентабельностью), был сделан вывод о том, что эффект субсидий зависел от квалифицированного управления. Результаты также показали, что успешное управление, которое однако невозможно было напрямую квантифицировать, оказалось определяющим при получении (торговых) кредитов и обусловило взаимосвязь между наличием долгов и эффективностью. То есть поставщики продолжали свои отношения с молочными хозяйствами благодаря наличию деловой репутации последних, определенной посредством высокой прибыли, зарплаты, молочной продуктивности и субсидий. Анализ характеристик молочных хозяйств по данным 1990 г. показал, что группа успешно функционирующих хозяйств, самая малочисленная, состояла из производителей, которые и в дореформенный период были одними из самых успешных. Эти хозяйства сократили свои производственные ресурсы в меньшей степени, чем другие хозяйства. Проблема невыплаченных долгов на этих предприятий также оказалась менее острой, чем у других хозяйств.

Заключительная **седьмая глава** представляет собой обсуждение положительных и отрицательных сторон данных и методик, использованных в данной диссертации, обобщает результаты разных глав, ставит вопросы, заслуживающие дальнейшего исследования, и приводит основные выводы. Основные выводы этой главы сводятся к следующему. Функция прибыли оказалась подходящим инструментом моделирования и анализа влияния субсидий на результаты деятельности хозяйств, так как она позволила учесть взаимосвязь между субсидиями и ценами. Совокупность молочных хозяйств Московской области оказалась нерепрезентативной по России, в силу атипичных особенностей этого региона в отношении доступа к более благоприятным рынкам сбыта, возможностей трудоустройства, а также особенностей субсидирования. Различия в ре-

зультатах влияния субсидий на эффективность, полученных в главах 3-6, были объяснены использованием разных совокупностей хозяйств, особенностями внешней среды функционирования предприятий в Московском регионе, а также априорными предпосылками о принадлежности субсидий к типу Корнаи. Подтверждение результатов в отношении (а) очень больших размеров хозяйств, (б) положительной роли задолженности в эффективности, (с) улучшения эффективности после 1998 г., полученных посредством различных подходов и с использованием разных совокупностей, укрепили выводы данного исследования в отношении положительного влияния задолженности на эффективность предприятий. Крайняя несбалансированность трудовых и земельных ресурсов с материальными ресурсами и реально задействованными в производстве основными фондами, а также все еще слабая реакция молочных производителей на изменение цен на молоко свидетельствуют о том, что эти хозяйства, в силу ограниченности финансовых ресурсов, лишь в слабой мере приспособили свою структуру и поведение к новой рыночной среде. Способствование развитию рынков труда, укрепление институтов правового регулирования земельных отношений, согласование программ субсидирования с достижением экономических целей должно способствовать улучшению экономико-организационной деятельности предприятий.

Other related publications

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Completed Training and Supervision Plan

During the period of appointment a minimum of 20 credits educational program within Mansholt Graduate School (MGS) is completed. One credit is equivalent to 40 hours of course work.

Table. Educational program completed by I. Bezlepkina

Name of the course	Department/Institute	Year	Credits
I. General part			
Scientific writing	Wageningen University	1999	1
Subtotal part I (max. 6 credits)			1
II. Mansholt-specific part			
Mansholt Multidisciplinary Seminar	Mansholt Graduate School	2004	1
Other presentations at (international) conferences and workshops	EAAE[1)] conferences, Warsaw and Zaragoza	1999/2002	2
	Arkleton conference, Aberdeen	2000	
	IAAE[2)] conferences, Berlin and Durban	2000/2003	
	AAEA[3)] conference, Chicago	2001	
	IAMO[4)] conferences, Halle	2003/2004	
Subtotal part I (min. 2, max. 6 credits)			3
III. Discipline-specific part			
Agricultural Models	Wageningen University, the Netherlands	1998	5
Econometrics II	Wageningen University, the Netherlands	1998	4
Mathematical methods for Economists I, II	Tinbergen Institute, The Netherlands	1999	4
Microeconomics Theory	Tinbergen Institute, The Netherlands	1999	4
Economic theory of the organization	Tinbergen Institute, The Netherlands	1999	2
Applied Microeconometrics	Tinbergen Institute, The Netherlands	1999	2
Time-series and cross-section data analysis	New Economic School, Russia	2000	2
Market and governance failure in Transition	Economic Education and Research Consortium, Russia and Ukraine	2001	1
Empirical Corporate Finance	Netherlands Network of Economics	2003	2
Parametric and Non-parametric efficiency analysis	Netherlands Network of Economics	2003	2
Subtotal part III (min. 9 credits)			28
Total (min. 20 credits)			32

[1)] EAAE is European Association of Agricultural Economists; [2)] IAAE is International Association of Agricultural Economists; [3)] AAEA is American Agricultural Economics Association; [4)] IAMO is Institute of Agricultural Development in Central and Eastern Europe.

Curriculum vitae

Irina Viktorovna Bezlepkina (1975, Noginsk, Russia), graduated from the economic faculty of the Moscow Timiryazev Agricultural Academy (MTAA), obtaining the diploma of economist with specialisation in agricultural modelling ″with distinction″, in 1997. Immediately after, she joined the Master's study program at Wageningen University, the Netherlands, facilitated through the international Tempus project. She was awarded the MSc diploma in Agricultural Economics and Management at Wageningen ″with distinction″. While finishing her MSc thesis she worked on a PhD research proposal for investigating the financial problems of Russian agriculture. In August 1999 she joined the ″Sandwich PhD″ program at the Wageningen Agricultural Economics and Rural Policy Group and Business Economics Group. From January 2003 she has been employed as PhD researcher (AIO) in the Business Economics Group. Within the Sandwich PhD project she worked at MTAA as a lecturer assistant and carried out research from July 2000 to November 2001. During that period, she obtained a grant from the Economic Education and Research Consortium (EERC, Russia) and collaborated with researchers from MTAA, the Center for Agro-Food Policies and the EERC.

Since March 2004 Irina Bezlepkina has been working as Education Co-ordinator of the Mansholt Graduate School, and has been appointed postdoctoral researcher in the Business Economics Group.

Краткая автобиография (CV in Russian)

Ирина Викторовна Безлепкина (1975 г.р.) с отличием закончила экономический факультет Московской сельскохозяйственной академии им. К.А. Тимирязева (МСХА) в 1997 г. по специальности «Математические методы и исследование операций в экономике». В 1997-1999 гг. обучалась в университете г. Вагенинген (WUR, Нидерланды) в рамках проекта Темпус и получила степень магистра сельскохозяйственной экономики и менеджмента с отличием. Во время написания магистерской диссертации начала работу над исследовательской заявкой и в августе 1999 г. была принята на докторскую программу для иностранных студентов (Sandwich PhD) в университете г. Вагенинген. Будучи докторантом университета г. Вагенинген, в 1999-2001 гг. И.В. Безлепкина работала в МСХА в качестве ассистента кафедры политэкономии и участвовала в конкурсах исследовательских заявок и семинарах, организуемых Российской Программой Экономических Исследований (РПЭИ). С января 2003 г. И.В. Безлепкина продолжила работу над диссертацией в качестве научного сотрудника кафедры экономики предпринимательства (WUR). Во время работы над диссертацией в 1999-2004 гг. принимала активное участие в конгрессах и конференциях международных сообществ аграрных экономистов (EAAE, AAEA, IAAE), а также вела курсы по микроэкономике в аграрных университетах г. Омска, Ташкента, Самарканда и Ставрополя в рамках проекта Темпус.

Начиная с марта 2004 г., И.В. Безлепкина работает в качестве координатора учебного процесса в научно-исследовательском институте им. Мансхолта, а также в рамках постдокторантуры продолжает исследовательскую деятельность на кафедре экономики предпринимательства.

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Chris Ogbu. The cover is designed with a multiprong approach, the images depictive of a variety in farming under post-communist conditions. The highlighted circle is indicatory of a focus in the thesis while the currency, subdued in the background, is representative of the then rapidly changing economy.

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In the past decade, the Russian economy has undergone transformations that had an important impact on agriculture. The major agricultural policy change during transition was a substantial reduction of subsidies. The performance of agricultural enterprises continued worsening up to 1999, with low returns, declining productivity and high indebtedness resulting in a large number of loss-making enterprises.

This book combines various methods of economic analysis and applies these to data of 20,000 agricultural enterprises from all over Russia and 150 dairy enterprises from the Moscow region. The theoretical concepts of productivity, profitability and efficiency were used. The degree of adjustment of agricultural enterprises to reforms was assessed in relation to the adjustment of farm structure, organisation, efficiency of production technology and performance. Past and present characteristics of dairy enterprises were assessed to analyse the impact of historical performance and pre-reform conditions on current performance of enterprises.