LAND POLICY AND FARM EFFICIENCY: THE LESSONS OF MOLDOVA

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„What was expected, what we observed,

the lessons learned."

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1 INTRODUCTION

Since 1991, Moldova has carried out a wide range of radical reforms affecting its social and economic system. The reforms have been aimed at the creation of political, legal and economic foundations for a market economy based predominantly on the private sector. Within this general framework, agrarian reform proceeded in the following main directions:

- Mass privatization of agricultural land, culminating in physical distribution of land plots and issue of land titles to individual owners;
- Transformation of traditional collective and state farms into new forms of market-oriented organizations.

Over 1 million residents became landowners as a result of this process, which ended between 1998 and 2000. Many of them used their privately owned land to establish independent family farms, while others entrusted their land to managers of newly created corporate farms (partnerships, limited liability companies, agricultural cooperatives, joint stock companies, etc.). As of today, 50% of agricultural land in Moldova is used by individual producers. This is in stark contrast to the pre-reform situation, when individuals cultivated only 2% of agricultural land.

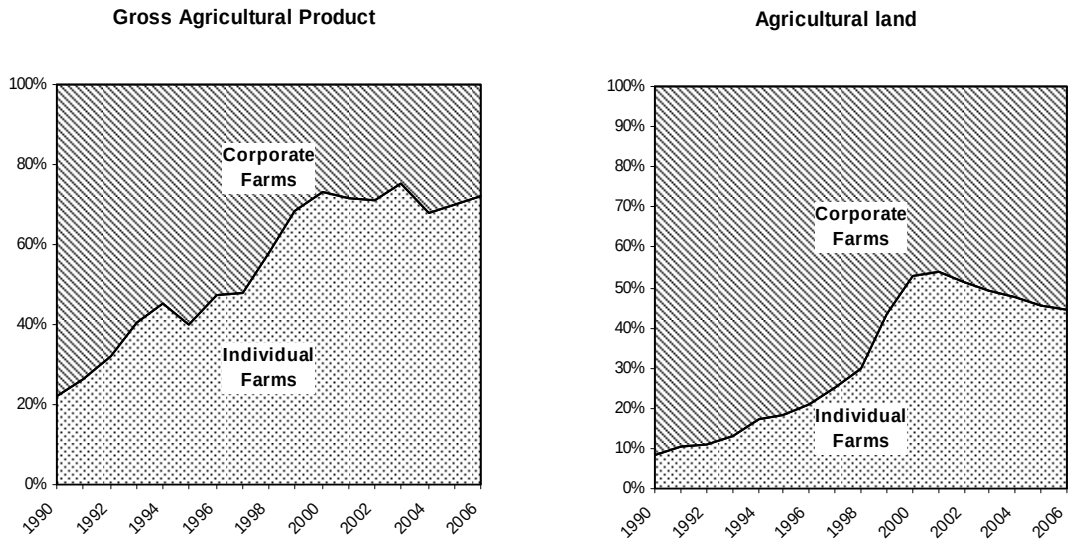
Meanwhile, the progress in land privatization does not led to the individualization of agriculture. Half of agricultural land in Moldova is farmed by the corporate sector. Although this is a positive result, comparing with other transition countries like Russia and Ukraine, it is far from being satisfactory, while compared with market economies, where the share of corporate farms in the total area of agricultural land is much smaller.

One of the main features of the Moldovan agriculture is its structural duality, expressed by the existence of a reduced number of large corporate farms - at one pole, and a large number of small and very small peasant (family) farms and rural households – at another one. Almost do not exist the so-called "medium-sized" family farms, the main organization form in market economies' agriculture. At the same time, the relationship between the organization form and farm size is not always the same. Usually, family farms are small farms, but some of them fall in the category of large farms. A similar picture is observed with corporate farms, which are typically large, but not all of them. Therefore, the structural duality in agriculture in transition will be analyzed in two dimensions: the organizational form dimension and the farm size dimension.

2 INDIVIDUAL VERSUS CORPORATE FARMS

The emergence of two well-defined categories of organizational forms as a result of the post-socialist land and farm structure reforms has triggered an ongoing debate among policy makers and economists concerning the efficiency and performance advantages of corporate farms versus individual farms in transition countries. The traditional socialist thinking believed in economies of scale and thus gave preference to large corporate farms. The Western market-oriented thinking attaches more importance to individual incentives and thus emphasizes the advantages of smaller family farms. GORTON and DAVIDOVA (2004) note that, contrary to prior expectations, there is no clear-cut empirical evidence in transition economies that family farms are more efficient than corporate farms in all farming activities. While significant differences have been found in favor of family farms against the average corporate farm, the best corporate farms still tend to perform as well as the best family farms. Yet these findings clearly support the previous conclusion (LERMAN et al., 2004) that, contrary to the economies-of-scale school of thought, large corporate farms do not have a significant performance advantage over individual farms. We use national statistics and survey data to examine the comparative performance of individual and corporate farms in Moldova.

Figure 1: Increasing role of individual sector



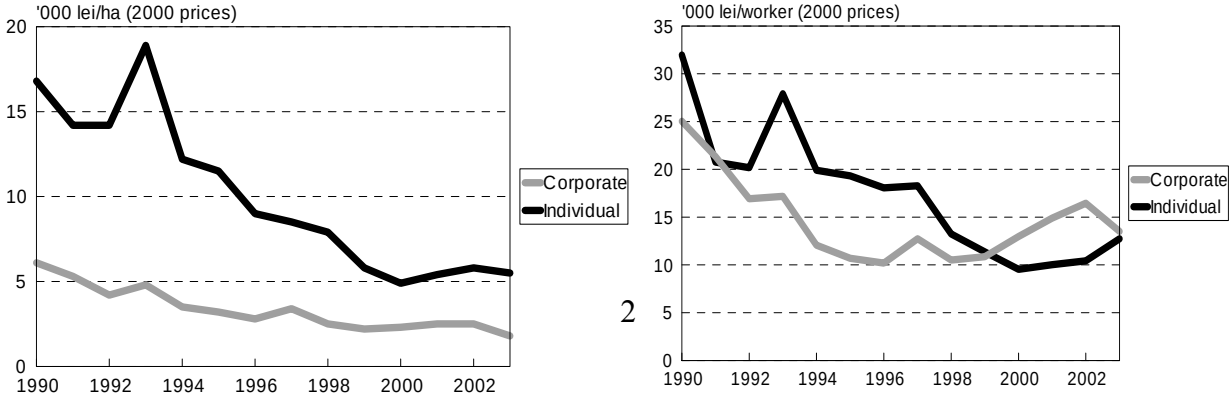
Source: Statistical Yearbooks of Moldova of various years;
State Cadastre, end of year data

The shift of agricultural land from corporate to individual farms has led to significant changes in the production structure of Moldovan agriculture: the output of the corporate farm sector decreased, while the output of the individual sector shows a steady growth. At the beginning of agricultural reforms in the early 1990s, the individual sector was producing 20% of agricultural output on less than 10% of agricultural land; in 2003 individual farms produce three-quarters of agricultural output on half the agricultural land (**Figure 1**). The discrepant shares of the two farm sectors in land and output clearly show that the individual farms use their land more productively than the corporate farms. This phenomenon has persisted since 1990, as the share of individual output has always been greater than the share of land in individual tenure.

The partial productivities of land and labour decreased over time in both corporate and individual farms, and the results are summarized in next figure as averages for the entire period 1990-2003 and for two subperiods.

The land productivity of individual farms is statistically significantly higher than that of corporate farms. The difference in labor productivity, on the other hand, is not statistically significant, although the mean for the entire period 1990-2003 is observed to be higher for individual farms (**Figure 2**). In other transition countries we also observe that the productivity of land is higher for individual farms, but the productivity of labor is actually higher for corporate farms. For Moldova, the labor productivity of corporate farms is indeed higher in the later subperiod 1997-2003, but again the difference is not statistically significant. Thus, the two partial productivity measures for land and labour do not give a consistent picture: **while land productivity is definitely higher for individual farms, the results for labor productivity are ambiguous**. To resolve the ambiguity, we have to calculate a measure of Total Factor Productivity (TFP).

Figure 2: Agriculture land and labour productivity for corporate and individual farms



a) Agricultural land productivity *b) Labour productivity*

In the absence of market prices for valuing the cost of inputs (such as the price of land), TFP is usually determined by estimating a production function and then using the estimated input coefficients as the weights to calculate the value of the bundle of inputs. From considerations of data reliability, we have decided to calculate production functions using two inputs only: land and labour.

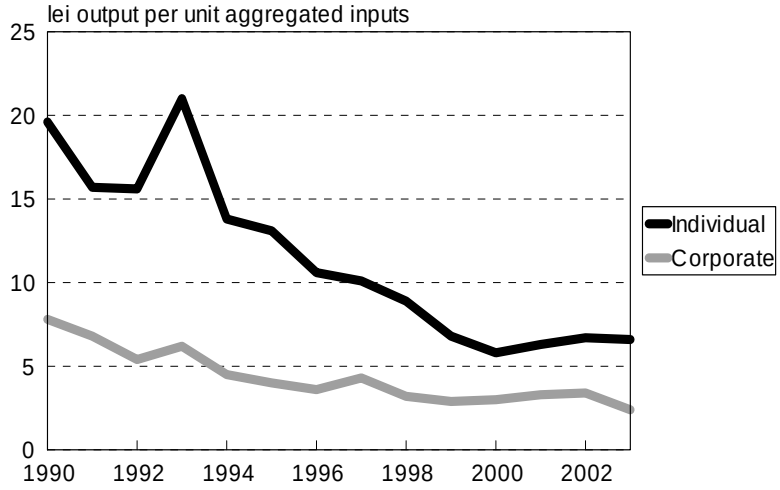
A qualitative picture of TFP changes over time was obtained from national statistics by assuming a conventional Cobb-Douglas production function with stylized factor shares of 0.7 for land and 0.3 for labour (these are the factor shares that we consistently obtained in production functions estimated using various farm surveys in Moldova). Next figure presents the TFP results calculated with these land and labour weights using the full time series. The TFP for individual farms is higher than for corporate farms over the entire period 1990-2003. The respective means for 1990-2003 are 11.5 for individual farms and 4.4 for corporate farms (the difference is statistically significant).

Figure 3: Total factor productivity for individual and corporate farms 1990-2003

Notes: Inputs from national statistics (see **Table 2**) aggregated using hypothetical factor shares of 0.7 to land and 0.3 to labour.

The TFP results in **Figure 3** are derived by production-function methodology using national statistics and they reflect Total Factor Productivity in a sectoral perspective. A different methodology can be used to estimate the efficiency of specific farms from survey data (at a point in time). The efficiency of input use for a particular farm is measured in relation to the production frontier, which is the locus of "best attainable" points, i.e., points where the maximum output is achieved for every given bundle of inputs. Once the production frontier has been constructed, we can calculate the technical efficiency of each farm by measuring its relative distance from the frontier. Points on the frontier are technically efficient; their distance from the frontier is 0, and their technical efficiency (TE) score is 1. As the distance of a particular point from the frontier increases, its TE score decreases. Each TE score is the fraction of the "best performer" output that a given farm achieves with the same bundle of inputs.

Next presents the mean TE scores obtained for farms of different types in two samples from 2003 surveys in Moldova.[1] While all farms surveyed are relatively inefficient (compared to the efficiency benchmark of TE = 1), individual farms achieve higher TE scores than corporate



farms (the difference is statistically significant in both samples). This indicates that the individual farms on average utilize the two inputs (land and labour) more efficiently than the corporate farms: for any given bundle of inputs, they produce on average more than the

[1] The TE scores were derived by Stochastic Frontier Analysis (SFA), an econometric production frontier technique that is conceptually close to production function estimation. For details, see COELLI et al. (2005).

corporate farms. These results are consistent with the TFP results: individual farms are more productive and more efficient than corporate farms.

Table 1: TE scores obtained by Stochastic Frontier Analysis (SFA)

	WB 2003 survey (n = 198)	WB 2003 survey pooled with PFAP 2003 corporate farm survey (n = 719)
Corporate	0.46[a] (n = 22)	0.67[b] (n = 543)
Individual	0.64[a] (n = 176)	0.70[b] (n = 176)

Notes: [a] Difference statistically significant at p = 0.10 by parametric and nonparametric tests.
[b] Difference statistically significant at p = 0.10 by nonparametric test only.

Source: Authors' calculations based on DUDWICK et al. (2005) for WB 2003 survey; MURAVSCHI and BUCATA (2005) for PFAP 2003 survey.

3 LARGE VERSUS SMALL FARMS

The second dimension of farm-structure duality involves farm sizes – large versus small. The optimum farm size is difficult to define because opinions about the farmers' objective function differ and because the same determinants can affect farm size in different ways across different farms or countries (KOESTER, 2003). The optimality of farm size for a given country is largely an empirical question (SWINNEN, 2006). In general, the optimal farm size is a relative notion that depends on the local conditions, such as the share of rural population and the land endowment.

In the absence of a universal optimum, average farm sizes can be meaningfully compared only for countries with similar natural conditions. In this context, an appropriate benchmark for Moldova is provided by the relatively densely populated and land-poor European countries, such as Portugal, Greece, and Italy. These three countries actually have the smallest family farms among the EU-15 – 5-10 hectares, compared with an average farm size of around 20 hectares for EU-15 as a group (Eurostat data from EUROPEAN COMMISSION (2005)). The family farms in Portugal, Greece, and Italy are thus not dramatically larger than the average peasant farm in Moldova (2 hectares national average, 4-5 hectares in various surveys – see **Table 5**), but they are certainly much smaller than the average corporate farm in Moldova.

Next table presents the size characteristics and the partial productivity measures for small and large farms in four recent surveys in Moldova. While the large farms as a group are substantially larger than the small farms by all measures – output, land, and labour, the partial productivities show a mixed picture:

- The partial productivity of land (output per hectare) is higher for small farms.
- The partial productivity of labour (output per worker) is lower for small farms.
- The number of workers per hectare is much higher in small individual farms than in large corporate farms (the "labour sink" effect of individual farms).

Table 2: Size characteristics and productivity measures for small and large farms in Moldova: survey data

	WB 2003 survey		PFAP 2003 surveys		WB 2000 baseline survey	
	Small farms	Large farms	Small farms	Large farms	Small farms	Large farms
Number of observations	176	22	1,166	521	170	180
Ag land (ha)	4.48	971	4.02	918	5.7	533
Workers	4.51	332	6.27	150	1.6	43.7
Ag output ('000 lei)	25.8	3,230	25.3	2,038	75.4	1,642

Output/ha (lei)	6,765	2,745	9,535	2,085	6,414	3,145
Output/worker (lei)	6,857	17,135	5,145	17,824	55,304	54,393
TFP	6,426	4,745	7,424	3,464	8,420	4,010
Workers/ha	1.42	0.26	3.25	0.19		

Note: All differences between small and large farms are statistically significant at $p = 0.1$ (except the differences in productivity of labour – output/worker – in the WB 2000 survey).

Source: DUDWICK et al. (2005) for WB 2003 survey; MURAVSCHI and BUCATA (2005) for PFAP 2003 surveys; LERMAN (2001) for WB 2000 survey.

The ambiguity in partial productivity measures is resolved by calculating total factor productivity (TFP). TFP calculations conclusively show *decreasing* returns to scale: large farms produce less per unit of inputs in the margin than small farms.

We have shown that in Moldova individual farms are more productive than corporate farms and that small farms are more productive than large farms. Typically, individual farms are small while corporate farms are large, and there is a fairly sharp size gap between the farms of two organizational forms (WORLD BANK, 2005). It could therefore be argued that the farm size effect observed in our analysis is simply a result of the organizational form effect, or vice versa. To try and disentangle the two effects, we have looked at two homogeneous samples: a sample of corporate farms (without any individual farms) and a sample of peasant farms (without any corporate farms).

Table 3: TFP of corporate farms by land size categories: PFAP 2003 survey

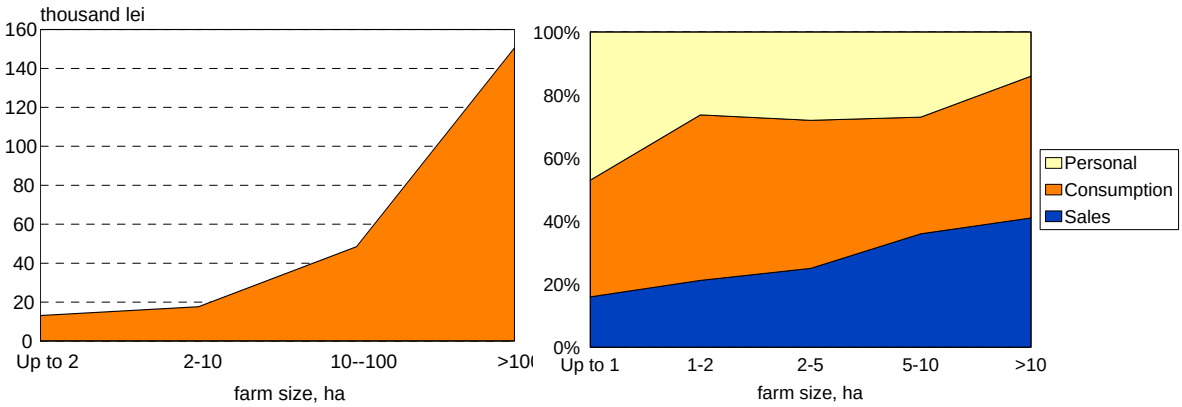
	<500 ha (1)	**500-2000 ha (2)**	**>2000 ha (3)**
Number of farms	238	225	58
Land productivity (output/ha, lei)	1,927	2,162	2,430
Labour productivity (output/worker, lei)	18,660	16,580	19,219
TFP (lei per unit of aggregated inputs)	3,162	3,603	4,167

Source: Authors' calculations from MURAVSCHI and BUCATCA (2005).

The homogeneous sample of 521 corporate farms from the 2003 PFAP survey (MURAVSCHI and BUCATCA, 2005) was grouped into three size categories (**Table 3**). The productivity of land clearly increases with farm size, whereas the productivity of labour does not. Most importantly for our purposes, total factor productivity calculated by aggregating land and labour with appropriate weights from the production function shows a definite increase with farm size in the homogeneous sample of corporate farms.

The World Bank Survey 2000 findings conclusively show that farm income increases with farm sizes. As we see from the next figure, a substantial increase in farm income is observed for farms larger than 10 ha. Also, the findings denote that as larger the farmer is, the level of its commercialization is higher, or they consume less than sell, whish is quite the opposite to very small farms.

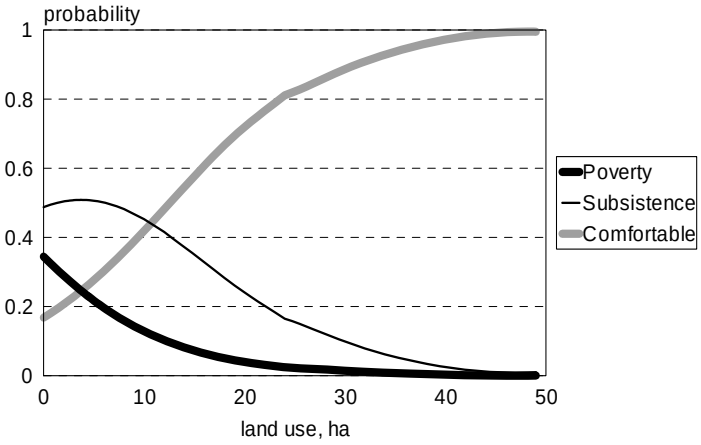
Figure 4: Family income increasing and its structure



Source: World Bank Survey, 2000

In a homogeneous sample of peasant farms from the 2005 WB survey (WORLD BANK, 2005), the standard of living of rural families was observed to increase with farm size. Here, a qualitative variable characterizing different levels of family well-being ("comfortable", "subsistence", "poverty") was used as a proxy for farm performance in the absence of TFP estimates for this sample. Among peasant farms, a comfortable standard of living is associated with much larger family farms than lower standards of living. Peasant farmers reporting a comfortable standard of living had 11 hectares on average, compared with less than 5 hectares for farms in the two lower categories – poverty, when family income is not sufficient to buy food, and subsistence, when family income is sufficient to buy food and daily necessities (the difference between farm sizes is statistically significant at $p < 0.01$).

Figure 5: Probability of achieving a given standard of living as a function of farm size for peasant farmers.



Note: Definition of standard of living levels: "poverty" – family income not sufficient to buy food; "subsistence" – family income just sufficient to buy food and daily necessities; "comfortable" – family income sufficient to buy food, daily necessities, and durables.
Source : Authors' calculations based on WB 2005 survey (WORLD BANK, 2005).

The standard of living of peasant farmers is thus an increasing function of farm size, as is commonly observed in farm surveys in CIS and other transition countries.

A different view of the relationship between standard of living and farm size for peasant farmers is presented in **Figure 5**, which plots the probability of being in one of the three standard-of-living levels as a function of farm size. The probability of being in the highest standard of living (gray curve) increases with farm size, while the probability of being on the lowest "poverty" level (thick black curve), sharply decreases with farm size.[2] These results provide support for

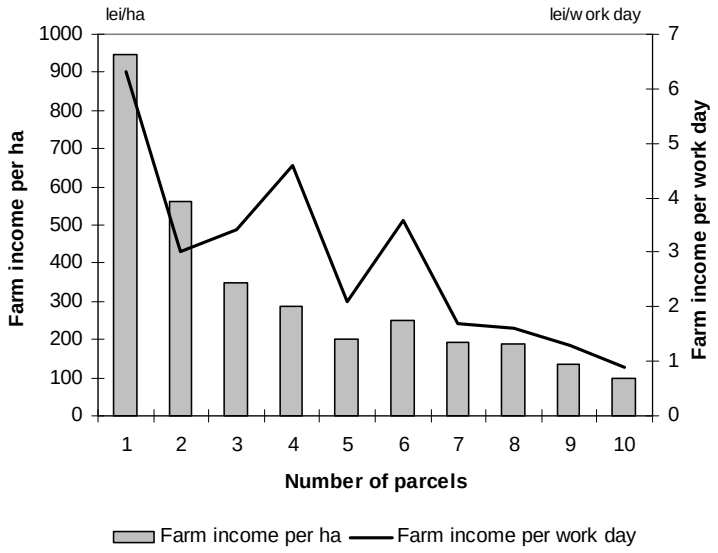
[2] The probabilities of achieving a given standard of living were obtained in a multinomial logistic regression with the three-level standard of living as the discrete dependent variable and farm size as the continuous covariate.

increasing the average size of the individual farms through land market development and land consolidation policies.

These results demonstrate that farm performance actually improves with increasing farm size for farms of the same organizational form. The inverse productivity–farm size relationship is observed for mixed samples that include farms of different organizational forms (both individual and corporate). This suggests that the decrease of productivity with farm size is primarily an organizational form effect, and not a farm size effect: individual farms are more productive than corporate farms, and the size effect observed in our analysis appears to be simply a proxy for the organizational form effect.

Common wisdom argues that consolidation of small disjointed parcels into contiguous holdings is preferred by farmers and landowners. This kind of consolidation should reduce production costs and improve net income for a farm of given size. Land consolidation that produces larger farms (keeping the number of parcels fixed) is also believed to be beneficial, as it should reduce the ratio of fixed costs per unit of land, allow more efficient use of technology, and ultimately increase productivity and efficiency. These theoretical arguments, however, are difficult to substantiate empirically and world experience does not unanimously support either position.

Figure 6: Partial productivity measures versus number of parcels for household plots in Moldova



Source: 2003 WB survey of household plots

Some evidence that supports the advisability of reducing the number of parcels through land consolidation is provided by a 2003 World Bank survey of household plot operators in Moldova. This survey shows a clear negative relationship between productivity and the number of parcels held by the operator. The partial productivities of land and labor are calculated from the survey data as the value of farm income (including cash revenue from sales of farm products and value of own consumption) per hectare of land and per work day (including family workers and outsiders). The results presented in **Figure 6** clearly show that both the productivity of land (farm income per hectare) and the productivity of labor (farm income per work day) decrease as fragmentation (i.e., the number of parcels) increases. The negative relationship between productivity and fragmentation in **Figure 6** is statistically significant by all standard measures.

This conclusion is supported by the analysis of individual farms in Georgia from the 2003 HUJ survey.[3] The Georgian survey also shows that productivity decreases with the increase of fragmentation, controlling for a number of other relevant factors (LERMAN, 2005).

[3] The 2003 HUJ survey in Georgia was conducted by Ayal Kimhi, Department of Agricultural Economics and

4 CONCLUSIONS AND RECOMMENDATIONS

Analysis based on national statistics and survey data shows that individual farms are more efficient than corporate farms. This conclusion does not necessarily mean that corporate farms should be eliminated and replaced with family farms. Corporate farms do exist in market economies, which proves that they are able to compete with individual farms. The small number of corporate farms that do exist in market economies appear to be even more efficient than individual farms as a group: in the United States, corporate farms control 2% of agricultural land and generate 20% of output (in Moldova, the relationship is reversed: corporate farms control 50% of land and generate less than 30% of output). The market economies have achieved an equilibrium farm structure, which includes a mix of individual farms (the dominant majority) and corporate farms (a small minority) determined by resource availability, managerial capacity, and personal preferences of farmers and investors. A similar process can unfold in Moldova, but the development of corporate farms must be left to market forces, free from government intervention and programming.

Analyzing the dichotomy between small and large farms, we conclude based on several surveys that small farms are more productive and more efficient than large farms. This result is based on a mixed sample of both individual and corporate farms, which overall show decreasing returns to scale. On the other hand, a homogeneous sample comprising only corporate farms shows increasing returns to scale, i.e., among farms of the same type size has a beneficial effect on performance. Similarly, in a homogeneous sample comprising only individual farms, family well-being increases with farm size. Based on these findings we tend to believe that the different behaviour is determined primarily by organizational form: small farms do better than large farm not because of a size effect, but because individual farms (which happen to be small) outperform corporate farms (which happen to be large). In this context, the Government of Moldova should abandon its preference for large-scale corporate farms and concentrate on improving the operating conditions for small individual farms.

REFERENCES

COELLI, T., RAO, D. S. P., BATTESE, G. (1998): *An Introduction to Efficiency and Productivity Analysis*, Kluwer, Boston.

DSS (2004a): *Agricultural Activity of Households and Farms in the Republic of Moldova in 2003 (Results of the Statistical Survey)*. Department of Statistics and Sociology, Chisinau, Moldova.

DSS (2004b): *Agriculture in Moldova 2004*, Department of Statistics and Sociology, Chisinau, Moldova.

DUDWICK, N., FOCK, K., SEDIK, D. (2005): *A Stock-Taking of Land Reform and Farm Restructuring in Bulgaria, Moldova, Azerbaijan, and Kazakhstan*, World Bank, Washington, DC (unpublished).

KOESTER, U. (2003): A revival of large farms in Eastern Europe? – How important are institutions? Plenary paper presented at the Conference of International Association of Agricultural Economists, Durban, South Africa, 16-22 August 2003.

LERMAN, Z., CSAKI, C., MOROZ, V. (1998): *Land Reform and Farm Restructuring in Moldova: Progress and Prospects*, World Bank Discussion Paper 398, World Bank, Washington, DC.

LERMAN, Z. (2001): *Moldova Baseline Farm Survey October-November 2000. Part I: Survey of Corporate Farm Managers and Peasant farmers; Part II. Survey of Rural Families with Household Plots*, Draft analytical report, World Bank, Washington, DC (unpublished).

Management, The Hebrew University of Jerusalem (HUJ), Israel, with financial support from USAID/CDR.

LERMAN, Z., CSAKI, C., FEDER, G. (2004): *Agriculture in Transition: Land Policies and Evolving Farm Structures in Post-Soviet Countries*, Lexington Books, Lanham, MD.

MURAVSCHI, A., BUCATCA, A. (2005): *Agricultural Policy in Farmers' Opinion.* PFAP - Private Farmers Assistance Program, East-West Management Institute and USAID, Chisinau, Moldova.

SWINNEN, J. (2006): Endogenous agricultural structures: Insights from transition countries. Paper presented at the 96-th EAAE Seminar *Causes and Impacts of Agricultural Structures*, Taenikon, Switzerland, 10-11 January 2006.

WORLD BANK (2005): *Moldova Agricultural Policy Notes: Agricultural Land*, Draft analytical report, World Bank, Washington, DC (unpublished).