

# Empirical Measures of Corporate Farm Productivity

## Multifactor Productivity

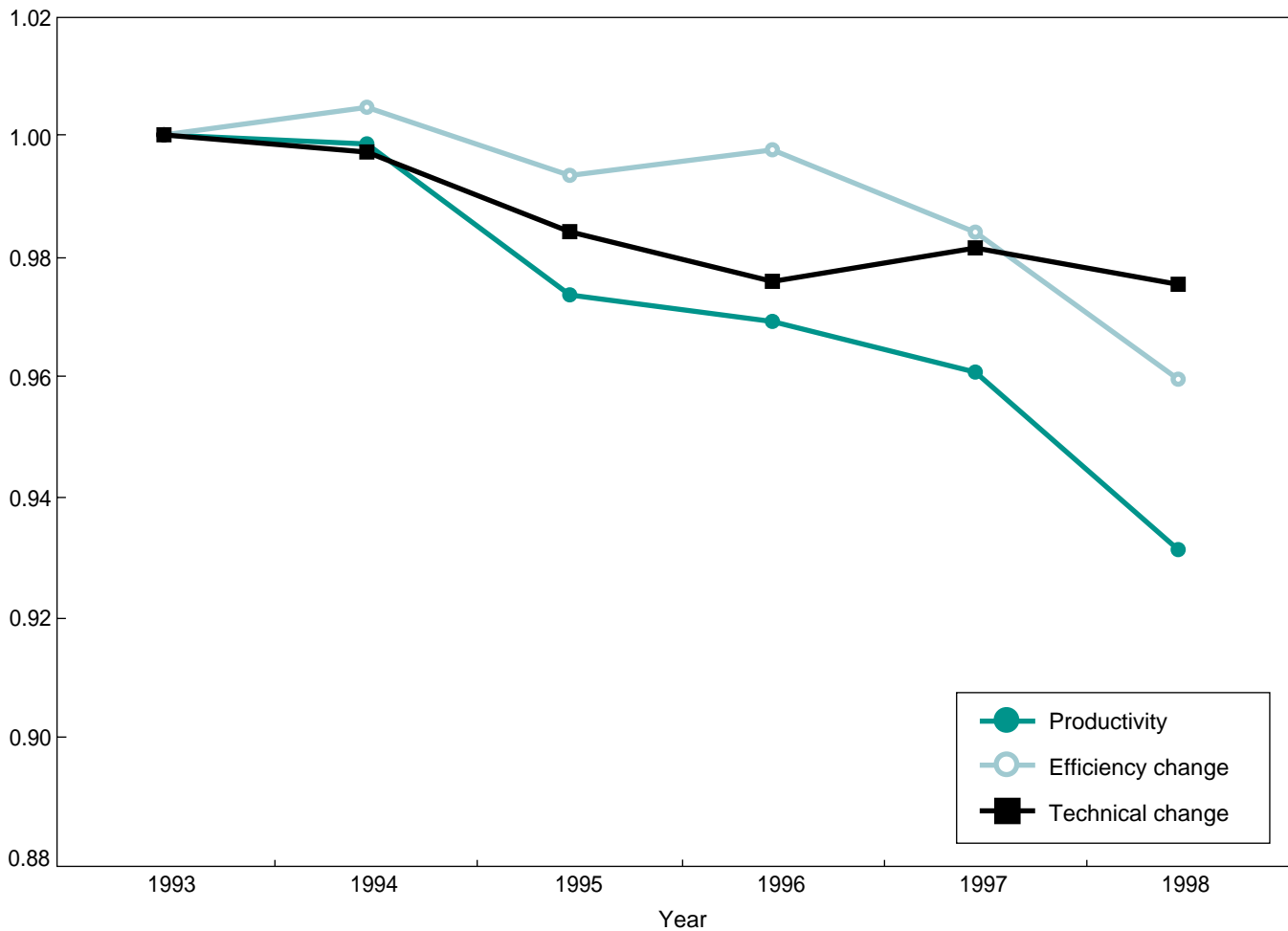
Some of the evidence of poor corporate farm performance is revealed by the multifactor productivity (MFP) measure achieved by corporate farms in Russia from 1993 to 1998 (Trueblood and Osborne, 2002) (fig. 6). MFP measures the growth in total output relative to the growth of total input use, in which the inputs are aggregated with appropriate weights. The results of the analysis show that MFP declined by 1.7 percent per year from 1993 to 1998. Changes in the ratio of input use to output can be attributed to two sources: 1) changes in the relative performance of

farms compared with the best domestic practice (i.e., improvements in efficiency); and 2) changes in the best domestic practice (shifts in the production frontier). The production frontier contracted by 0.6 percent per year, while the decline in efficiency caused an average decline of 1.1 percent.

Earlier studies of the USSR found that agricultural productivity before 1992 was stagnant at best (Trueblood, 1996; Arnade, 1997). One study found that MFP declined by 1.69 percent a year from 1960 to 1980 (Wong, 1986). More recently, Voigt and Uvarovsky (2001) found a similar result for the overall productivity of the crop and livestock sector combined. Apart from including the livestock sector, their study differs from Trueblood and Osborne (2002) in that they exclude fuel and land from the measured produc-

Figure 6  
Russia's crop multifactor productivity, 1993-98\*

1993 = 1



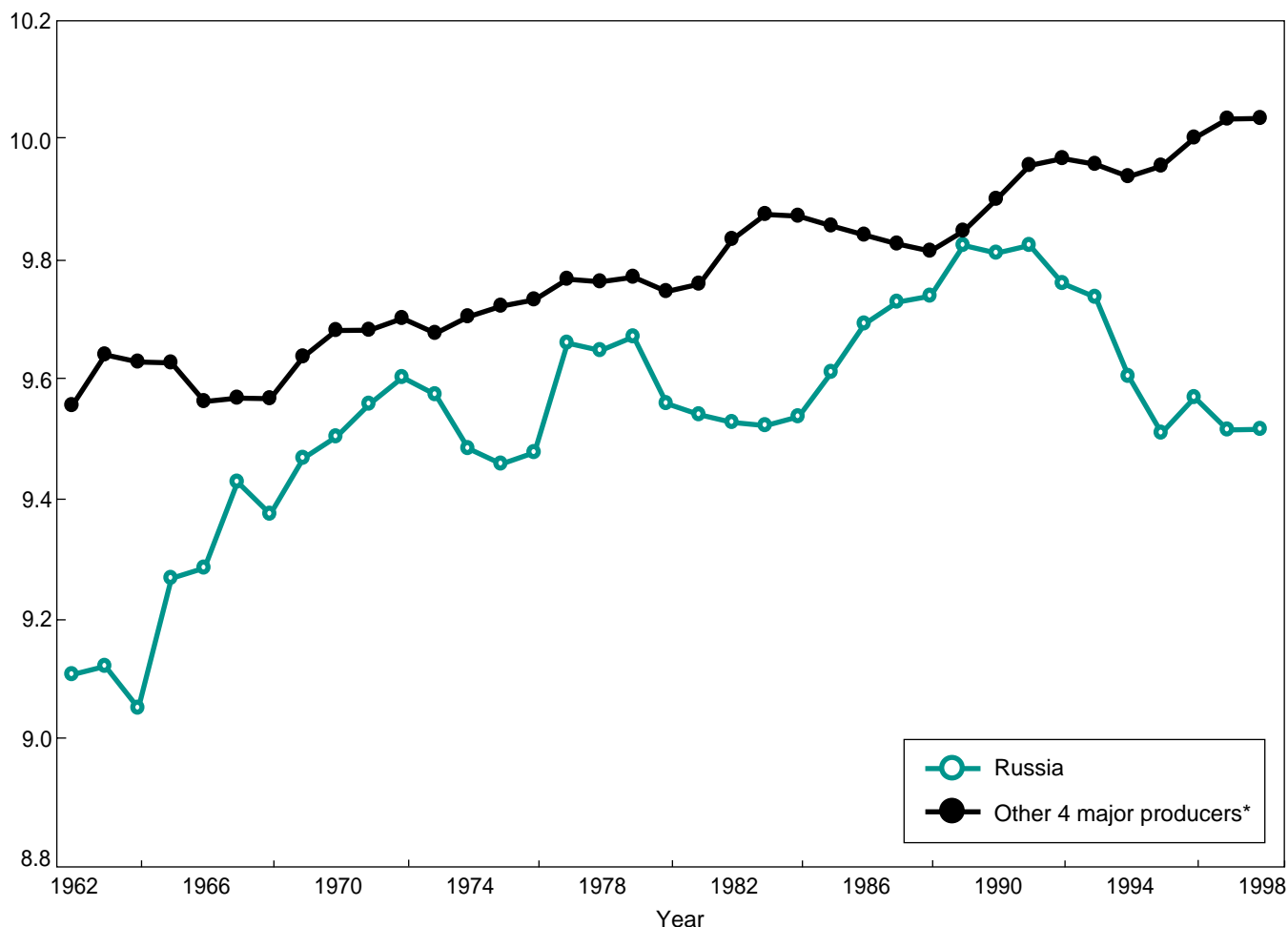
\*Productivity changes can be attributed to changes in the best domestic practice (technical change), and departure from the best domestic practice (efficiency change).

Source: Trueblood and Osborne (2002).

Figure 7

**Comparison of Russian yield trends with other major wheat producers with similar endowments**

Kilograms per hectare (logarithm)



\*The other four main producers are Canada, United States, Argentina, and Australia.  
Source: Trueblood and Arnade (2001).

tion function, and they find that technical efficiency rose from 1993 to 1998. However, a recent paper by Lerman et al. (2001) suggests that agricultural productivity growth in Russia was positive between 1992 and 1997 (7-percent cumulative growth). The seemingly contradictory conclusions reached by Lerman et al. result partly from the use of data from 1992. From 1992 to 1993, the use of fertilizer and other chemicals dropped drastically (table 1), resulting in a one-time increase in productivity. The ERS analyses span the period from 1993 to 1998, so this one-time productivity increase is not measured.<sup>4</sup> Except for the one-time

jump in productivity in 1992, it seems that the decline in productivity that started under Soviet rule continued throughout the 1990s.

**Yields**

The fall in overall productivity is reflected also in the fall in yields (Trueblood and Arnade, 2001). Until 1992, yields in the Soviet Union were approaching those in the West, but since the 1992 reforms, the gap between yields in the West and the CIS has fallen back to the levels of the 1960s. This finding holds for six of the most important crops in Russia (wheat, corn, rye, sugarbeets, sunflowers, and potatoes). Figure 7 illustrates this phenomenon for wheat.

<sup>4</sup>The Lerman et al. study also used a different methodology, included all former Soviet republics in the analysis, and measured productivity for the entire agricultural sector (including livestock).

Much of the drop in yields resulted from the deterioration in terms of trade following the price liberalization of 1992. Following the removal of subsidies on fertilizers and grain (table 4), farmers drastically reduced the amount of fertilizers applied to crops, as shown in table 1. While the resulting decline in yields could be considered part of the “irreversible” output decline described earlier, the decline in fertilizer use may have had an effect on MFP as well. Fields that have not been treated with fertilizer for many years generally lose some fertility, resulting in lower yields.

## Technical Efficiency

Evidence of deteriorating corporate farm performance was also found in declining technical efficiency from 1993 to 1996 (Sotnikov, 1998; Sedik et al., 1999). This indicator, which can be considered a component of overall productivity growth described earlier, measures the extent to which a farm’s output would increase if it were to adopt the best domestic practice. The studies used input and output data from corporate farms in different regions of Russia to compute numerical “technical efficiency” scores showing how each region performed compared with the best domestic practice. This method offered the advantage of simultaneously measuring and explaining the changes in technical efficiency.

Sedik et al. identified several factors that explained the declining technical efficiency scores, but two of the more important factors were:

- **The soft budget constraint.** One compelling theoretical explanation for the weak incentive to improve performance is the “soft budget constraint” phenomenon (that is, routine loan forgiveness). The technical efficiency scores provide evidence that incentives to improve performance are weak because initial conditions are a good predictor of technical efficiency scores. Firms that enjoy a soft budget constraint are usually strategically important and can convince the government to subsidize them to prevent bankruptcy. Knowing that bankruptcy is not a real threat, farms have no incentive to operate efficiently. In Russia, very few farms were forced into bankruptcy during the first 6 years of reform, although some liquidated themselves voluntarily.<sup>5</sup>

<sup>5</sup>In the last 2 years, outside creditors have started to bankrupt chronically insolvent farms, but the number of bankruptcies remains small.

The theory of the soft budget constraint also predicts that farms can only be kept out of bankruptcy with subsidies, so that the poorly performing farms will have a high percentage of revenue from subsidies. This was borne out by the technical efficiency scores. The combination of subsidies to keep insolvent farms afloat and the lack of bankruptcy procedures were particularly characteristic of the operation of firms in the planned economy. The measured inefficiency, then, may show that the economic environment corporate farms face has not changed much since the Soviet period.<sup>6</sup> Agriculture-specific reform (particularly privatization) was supposed to make farms’ budget constraints “harder,” but the technical efficiency scores suggest that the reforms implemented so far have been insufficient.

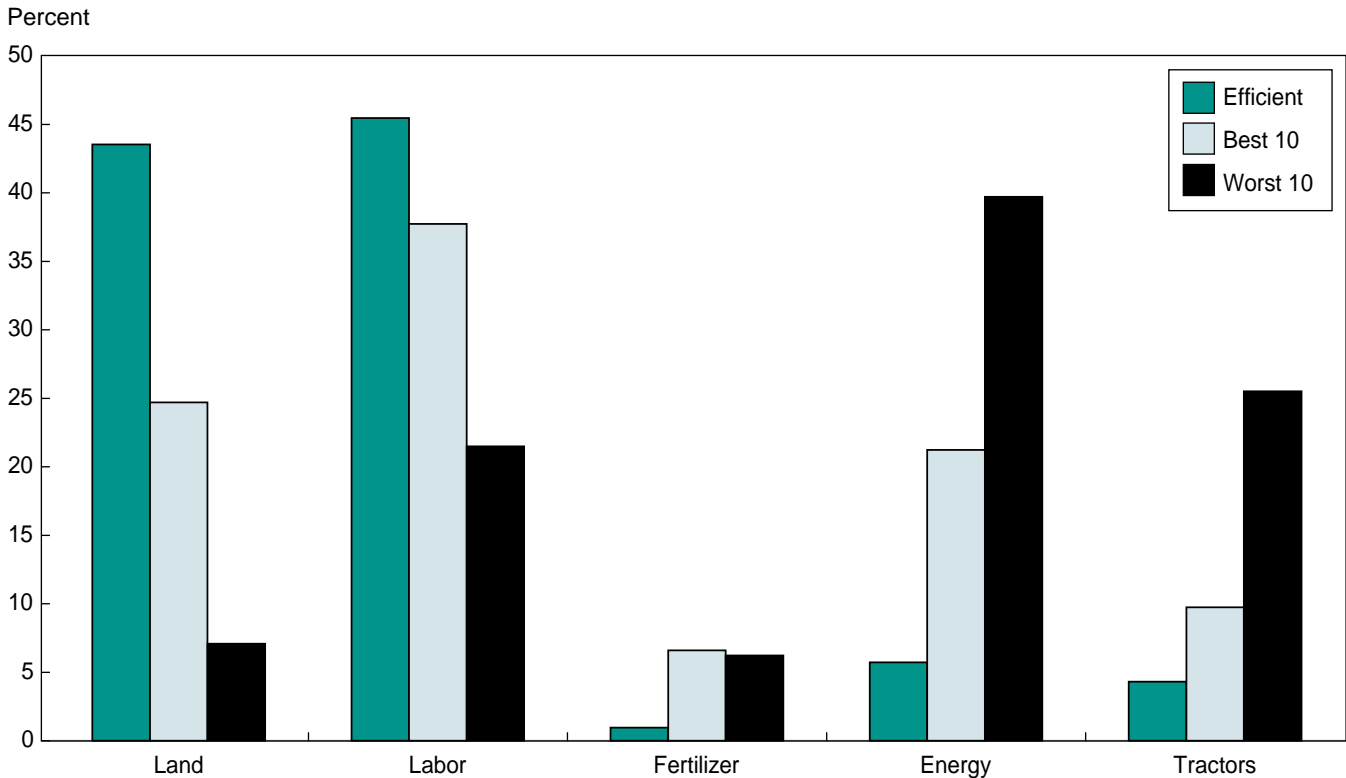
- **The degree of regional crop specialization.** The more specialized agricultural production was in a given region, the more efficient it was. Some regions with high-quality land have tried to encourage diversification of crop production in the name of self-sufficiency. Many regions pursued this policy after neighboring regions restricted trade outflows. However, by diversifying agricultural production, regions are necessarily producing less of what they produce best. The cost of the self-sufficiency policy is lower technical efficiency. Since these trade restrictions are largely the result of policy instituted by regional officials, they can only be removed by enforcing the Federal Government’s jurisdiction over internal trade flows more firmly.

Ukraine’s agricultural enterprises also displayed declining technical efficiency scores from 1993 to 1996. However, unlike Russia, technical efficiency scores have recovered slightly in Ukraine since 1996 (Murova, 2000). This same study also compared technical efficiency in Russia and Ukraine and found that Ukraine’s average technical efficiency scores were higher than Russia’s, even after adjusting for land quality. The variation in efficiency scores between regions in Ukraine was smaller than in Russia, in part due to Ukraine’s smaller geographic area and homogeneous weather patterns and land endowments.

<sup>6</sup>Farms also face incentives to overstate their losses in order to avoid paying profit taxes. Some measured drop in productivity may be a result of underestimates of revenue earned from output or the exaggeration of expenditures on inputs.

Figure 8

**Optimum cost shares, and shares of most, least efficient farms**



Source: Osborne and Trueblood (2002).

**Allocative Efficiency**

Evidence of declining corporate farm performance in the 1990s can also be found in declining allocative efficiency scores, which measure the loss (in rubles) resulting from the use of a mix of inputs other than the cost-minimizing one (Osborne and Trueblood, 2002). This study measured the allocative efficiency of Russian corporate farms from 1993 to 1998 and tried to identify nonmarket incentives that are encouraging farmers to use an inefficient mix of inputs.

The results of the allocative efficiency study show that, given current input prices, corporate farms use too much machinery, fuel, and fertilizer relative to labor and land (fig. 8). Since the technical efficiency study showed that all input use could be reduced, the allocative efficiency results suggest that greater cost savings could be achieved by reducing the use of machinery, fuel, and fertilizer relative to that of labor and land. Table 1 shows that the use of machinery, fuel, and fertilizer has already fallen relatively more than land and labor since reforms began, so the analysis indicates that these trends must continue for corporate farms to

continue to lower their costs (fig. 9). Before reforms began, the Soviets encouraged machinery-intensive farming practices, and Russian and Ukrainian agriculture have inherited the technology of the Soviet era. The present environment suggests that technology would be more efficient if it were more labor-intensive, given that rural labor is presently inexpensive.

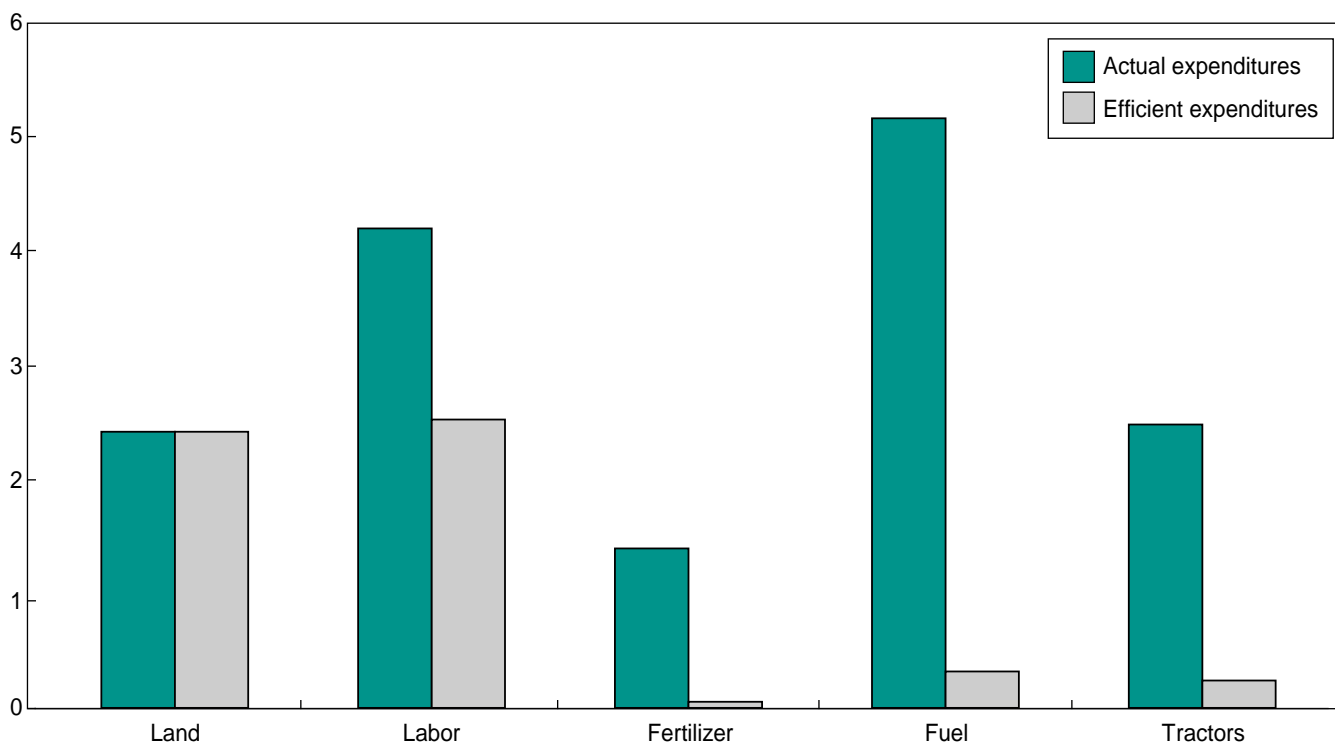
If the agricultural credit markets in Russia and Ukraine were well developed, farms could invest in more labor-intensive machinery. For example, large combines that operate most efficiently in combination with other heavy machinery could be replaced by smaller machines, where manual labor performs more of the work. In general, the equipment inherited from the Soviet era needs to be replaced, and small tractors and small-scale machinery may be the appropriate replacement technology. Unfortunately, agricultural credit markets are not well developed, a topic discussed in more detail below.

The apparent overuse of fuel and fertilizer may also be due to the diversion of inputs from corporate to subsidiary plots. Private or “subsidiary” plot farming in

Figure 9

### Average actual and efficient expenditures per farm

Million 1996 rubles



Source: Osborne and Trueblood (2002).

Russia, although using less than 10 percent of the available arable land, accounts for more than 50 percent of the value of total crop production.<sup>7</sup>

However, the relative success of subsidiary plot farming compared with corporate farms may not be due to more efficient agricultural production. At least part of the success of subsidiary plots arises from the workers' access to inputs appropriated clandestinely from the mother farms. Subsidiary plots are not equivalent to privately owned farms, but instead are a relic of the Soviet era. In the planned economy, workers at the corporate farms were allowed to work small plots<sup>8</sup> in their spare time. These plots were ostensibly the property of the corporate "mother" farm. Pilferage of

<sup>7</sup>The composition of subsidiary plot farming is generally different from that of corporate farms. Corporate farms produce mostly grains, oilseeds, and sugarbeets, while subsidiary farms grow vegetables, potatoes, and livestock.

<sup>8</sup>The average subsidiary plot is about 0.4 hectare. The average size of a truly private farm in Russia is about 50-60 hectares.

inputs for use on subsidiary plots was common practice in the Soviet era. The analysis suggests that this practice has continued into the present.

Eliminating the redirection of resources from corporate farms to subsidiary plots—an incentive to do so could be provided by the credible threat of bankruptcy for insolvent farms—might improve the corporate farms' performance relative to the subsidiary plots.

### Output Targeting

Anecdotal evidence suggests that a further source of poor corporate farm performance is that incentives for farm managers may not have changed since the era of the planned economy. Rather than responding to input and output prices to maximize profits, managers may be responding to pressure from local authorities to maximize the crop output and livestock inventories (as was the practice under the Soviet regime). However, economic research on crop production early in the reform period found that the loss of profitability due to output targeting is fairly small when considering crop

output in general (Arnade and Gopinath, 2000).<sup>9</sup> For wheat and sugarbeets, where corporate farms respectively account for 92 and 94 percent of crop production, output targeting lowered profits by only 5 percent. The impact of output targeting is greater for other

<sup>9</sup>Arnade and Gopinath studied the profitability of agriculture in Russia in 1994 and 1995.

specific crops. For potatoes and vegetables, profitability would have been 44 and 33 percent higher, respectively, if outputs had not been targeted. However, corporate farms do not normally produce potatoes and vegetables—barely 1 percent of the potato and vegetable harvest comes from corporate farms. Therefore, while there is some evidence of residual Soviet-style output targeting in the new market economy, its effect on agricultural production is relatively slight.

### How Important Is a Mortgage Market?

This study makes frequent references to mortgage markets as one of the more important reforms Russia and Ukraine can implement to improve productivity in agriculture. Since using land for collateral is politically unpopular, it is worth taking a closer look at mortgage markets and their role in improving agricultural productivity.

Mortgages influence agricultural productivity in two ways. One is to penalize mortgagees for failure. The fact that a mortgagee will lose the collateralized property if the loan goes into default encourages the mortgagee to make an effort to pay off the loan. The other purpose is to provide investors with a minimum payoff when they engage in a risky loan.

The Russian government may choose a policy strategy that provides similar incentives. For example, the government can force nonperforming farms into bankruptcy in order to penalize farmers for failing to repay loans. The government can also guarantee loans made to the agricultural sector in order to guarantee investors a minimum payoff.

However, the Russian government continues to resist forcing farms into bankruptcy. It is exceedingly difficult, politically, to justify the loss of rural jobs that will result from bankrupting an agricultural enterprise. The increase in rural jobs and incomes that would result from increased productivity and efficiency of corporate farms will take some time to manifest, at which point local politicians may find themselves already voted out of office. The policy of providing soft credit to agriculture is equivalent to a loan guarantee: because the loans are either rolled over or forgiven, the government is in effect guaranteeing the returns on these loans. But this strategy has proven extremely expensive, as the majority of farms in all but the last year of the last decade have not repaid their soft credit loans. By 2000, the Russian government had abandoned the soft credit strategy in favor of subsidizing interest rates for loans.

Liberalizing land and mortgage markets will provide better incentives to use land efficiently than the current policy, which would then lead to an increase in agricultural productivity.



Photo from ERS photo files.

## Summary

There are many factors that hinder efficiency improvements in Russian agriculture. However, based upon the empirical evidence in recent studies, four of the most important problems may be summarized as follows:

1. The soft-budget constraint phenomenon discussed in the technical efficiency study;
2. The diversion of inputs (machinery, fuel, fertilizer, etc.) from corporate farms to subsidiary plots, as revealed by the allocative efficiency study;
3. The obsolescence of machinery-intensive technology inherited from the USSR, another conclusion of the allocative efficiency study; and
4. The lack of crop specialization due to self-sufficiency policies, pointed out in the technical efficiency study.

The first two problems can be solved by refusing to roll over unpaid loans to farms, which will force insolvent corporate farms to go bankrupt (see box, “How Important Is a Mortgage Market?”). The threat of bankruptcy will provide an incentive to operate the farms more efficiently and prevent the diversion of inputs to subsidiary plots. The third problem must be addressed by improving the performance of credit markets in Russia, which would help replace the machinery-intensive technology inherited from the Soviet Union with more labor-intensive machinery. The last problem must be addressed in the policy arena. Although the issue of output targeting has also been raised as a potential obstacle to improving efficiency, ERS research has found little evidence to support that premise.