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Administrative Valuation of Soviet Agricultural Land

Results Using Lithuanian Production Data

Karen Brooks

New land tenure arrangements in the Soviet Union require those who farm the land to pay for its use. But Soviet land markets are constrained or ineffective, and land use fees must be set administratively.

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New land tenure arrangements in the USSR require that agricultural producers pay for land use. The current distorted pricing system and the absence of functioning land markets complicate land valuation, and slow the adoption of new property relations.

In a market economy that functions well, agricultural land would earn its approximate marginal value product in agricultural production. This value can be measured empirically from production data and can serve as an appropriate initial value for users' fees.

Brooks estimates marginal value products for land for 1,032 collective and state farms in Lithuania using farm-level data for 1986 and 1987 and compares the marginal value products derived from actual received producer prices with those derived from border prices with alternative assumed exchange rates for the ruble.

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Administrative Valuation of Soviet Agricultural Land: Results Using Lithuanian Production Data

by
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ADMINISTRATIVE VALUATION OF SOVIET AGRICULTURAL LAND
Results Using Lithuanian Production Data

Events throughout East and Central Europe and the Soviet Union since January, 1990 have clarified the common tasks that these countries face in their efforts to replace defunct institutions of central planning with a more vital market mechanism (see Brooks, et.al., 1991). Each country has adopted a unique mix of policies to move forward on this broadly common agenda. In fall of 1990 it became apparent that the Soviet Union was diverging, perhaps temporarily, from the directions of her East and Central European neighbors. The Gorbachev government at the Union level in October, 1990 promulgated a set of guidelines that imply continued administrative control of many aspects of the economy, including pricing and procurement, and continued state ownership of most productive assets. The guidelines seek to capture many gains of a market economy without allowing markets to function. They thus pose the need for imaginative administrative behavior that mimics the market mechanism. The effort to elicit such behavior through the piece-meal reforms of the past has not been successful.

The hiatus in the Soviet transition, whether temporary or permanent, has profound implications for agriculture and particularly for land tenure. The differences in land tenure in the Soviet Union and East/Central European countries throughout the post war period were evident, but were masked by managerial practices that muted the importance of formal property rights in land. The formalities remained, however, and throughout East and Central Europe the state owned little agricultural land. Even in countries that were fully collectivized, individuals retained formal title to much land, and where they had surrendered title, it was usually to the collective, rather than to the state.

Throughout Eastern and Central Europe debates about land ownership over the past year have centered on the issue of which competing private property claims hold priority and how they should be recognized, rather than the more elementary issue of

the legitimacy of private ownership of land. Incomplete nationalization of land in Eastern and Central Europe appears markedly to have altered the political economy of agricultural reform, and weakened the constituency of support for the inherited system.

In the USSR, private ownership of land is at this writing not yet legal at the Union level, despite recent legislation that legalized private ownership of other assets. Republics are proceeding with their own land laws that recognize different forms of individual tenure with varying restrictions on transferability. Although it is difficult to predict the future course of policies, it appears less likely that fully functioning land markets will develop in the USSR in the near term than in Eastern Europe. The state will retain ownership of most if not all agricultural land, but will allow a more diverse set of users to have contractual access to the land. The parties involved in contractual agreements will be the state and collective farms, local councils, individuals, and small cooperatives.

Under the new tenurial arrangements, those who farm land are to pay for the use of it. With land markets constrained or inactive, land use fees must be set administratively. There is no consensus in the Soviet economics literature yet on how best to value land administratively. The Union level land law of March, 1990 mandates a full scale land cadastre to record characteristics of land. Reliance on cadastral results would greatly postpone the introduction of land use fees. Furthermore, there is no clear methodology for transforming cadastral surveys into land values.

In a well functioning competitive market economy, agricultural land would earn its marginal value product in agricultural production. This value can be measured empirically from production data and actual or proposed prices. The marginal value product will depend on the structure of output prices, the production technology, and managerial efficiency at the farm level. Valuation of land is intimately linked to the

structure of output prices, and the impact of price liberalization or administrati price revision on optimal users fees can be shown.

This approach to land valuation is approximate at best, and would not be necessary if land markets were permitted to function. It has the advantage of simplicity and speed, and allows tenure reform to proceed before the lengthy cadastre is completed. It furthermore provides a benchmark with which to evaluate the claims of farm chairmen that user fees (which they pay) should be very low but fees for intra-farm leaseholds (which they collect) quite high.

The calculation of marginal value products for land of differing quality is a simple technical exercise that embodies no assumptions about allocative efficiency, market clearing, or prices that reflect scarcity values. To step further and argue that marginal value products are optimal user fees does require strong assumptions, in particular that other factors of production are priced according to their scarcity values, and that farm managers are allocatively efficient. When these conditions do not hold, the administrator given the unenviable task of stimulating market behavior without a market has several choices. He or she can adjust user fees to reflect distortions elsewhere, or can attempt through administrative means to remove these distortions. The measurement of marginal value products, and particularly demonstration of their dependence on the structure of output prices, simply expands the set of empirical information that can be used for administrative decision making. The introduction of a genuine market mechanism would greatly reduce the need for continued administration of the economy. Under several plausible paths of transition to a functioning market mechanism, however, initial administrative valuation of agricultural land is required. An empirical understanding of the marginal value products of land could therefore generate information useful for a genuine transition.

In the following discussion I use farm level data from Lithuanian state and collective farms to estimate the marginal value product of land under the 1986 and

1987 output price structure, and what it would be if producers had received world trading prices but used unchanged technology and did not adjust to the different relative prices.

The particular parameter estimates in this work do not generalize to the Soviet Union as a whole. Producer prices for grains in 1986 and 1987 were higher in Lithuania than in the grain belt of the USSR, and prices for livestock products, particularly milk, were lower than in more easterly regions. Because the USSR is so large and its separate regions have not been connected through rationally interlinked prices, it is inappropriate to generalize about the effects of reform on the USSR as a whole from analysis of a particular region. Conclusions based on analysis of average prices throughout the USSR do not capture the potential for better utilization of regional comparative advantage and interregional trade within the country, and this would be a major payoff of the reform. The methodological approach of this paper; i.e.; estimation of marginal value products of land under alternative output price structures, could be used throughout the USSR as the methodology of valuation if land markets continue to be repressed.

The following discussion is based on data from the 1986 and 1987 annual accounts (godovye otchety) of 1032 state and collective farms in Lithuania. The Lithuanian data are additionally valuable because they include measures of land quality rarely available with production data. Lithuanian researchers have made detailed analysis of different soil types on each of the state and collective farms. Each farm is assigned a soil quality indicator (bonitet) based on the yield of a standard crop (standardized according to feed units) on comparable soil under conditions of average management. The variable measuring land quality (bonitet) ranges from 27 to 66 with a mean value of 41.

Price Reform and Land Valuation

The price structure affects the returns to operators working under alternative tenurial arrangements. Valuation under the current pricing system, with a multiplicity of prices for the same product, is difficult and yields distorted asset values and poor resource use. The centrality of land valuation to the process of tenurial reform makes it very difficult to promote new property relations without price reform. The price reform would ideally constitute a full liberalization of prices, but would as a minimum correct distortions in relative prices and remove farm specific deviations from prevailing prices.

Land has historically been offered to farms in the Soviet Union without charge. Implicit land rents have been collected through differentiated, farm specific output prices. One objective of the economic reform is to make the domestic price system more consistent with world prices. This can be attempted by setting output prices equal to border prices (adjusted for transportation costs), and deriving land use fees based on the marginal value product of land with existing factor productivity and technology.

Translation of border prices into domestic prices requires choice of an exchange rate, and no readily defensible candidate is available. Domestic relative prices can be aligned with border prices, however, and the price level made conditional upon the chosen exchange rate.

Lithuanian Producer Prices

Prices received by Lithuanian producers for sales to the state are shown in Table 1 and displayed to show the dispersion among farms. The prices are unit values, and include all premia for quality, quantity, and farm specific differentials. For example, the one quarter of milk producers who received the lowest prices in 1987 were paid less than 335 rubles per ton of fluid milk, while the quarter of producers

who received the highest prices were paid between 352 and 410 rubles per ton. The base price for milk in Lithuania at the time was 310 rubles per ton.

Comparison of Lithuanian prices with those in Latvia, Estonia, and Belorussia indicates some significant differences. Belorussian prices for milk and meat are significantly higher, as shown in Table 2. The price dispersion across republics within this relatively small region illustrates the adjustments that reform would bring. These adjustments would facilitate better use of resources specific to each locality, and expanded gains from interregional trade within the country.

Procurement organizations have traditionally paid different prices to different farms for the same product. Price differentiation enters through zonal pricing and through the bonus system. Several bonuses can raise received prices above base prices. The most important are quality differentials, bonuses for sales in excess of a moving average of past years, and premia for farms in financial stress.[1]

The Lithuanian data show price differentiation, but the degree appears to be less than reported in other parts of the Soviet Union. In 1987 15 percent of Lithuanian state and collective farms had profitability (rentabel'nost) of 10 percent or less (which would qualify them for bonuses of up to 75 percent of base prices in many parts of the country). The data do not show that these farms received high bonus prices for meat or milk, suggesting that special bonuses for financially weak farms were not widely used in Lithuania.

A strong negative correlation between meat prices and land quality in 1987 is shown in Table 3, indicating that farms on poor quality land were paid higher prices for livestock products. The 1986 data also show a strong negative correlation between meat and milk prices and land quality. Differentiated prices for livestock products appear to be the mechanism through which implicit land rents were collected in this region.

Border prices converted into rubles at exchange rates of two and four rubles to the dollar are also shown in Table 1 for reference and comparison. The border prices for commercially traded products are prices c.i.f. northern European ports adjusted to farm gate product definitions.[2] For example, the beef price is beef c.i.f. northern European ports adjusted to live weight using the standard Soviet coefficient of .55 live weight to carcass weight. The border price for milk is equivalent to $10 per hundredweight converted to rubles at the stated exchange rate.[3]

For little traded products, such as potatoes, the listed border price is the marginal price of the third quarter of domestic producers; 75 percent of Lithuanian producers received a price at or below the listed price. In choosing this price for nontraded products, I assumed that the price (for average quality) after the reform would be based not on the highest current price, but on one that was in the high end of the current range.

Relative prices in Lithuania in 1987 differed from border prices; grains and milk were relatively low and meat high. Virtually all dairy producers received less than border prices even at two rubles to the dollar and the difference is greater at four. Meat prices were not as low relative to world values as were milk prices.

Output Prices, Land Quality, and Profitability

Differentiated prices and meticulous measurement of land quality were intended to capture rents associated with preferential access to land at no cost (Poshkus, 1979). If the system worked well, farms would show a range of profitability, but there would be no systematic link between land quality and profitability, unless some other factor contributing to profitability were strongly correlated with land quality.

Table 3 shows pair-wise correlation coefficients for prices, land quality, and profitability in 1987. For example, farms that received high prices for rye tended also to receive high prices for barley, as indicated by the positive, significant correlation coefficient of .28. Individual product prices tended not to be strongly correlated with

farm profitability, except for poultry. Land quality, on the other hand, was positively and significantly correlated with profitability; the correlation coefficient is .36 between land quality (bonitet) and profitability (rentabel'nost'). Farms in the lowest quarter according to profitability had an average indicator of land quality of 38.50, compared to 44.52 for farms in the highest quarter of profitability.

Even though there is a significant correlation between land quality and measured profitability (suggesting that not all implicit land rents are taxed away through prices), not all farms with high quality land are highly profitable. The range of land quality within profitability groupings is greater than the difference in mean quality across groupings.

Regression analysis indicates that variation in land quality is a significant contributor to variation in net output when output is aggregated with actual unit values received by each farm. Regression coefficients for log linear production functions are shown in Table 4.[4] The dependent variable in Table 4 is farm level net output aggregated at prices actually received. Net output excludes all product used for feed, whether produced on the farm or purchased. Output prices vary among farms, and hence this dependent variable is flawed as a measure of farm level output or productivity. It does allow, however, a view of the contribution of factors of production to farm revenues under the prevailing distorted pricing structure.

The independent variables in this regression are land quality (bonitet), land quantity (one unit of cropland is assumed equivalent to two units of hay land), labor in reported hours worked, ruble expenditures on fertilizer, machinery in reported horsepower units, and an aggregate of animals with swine, sheep, and goats weighted at .3 of a cow. The table shows separate estimates for the full samples of over one thousand farms in 1986 and 1987, and sub-samples in 1987 in profitability groupings.

Results for another set of regressions are displayed in Table 5. The dependent variable in Table 5 is net output aggregated at border prices invariant across farms and converted into rubles at two rubles to the dollar. The independent variables in Table 5 are the same as in Table 4. The difference in estimated coefficients in Tables 4 and 5 thus shows the effect of the domestic price structure on returns to factors of production compared to returns using world prices (but keeping the same technology and physical productivity.)

If price differentiation (in the domestic price structure) had succeeded in fully capturing rents associated with superior land quality, the regression coefficient associated with land quality (bonitet) in Table 4 would presumably be small. It is in fact rather large (.53 for 1986) and precisely measured (t=12.74). When net output is aggregated with border prices invariant across farms (Table 5), the contribution of land quality to variation in net output is even greater (coefficient = .81, t=20.66). This suggests that the current prices differentiated at the farm level capture some of the rent associated with high quality land, but not all.

Descriptive data characterizing the farms in the 1987 samples are displayed in Table 6. Table 6 indicates that farms with different levels of profitability show little difference in farm size (mean size is about 2200 hectares of cropland and weighted hayland in each category). More profitable farms pay slightly higher wages but employ the same number of hours, spend a little more on fertilizer, command more machinery power, and have a few more animals. The farms of different levels of profitability are remarkable for their similarity in average command of factors of production. They differ more in net output than in inputs, and the difference is more pronounced under the domestic price structure than under world prices.

Marginal Value Products of Land With Current and Reformed Prices

Marginal value products for all factors of production calculated from sample means of the 1987 regressions with actual prices are displayed in Table 7. Marginal

value products for land quantity and quality evaluated at sample means for all regressions are shown in Table 8.

The estimated marginal value products (Table 8) range from approximately 40 rubles per hectare of average quality land to approximately 150, depending on year, division of the sample, and prices used to aggregate net output. The full sample of 1032 farms in 1987 shows a low value for a hectare of average quality land (40 rubles). When the sample is broken into profitability groups, the dispersion of quality within the groups is reduced somewhat, since quality and profitability are positively correlated. In the profitability based subsamples, the value of a hectare of average quality land (average for the group) is greater and the value of a unitary deviation of quality from average is reduced.

The substitution of uniform border prices (at two rubles to the dollar) for actual received prices raises both the value of a hectare of average quality land and the value of deviations from average quality, since the contribution of quality is not taxed away through the price system. This is apparent in both 1986 and 1987.

The estimated values for land quantity appear reasonable, although they span a wide range. One could conclude conservatively that a farm manager able to sell output at border prices (at two rubles to the dollar) would be willing to pay approximately one hundred rubles for use of a hectare of average quality cropland, if payments to other factors of production do not exceed their marginal value products.

Introducing payments for land while retaining the current price structure would be more problematical. The regressions indicate that the user fee for land would be lower, perhaps by as much as a half, and the gradation according to quality would also be less than if output prices were revised. Introducing uniform user fees (differentiated by quality) without output price revision would penalize livestock

producers on high quality land. User fees without price reform or revision could thus bring a negative instead of positive supply response.

Is 100 rubles per hectare a high or low rental rate? Minnesota's mixed dairy, feed, wheat, hogs, and sugar beet economy is superficially similar to Lithuania's. Cash rents in Minnesota have been declining since 1983 and were in 1989 $50 per acre (240 rubles per hectare at 2 rubles to the dollar) for average quality land.

How can the measurement of the contribution of land quality best be used? This is a nontraditional input, measured on a per hectare basis. The attempt to value it directly as if it were a traditional variable input yields unrealistically high values for a unit of bonitet (e.g., see Table 7). If used for policy purposes this would imply that land of slightly less than average quality should be offered without fee, and land of slightly higher than average quality should command a much higher fee. An alternative to direct valuation of a unit of land quality is to exploit the measured contribution of bonitet to the marginal value product of a hectare of land.[1] A farm that was average in other respects but had land quality of 30 units instead of the mean value of 41 earned a marginal value product (with actual 1987 prices) of 37 rubles per hectare, rather than 40. An average farm with bonitet equal to 50 earned a marginal value product of land of 47 rubles per hectare. These values understate actual contribution of land quality to physical productivity, since price distortions mute the impact of land quality on farm revenue. The measured coefficients of land quality when border prices, rather than domestic prices, are used are significantly higher, and imply a larger deviation of land's marginal value product associated with lower and higher quality land.[5]

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[1] This stretches the literal interpretation of the elasticity of farm output or revenue with respect to land quality, since we are evaluating the contribution of land quality at a value far from its mean. It offers apparently reasonable valuation of hectares of land of different quality, however, and is thus attractive for practical purposes. I thank Robert Dorfman for suggesting this use of the measured contribution of bonitet.

The analysis further suggests that a share contract in Lithuania in which all inputs besides land are separately priced should give the parent farm about 10 percent of output, plus perhaps a risk premium.[6] The share of revenue paid for land should not exceed the share of land's contribution to net output if land is to be paid its marginal value product, and costs of other purchased inputs are not shared. The regression coefficients for land quantity using actual prices received (Table 4) range from .07 to .11 in the subsamples, and are .045 and .13 in the full samples for 1987 and 1986, respectively.

From these estimated elasticities, it can be concluded that the share of land's contribution to variation in net output is approximately 10 percent, and not greater than 15 percent. Land users asked to pay a higher share than this for use of land will adopt uneconomically land-saving technology that will increase society's costs of producing a given level of output. The fragmentary evidence on lease contracting reported from various regions of the USSR suggests that collective and state farm managers often charge share leaseholders a higher share than can reasonably be expected to correspond to land's contribution to net output (Brooks, 1990).

Border Prices at Which Exchange Rate?

Border prices at two rubles to the dollar represent relative prices significantly different from producer prices in Lithuania in 1987. Border prices for milk and grain were higher and meat lower. Border prices converted at two rubles to the dollar, however, had a surprisingly small combined impact on mean net farm output. Since most farms in Lithuania are diversified producers of milk, meat, and cash crops, the price changes introduced with border prices (at two rubles to the dollar) were offsetting in their implied impact on aggregate farm incomes. This is shown in Table 6; there is virtually no difference in mean net output calculated with actual prices and border prices converted at two rubles to the dollar.

The adoption of border prices would bring gains and losses at the farm level even though the impact on mean net output is small. Ninety percent of producers in 1987 would have had net farm output at border prices (at two rubles to the dollar) within a range of 83 percent to 115 percent of received net farm output (actual prices). The ninety percent interval for 1986 is bounded by .81 and 1.19. Thus the introduction of prices based on border prices converted at two rubles to the dollar would bring short run gains and losses between 10 percent and 20 percent of farm income for ten percent of farms. Long run changes would depend on the supply response to the new relative price structure.

The finding that net farm output in Lithuania would change little if border prices (at two rubles to the dollar) were substituted for current prices is new and important. Its importance is enhanced by the absence of any rigorously justifiable estimates of an equilibrium exchange rate for the ruble.

Without knowledge of an equilibrium exchange rate, and in the absence of a general price liberalization, those designing administrative adjustments of agricultural producer prices must use their judgement about what exchange rates are feasible in a partial, sector specific price revision, considering the impact on farm incomes and consumer budgets. The Lithuanian data indicate that an implied exchange rate of fewer than two rubles to the dollar would bring a highly undesirable supply shock associated with the new price structure. In some parts of the Soviet Union where producer costs and prices are higher than in Lithuania, a supply shock may be a necessary part of the adjustment process to remove marginal producers. There is little indication of a need for exit of many marginal producers in Lithuania, if they can operate with the current relatively low producer prices.

Although 1987 levels of farm income were roughly consistent with an exchange rate of two rubles to the dollar, and producers realized implicit rents under the current system, it would be difficult to introduce land payments without raising the

general level of producer prices and incomes. Farms retained implicit land rents and reallocated them to cover other expenses and investment. If required to pay explicit rents without augmented incomes, many farms would have been pushed further into financial difficulty or bankruptcy. Almost half of the farms in Lithuania in 1987 fell in the range of profitability considered to indicate questionable long-term financial viability. There is little economic justification for forcing exit of producers who cannot compete at an overvalued exchange rate, and most observers would agree that the ruble is overvalued at two to the dollar. Producer prices have changed since 1987, but macroeconomic deterioration at the national level has probably increased the gap between domestic and world agricultural prices.

An implied rate of three or four rubles to the dollar would in 1987 have allowed payments for land and higher producer incentives for most products. If the chosen exchange rate with which to translate border prices into ruble prices is higher than the equilibrium rate that emerges as the economy opens, agricultural prices can be expected to adjust upward over time. The constraint in choice of an exchange rate on which to base revised agricultural producer prices is clearly what the demand side can absorb at the time of revision.

Price Reform and Demand Side Constraints

Producer prices based on border prices converted at three or four rubles to the dollar run directly into constraints imposed by the demand side. Consumers will face significantly higher prices when the subsidy covering the difference between retail prices and current producer prices is removed. The demand side adjustment would be even greater if subsidies were removed and producer prices simultaneously revised upward, as would be the case with a ruble exchange rate of 3 or 4 to the dollar.

Retail price policy has stymied revision or reform of producer prices in the past, and it continues to present difficult dilemmas. Retail prices are kept low by

large payments from the state budget. This component of the agricultural subsidy cost 90 billion rubles at the national level in 1989, or roughly 11 percent of GNP. The cost was estimated to increase to 115 billion rubles in 1990, with additional increases in early 1991. In Lithuania the budgetary cost of the subsidy for food consumed in the republic in 1989 was 1.39 billion rubles, or about 30 rubles per capita per month.[7]

If the subsidy were distributed as a compensatory per capita payment of thirty rubles per month, it would augment the money income of a family of four with two earners on average 30 percent. The compensation would be a higher relative payment for poorer and larger families. Without detailed information on income distribution and family budgets, it is difficult to judge whether compensation of this magnitude would exceed or fall short of the increment in food costs for most families. The subsidies are known to go disproportionately to higher income urban families who have preferential access to food at subsidized prices. It is thus likely that removal of the subsidies and distribution of the total as equal per capita compensatory payments would overcompensate many poorer families and undercompensate the wealthier. It would thus improve the income distribution without distorting wage payments by linking compensation to wages.

If revised producer prices were based on an exchange rate of three or four rubles to the dollar, retail prices would be even higher, since the current subsidy would be removed and producer prices would simultaneously be increased by a factor of 1.5 or 2 on average. In that case per capita monthly payments of thirty rubles would leave many families unable to cover their additional food costs, and arguments in favor of a targeted compensation program would increase. Means tested and commodity specific compensation programs could be considered. Poorer people receive much of their subsidy through dairy products, which are widely available in Lithuania at subsidized prices.

Conclusions

The old price system, along with constraints on marketing and input supply, limits the attractiveness of new tenurial relations to producers, and distorts the values of agricultural land. The multiplicity of prices complicates the contractual negotiations and leads to monetization of current distorted asset values.

Lithuanian farm accounts for 1986 and 1987 suggest that farms at that time received on average between 40 and 100 rubles annually in producer rents for use of a hectare of average quality land. Producer rents on individual farms varied according to the prices received on that particular farm. If prices were standardized and changed to border prices converted at two rubles to the dollar, the marginal value product of average quality land would be higher (146 rubles per hectare in the 1986 data, and 90 rubles in the 1987 data). Farms could be asked to pay that amount in rent without exceeding land's contribution to net output.

If prices were aligned with world prices at two rubles to the dollar, however, most Lithuanian farms would not have increased their incomes very much, and payment of 100 rubles per hectare would have worsened financial stress. If prices were standardized and increased to border prices converted at three rubles to the dollar instead of two, the marginal value product of average quality land would be approximately 150 rubles per hectare (1987 data). Producers could pay that much without additional financial stress, although movements in prices of other inputs are also relevant.

If all agricultural users paid land use fees and had access to the same prices for inputs and output, state and collective farm managers would be more eager to offer land for lease or private proprietorship or ownership. Agricultural price reform would thus facilitate changes in land tenure and land management.

Producer prices corresponding to border prices converted at three rubles to the dollar would present a shock to retail prices. Consumers probably could not be fully compensated for the increase, and targeted compensation would be appropriate.

Table 1: Lithuanian Producer Prices
(Unit values, rubles per ton, 1987 a/)
Grouped According to Prices Received

	Lowest 25%	Median	Highest 75%	Base a/ Prices	Border b/ 2 rubles/$	Border 4 rubles/$
Rye	162	169	186	170		
Barley	135	150	172	130	260	520
Oats	115	136	171			
Wheat	125	133	160	130		
Potatoes	125	143	167	125	167	334
Beets	59	59	61	58	40	80
Beans	323	476	625			
Fruit	254	334	400		398	796
Beef *	2,506	2,680	2,892	1,550	2,220	4,440
Mutton *	2,564	2,651	2,798	2,200	1,540	3,080
Pork *	2,447	2,685	3,000	2,100	1,540	3,080
Poultry *	2,000	2,079	2,323		1,540	3,080
Milk	335	343	352	310	440	880
Wool	4,626	5,000	5,667		5,000	10,000

* Live weight

Sources: (a) Godovye otchety, 1987, Lithuanian SSR.

(b) Chursin, A.M. Tseny i kachestvo sel'skokhoziaistvennoi produktsii, Moscow, Kolos, 1984.

(c) 1987-88 Commodity Trade and Price Trends. John Hopkins University Press, 1988. Price Prospects for Major Primary Commodities, 1988-2000. The World Bank, 1989.

Table 2: Producer Prices 1988
Average Unit Values (Rubles per ton) =
Total Receipts/Total Tons Sold to State

	ESTONIA		BELORUSSIA		LATVIA		LITHUANIA
	Collective	State	Collective	State	Collective	State	Collective 1987
Rye	221.5	220.9	190.1	187.2	214.3	221.3	180.1
Barley	171.1	151.5	176.5	169.5	160.7	166.4	155.3
Potatoes	244.1	230.5	153.3	154.6	208.2	183.2	155.4
Beef	2,586.4	2,506.2	3,406.7	3,361.4	2,902.2	2,881.3	2,689.7
Pork	2,303.5	2,285.1	2,912.9	2,568.6	2,599.7	2,501.0	2,720.5
Milk	370.4	367.6	497.5	528.1	414.1	421.2	343.8
Sugar-beets			70.4	75.3	85.9	91.0	60.8

Source: Godovye Otchety, Svodnye, 1988, listed republics

Table 8: Correlation Coefficients for Prices Land Quality, Farm Profitability

	Rye	Barley	Beets	Beef	Milk	Wheat	Oats	Pork	Poultry	Land Quality	Farm Profitability
Rye	1.00 (800)*										
Barley	.28 (745)	1.00 (948)									
Beets			1.00 (260)								
Beef			.21 (260)	1.00 (1030)							
Milk	.12 (798)		.25 (260)	.41 (1028)	1.00 (1028)						
Wheat	.12 (562)	.17 (734)				1.00 (755)					
Oats	.26 (420)	.21 (468)					1.00 (485)				
Pork		-.10 (938)	.25 (259)	.54 (1020)	.26 (1018)			1.00 (1020)			
Poultry								1.00 (143)			
Land Quality				-.55 (1027)	-.20 (1025)			-.47 (1017)		1.00 (1028)	
Farm Profitability	.11 (800	.14 (948)			.10 (1028)			.19 (1020)	.23 (143)	.36 (1028)	1.00 (1032)

All coefficients significant at .005 level. Prices are unit values. Land quality is bonitet.

*( ) indicates number of observations. Profitability (rentabel'nost) = (earnings-costs)/costs.

Table 4: Estimated Coefficients for Log Linear Production Functions
Lithuania, Actual Received Prices a/

	1986 Full Sample	1987 Full Sample	Profit 1 c/	Profit 2 d/	Profit 3 e/	Profit 4 f/
Intercept	3.69 (13.43) b/	3.42 (11.89)	3.37 (6.68)	3.04 (6.26)	4.01 (7.80)	3.35 (6.33)
Land Quality g/	.53 (12.74)	.45 (10.41)	.24 (2.82)	.28 (3.54)	.20 (2.62)	.41 (5.51)
Land Quantity h/	.1ᵢ (4.63)	.045 (1.50)	.07 (1.30)	.11 (2.08)	.07 (1.31)	.10 (1.97)
Labor i/	.29 (10.68)	.34 (11.13)	.45 (7.98)	.44 (8.03)	.38 (7.70)	.39 (6.79)
Fertilizer j/	.04 (2.62)	.10 (4.43)	.13 (3.56)	.10 (2.63)	.12 (3.37)	.05 (1.26)
Machinery k/	.13 (7.05)	.18 (8.13)	.10 (2.49)	.14 (3.81)	.16 (4.52)	.17 (3.82)
Animals l/	.30 (14.69)	.25 (12.05)	.14 (3.65)	.18 (5.65)	.18 (4.47	.24 (6.28)
R^2	.73	.73	.74	.80	.76	.79

a/ Dependent variable is net output aggregated with actual prices received

b/ t-statistics

c/ Profit < 15.70%

d/ 15.69% < Profit < 23.56%

e/ 23.65% < Profit < 32.01%

f/ Profit > 32%

g/ bonitet

h/ Land = cropland + .5 hayland

i/ Labor = hours worked in agriculture

j/ Fertilizer = total ruble expenditures

k/ Machinery = total horsepower

l Animals = cows + .3 (hogs and pigs) + .3 (sheep and goats)

Source: Godovye otchety, Litovskaia SSR, 1987, 1986.

Table 5: Estimated Coefficients for Log Linear Production Functions
Lithuania, Border Prices at 2 rubles/1$ a/

	1986 Full Sample	1987 Full Sample	Profit 1 c/	Profit 2	Profit 3	Profit 4
Intercept	2.12 (8.22) b/	2.39 (8.79)	2.41 (5.00)	1.70 (3.57)	4.01 (8.05)	2.55 (5.22)
Land Quality	.81 (20.66)	.71 (17.21)	.62 (7.72)	.57 (7.33)	.20 (2.62)	.58 (8.41)
Land Quantity	.18 (6.94)	.10 (3.60)	.14 (2.49)	.15 (2.79)	.07 (1.31)	.14 (3.13)
Labor	.33 (13.05)	.35 (12.35)	.45 (8.28)	.46 (8.53)	.38 (7.70)	.41 (7.73)
Fertilizer	.06 (3.70)	.09 (4.46)	.08 (2.28)	.12 (3.31)	.12 (3.37)	.05 (1.34)
Machinery	.14 (7.59)	.16 (7.73)	.10 (2.57)	.11 (3.14)	.16 (4.52)	.14 (3.52)
Animals	.21 (10.81)	.20 (10.41)	.10 (2.73)	.14 (4.51)	.18 (4.74)	.21 (6.00)
R^2	.78	.77	.77	.83	.76	.82

a/ Dependent variable is net output aggregated with border prices converted at 2 rubles/$1.

b/ t-statistics

c/ Profit 1: Rentabel'nost < 15.70%

d/ Profit 2: 15.69% < Rentabel'nost < 23.65%

e/ Profit 3: 23.64% < Rentabel'nost < 32.01%

f/ Profit 4: 32% < Rentabel'nost

Source: Godovye otchety, Litovskaia SSR, 1987, 1986.

Table 6: Sample Means, 1987

	Full Sample	Profit 1 a/	Profit 2 b/	Profit 3 c/	Profit 4 d/
No. in sample	1,032	260	259	259	257
Land Quality (bonitet)	40.92	38.50	39.53	41.13	44.52
Land Quantity (hectares)	2,199	2,235	2,171	2,189	2,200
Labor (hours)	535,798	536,335	532,525	551,741	522,447
Wages (Rubles/hour)	1.32	1.19	1.30	1.33	1.49
Fertilizer Expenditure in rubles	130,608	129,492	126,799	130,324	135,818
Machinery (Horsepower)	13,639	12,412	13,194	13,859	15,104
Animals(weighted aggregated cow = 1)	1,068	930	1,030	1,080	1,234
Net output (actual prices)	1,991,851	1,591,212	1,869,373	2,090,193	2,423,374
Net output (border prices) 2 rubles = $1)	1,971,870	1,590,417	1,836,058	2,071,387	2,396,070
Net output (border prices 4 rubles = $1)	3,943,741	3,180,834	3,672,117	4,142,775	4,792,140

a/ Profit 1: Rentabel'nost < 15.70%

b/ Profit 2: 15.69% < Rentabel'nost < 23.65%

c/ Profit 3: 23.64% < Rentabel'nost < 32.01%

d/ Profit 4: 32% < Rentabel'nost

Source: Godovye otchety, Litovskaia SSR, 1987.

Table 7: Marginal Value Products, Actual Prices, 1987

	Full Sample	Profit 1 a/	Profit 2 b/	Profit 3 c/	Profit 4 d/
Land Quality	9.99	4.41	6.11	4.69	10.30
Land Quantity	40	52	94	64	109
Labor	1.22	1.31	1.52	1.43	1.76
Fertilizer	1.48	1.70	1.49	2.01	.90
Machinery	25.77	12.94	19.24	25.56	26.90
Animals	477	253	344	354	489

a/ Profit 1: Rentabel'nost < 15.70%
b/ Profit 2: 15.69% < Rentabel'nost < 23.65%
c/ Profit 3: 23.64% < Rentabel'nost < 32.01%
d/ Profit 4: 32% < Rentabel'nost

Source: Tables 4 and 6, derived from Godovye otchety, Litovskaia SSR, 1987.

Table 8: Marginal Value Products of Land (rubles)

	Received Prices 1986	Received Prices 1987	Border Prices 1986 (2 rubles = $1)	Border Prices 1987 (2 rubles = $1)
1 Hectare Average quality				
Full sample	107.21	40.11	145.65	89.58
Profit < 15.70%		52.43		96.02
15.69 < Profit < 23.65%		93.52		119.84
23.64% < Profit < 32.01%		64.41		110.20
Profit > 32%		108.79		156.93
1 Unit of quality (bonitet)				
Full sample	10.79	9.99	15.85	15.36
Profit < 15.70%		4.41		11.52
15.69 < Profit < 23.65%		6.11		12.08
23.64% < Profit < 32.01%		4.69		10.30
Profit > 32%		10.30		14.31

Sources: Tables 4, 5 and 6.

References

Avdiiants, Iu. P. and A. L. Meiendorf. Tsenoobrazovanie v agropromyshlennom komplekse. Moscow, Agropromizdat, 1989.

Boisvert, Richard. "The Translog Production Function: Its Properties, Its several Interpretations and Estimation Problems." A.E. Res. 82-28, Department of Agricultural Economics, Cornell University, 1982.

Brooks, Karen, "Lease Contracting in Soviet Agriculture in 1989," Comparative Economic Studies, Vol. XXXII, No. 2, 1990.

Brooks, Karen, J. Luis Guasch, Avishay Braverman, Csaba Csaki, 1991. "Agriculture and the Transition to the Market." Journal of Economic Perspectives, forthcoming.

Cook, Edward C, William Liefert, and Robert Koopman, "Government Intervention in Soviet Agriculture: Estimate of Consumer and Producer Subsidy Equivalents." Agriculture and Trade Analysis Division, Economic Research Service, U.S. Department of Agriculture. Staff Report, 1990.

Poshkus, Bolius I. Vyravnivanie ekonomicheskikh uslovii khoziaistvovaniia. Vilnius: Mokslas, 1979.

Andrew Schwab and Philip Raup, The Minnesota Rural Real Estate Market in 1988, University of Minnesota, Agricultural and Applied Economics, Economic Report ER 89-3, July, 1989).22

Endnotes

1. Avdiiants, Iu. P. and A.L. Melendorf. Tsenoobrazovanie v agropromyshlennomkomplekse. Moscow, Agropromizdat, 1989.

2. The border prices are not adjusted for transport differentials within the Soviet Union. Lithuania is small and has a major ice free port at Klaipeda linked to the rest of the republic by a road and rail system better than in many parts of the USSR. Analysis of Soviet producer prices in areas more distant from borders would require adjustment for transport differentials.

3. These reference prices are consistent with prices used in the SWOPSIM model for the USSR developed by the Centrally Planned Economies Division of the Economic Research Service, USDA, but were independently derived (Cook, 1990).

4. Translog production functions yielded negative marginal value products for several factors, including labor, and are not reported here. Use of the translog may not be justified if elasticities of substitution are less important to the analysis than are marginal value products (Boisvert, 1982, p. 32). The log linear production functions reported here yielded reasonable parameters, and the translog did not, even though several of the cross product terms in the translog had non-zero estimated coefficients.

5. Sale prices of high and low quality agricultural land in Minnesota show a range of 40 percent around the price of land of average quality (Schwab and Raup, 1989).

6. As long as the budget constraint for the parent farm remains soft, justification for a risk premium is weak.

7. Interviews during August, 1989 with economists in the Lithuanian Council of Ministers.

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