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ARE SMALLER FARMS APPROPRIATE FOR FORMER SOVIET REPUBLICS?

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Executive Summary

There is very little empirical evidence for the existence of economies of scale in farming. Although it is possible that such economies exist under very specific circumstances, they can be offset through rental machinery markets, hiring of managerial and technical skills, and publicly financed extension services. Potential economies of scale are also offset by higher costs on large farms of monitoring the quality and amount of effort expended by workers. The evidence is that smaller farms are more productive than large farms, in part because family-operated farms tend to minimize labor-monitoring costs. In a market economy, farm size is determined by market signals. Market imperfections, such as granting larger farms subsidies or preferential access to credit, can negate natural advantages enjoyed by small farms. In the former Soviet republics, policy makers should strive to eliminate such imperfections, and even encourage farms to reorganize into smaller units. Policy makers should also strive to create a legal and policy framework, including an open land market, in which farmers can adjust farm size in response to market signals.

Introduction

There is a strongly held view in most former Soviet republics that large corporate farms are more efficient and competitive than small or mid-sized farms, and thus that the large enterprises should be protected from subdivision. Former Soviet republics are not the sole adherents of this belief. Communist countries, countries in transition to market economies, and even some market economies have paid an enormous price for assuming that large farms are more productive than small or mid-sized farms. This strongly held assumption is a major obstacle to legal, policy, and practical efforts to facilitate farm reorganization in many former Soviet republics. A recent World Bank Paper notes that this assumption has not been confronted with empirical evidence on farm size and efficiency from around the world.[1] This report is an effort to confront that assertion with such empirical evidence.

The report contains five sections. The first section discusses the basic arguments for and against the existence of economies of scale in agriculture. The second section discusses international experience and evidence on the relationship between farm size and productivity. The third section explores the productivity experience of collective farms. The fourth section summarizes the determinants of farm size in a market economy. The final section contains concluding recommendations concerning farm reorganization and land market development for former Soviet republics.

I. Economies of Scale in Agriculture

Most farms inherited from the Soviet Union are enormous by any standard. In Russia, for example, although the emergence of some individual family farms since 1990 created a sector of smaller-size farms (family farms control only about 5% of Russia's arable land), the vast majority of agricultural land remains in approximately 26,000 collective agricultural enterprises, each averaging about 4,800 hectares of arable land. In Ukraine, the vast majority of agricultural land remains in collective enterprises which average about 3,200 hectares each. By sharp contrast, average farm size is 190 hectares in the US, 31 hectares in Germany, 35 hectares in France, 68 hectares in England, 1.3 hectares in Japan, and only 0.5 hectares in China, all countries with agricultures which are significantly more productive than Russia or Ukraine.

The main argument advanced to support larger scales of farm production is related to the presumed existence of economies of scale. Detailed analysis indicates, however, that the empirical case for existence of economies of scale in agricultural production is very weak. The general consensus of researchers on economies of scale is that they do not

[1] Karen Brooks, Elmira Krylatykh, Zvi Lerman, Aleksandr Petrikov & Vasilii Uzun, *Agricultural Reform in Russia: A View from the Farm Level*, World Bank Discussion Paper 327 (June 1996).

exist, except under very special circumstances.[2] In fact, a recent study by World Bank researchers claims that "the literature contains no single example of economies of scale arising for farm sizes exceeding what one family with a medium tractor could comfortably manage."[3]

The most important potential source of scale economies in agricultural production arises from lumpy (or indivisible) inputs. Farm machinery such as combines, threshers, and large tractors are lumpy inputs and reach their lowest cost of operation per unit when applied to relatively large areas. With the advent of agricultural mechanization, many believed that the economies of scale associated with mechanization would be so large that the family farm would become obsolete. They feared that family farms would not be able to afford to purchase the efficient but expensive machinery. In most operations, however, small farmers can rent or hire machinery to circumvent the advantages of economies of large-scale associated with owning such machinery.[4] The rental market for combines in the United States is very efficient, involving large-scale movement of the machines from south to north during harvest season. Likewise, threshers that were too expensive for individual farms have been rented out in Europe since the 19th century.[5] Thus, economies of scale associated with machines can increase the minimum efficient farm size, but by less than expected because of rental markets.

Management skills are also indivisible and lumpy inputs, so the optimal farm size increases along with increases in the manager's skills. Technical change strengthens this tendency. In an environment of rapid technical change, acquiring and using information becomes increasingly important, giving better managers a competitive edge. However, like machinery, some management and technical skills can be contracted from specialized contractors or can be provided by publicly financed extension services.[6]

Machinery rental markets, contracted management and technical skills, and publicly financed extension services offset potential economies of scale arising from indivisibility of

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[2] See, e.g., Hans Binswanger, Klaus Deininger & Gershon Feder, "Power, Distortions, Revolt and Reform in Agricultural Land Relations," in Srinivasan & Behrman (eds.) *Handbook of Development Economics,* Vol. III, ch. 42, 2659-2772 (1995) [hereinafter, Binswanger, et al.]; Nancy L. Johnson & Vernon Ruttan, "Why Are Farms So Small?", 22 *World Development* 691(1994); and W. Peterson & Y. Kislev, "Economies of Scale in Agriculture: A Re-Examination of the Evidence," Staff Paper P91-43, Department of Agricultural and Applied Economics, University of Minnesota.

[3] Hans Binswanger & Klaus Deininger, "South African Land Policy: The Legacy of History and Current Options," in Johan van Zyl, Johann Kirsten & Hans Binswanger, eds., *Agricultural Land Reform in South Africa: Policies, Markets and Mechanisms* (1996), 64.

[4] Johan van Zyl, "The Farm Size-Efficiency Relationship," in Johan van Zyl, Johann Kirsten & Hans Binswanger, eds., *Agricultural Land Reform in South Africa: Policies, Markets and Mechanisms* (1996), 262.

[5] Klaus Deininger, *Cooperatives and the Break-up of Large Mechanized Farms: Theoretical Perspectives and Empirical Evidence*," World Bank Discussion Paper 218 (November 1993).

[6] van Zyl, *supra* note 4, 262-263.

inputs. The potential economies of scale are also offset by costs resulting from the need for the farm manager to monitor the quality and amount of effort expended by workers. Such costs are sometimes referred to as "agency costs." The need to supervise labor has profound implications for the organization of industrial production, in particular the optimal size of the firm.[7] These "agency costs" are particularly important in agricultural production due to the large area upon which production occurs and the need for the manager or workers to constantly adjust cultivation practices to micro-variations of the natural environment.[8]

Experts have long recognized that family-operated farms are superior to wage-operated large-scale agricultural operations because family farms tend to minimize the "agency costs". On family farms, because family members receive the benefits of all profits, family members: (a) have higher incentives to provide effort than hired labor; (b) share in the risk; and (c) can be employed more flexibly without incurring hiring or search costs.[9] Thus, important negative economies of scale exist when farming operations are conducted in a manner, or on a territory sufficiently large, that requires a significant proportion of non-family labor.

II. Relationship Between Farm Size and Productivity

Most studies examining the relationship between farm size and productivity show that the relationship is inverse -- that is, smaller farms are generally more productive than larger farms. Put another way, output (per unit of farmland or per unit of capital invested) decreases as farm size increases. The data in support of this contention are diverse, come from a variety of sources, and are cast in a variety of terms.

A World Bank study of Polish private farms found that small farms were more efficient than large farms over 20 hectares. Relative total factor productivity (TFP) was highest for farms of 10-15 hectares, but farms of 5-10 hectares and farms less than 5 hectares also showed higher TFP than farms over 20 hectares.[10]

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[7] Calvo & Wellisz, "Supervision, Loss of Control, and the Optimum Size of the Firm", *Journal of Political Economy* 86, 943-952 (1978).

[8] Mechanization in industry involves stationary machinery, which implies that the number of workers can be increased substantially without increasing labor supervision costs. In agriculture, labor and machines are both mobile, making supervision expensive and increasing management costs. Agricultural tasks are also sequential in nature due to the annual cycle of production. This limits the opportunities for specialization and division of labor, which creates few advantages to expansion beyond the size of the family farm. van Zyl, *supra* note 4, 267.

[9] Deininger, *supra* note 5, 6. *See also* R. Ellickson, "Property Rights in Land," 102 *Yale Law Journal* 1315, 1327-32 (April 1993).

[10] Johan van Zyl, Bill R. Miller, & Andrew Parker, *Agrarian Structure in Poland: The Myth of Large-Farm Superiority*, World Bank Policy Research Working Paper 1596 (April 1996).

A World Bank study on the higher efficiency of small versus large farms in Kenya found that output per hectare was 19 times higher and employment per hectare was 30 times higher on holdings under 0.5 hectare than on holdings over 8 hectares.[11] At the national level, this meant that a 10% reduction in average farm size would increase output by 7% and employment by 8%.[12]

Another study in India found that income per hectare on farms of less than 2 hectares was more than twice that on farms of over 10 hectares.[13] A 1990 study in Brazil found that net income per hectare consistently decreased as farm size increased. Net income per hectare for farms less than one hectare was almost 3 times greater than for farms between one and 10 hectares and nearly 30 times greater than for farms between 200 and 2,000 hectares.[14] Roy Prosterman and Jeff Riedinger, using data from 117 countries, found that 11 of the top 14 countries in terms of grain yields per hectare are countries in which small-scale family farming dominates.[15]

Giovanni Cornia, a United Nations researcher, analyzed the relationship between agricultural inputs, land yields, and labor productivity for farms of different sizes in 15 developing countries. He found a strong negative correlation between farm size on the one side, and factor inputs and yields per hectare on the other.[16] The substantially greater yields of small farms in 12 of the 15 countries were mainly the result of more intensive use of land and higher factor inputs. Based on evidence from the study, Cornia concludes that developing countries should promote more labor-intensive labor techniques and discourage premature labor-displacing techniques in order to increase food output, yields, and labor absorption.[17]

Some studies have examined the existence of market imperfections that tend to favor large farms including policies pursuant to which large farms receive greater subsidies and preferential access to credit. The studies show that such market imperfections can negate the typically inverse relationship between farm size and productivity. So, while a small-scale farming strategy holds greater promise for efficiency, small farms may be at a disadvantage if they are forced to compete with larger farms that are subsidized or have preferential access to credit. Policy makers must address critical policy issues relating to market imperfections that favor large farms.

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[11] World Bank, *Kenya: Growth and Structural Change,* Basic Economic Report, Africa Region (1983).

[12] van Zyl, *supra* note 4, 266.

[13] R. Netting, *Small Holders, Householders: Farm Families and the Ecology of Intensive, Sustainable Agriculture* (1993).

[14] William Thiesenhusen & Jolyne Melmed-Sanjak, "Brazil's Agrarian Structure: Changes from 1970 through 1980," 18 *World Development* 402 (1990).

[15] Roy Prosterman & Jeffrey Riedinger, *Land Reform and Democratic Development*, 44 (1987).

[16] Giovanni A. Cornia, "Farm Size, Land Yields and the Agricultural Production Function: An Analysis for Fifteen Developing Countries," 13 *World Development* 513-534 (1985).

[17] *Id.,* 532.

III. Productivity of Collective Farms

Recent studies in some former Soviet republics show that official farm reorganization has done little to change the management, production choices, or resource allocation of collective enterprises. A study of Russian agriculture shows that perhaps 95% of former state and collective farms have "reorganized" in Russia, most into shareholding farms.[18] However, the study also showed that these shareholding farms are managed internally like collective farms of the past.[19] While these farms are nominally "joint stock companies" or "limited liability companies", their collective nature remains. A recent study of Ukrainian agriculture likewise indicates that collective farm reorganization processes have been "purely formal," amounting to merely "changing the sign on the door."[20] A 1995 study in Moldova found that the transformation of collective farms into joint-stock societies, agro-firms and other "new forms" has been only nominal: the reorganized farms "are nothing but collective farms hiding behind a different name."[21] Experience from the reform period has shown that the collective nature of these farms in the former Soviet Union is shed only when they divide into much smaller units.

The literature clearly demonstrates that family farms are more efficient and superior to other modes of farming because of the way in which labor relations are organized.[22] Economic theory predicts that the potential drawbacks of collective farms far outweigh the potential advantages. The theoretical disadvantages of collective farms, largely confirmed by empirical studies, fall under three headings: efficiency, employment, and investment.[23]

- First, even if efforts of each individual worker were perfectly observable, collective production is likely to be inefficient because remuneration for each individual depends on the productive performance of the collective as a whole.

[18] Brooks, et. al, *supra* note 1, 2.

[19] *Id.*

[20] Csaba Csaki & Zvi Lerman, "Land Reform in Ukraine: The First Five Years," World Bank Discussion Paper 371 (1997), 24.

[21] World Bank, "With Farmer's Eyes: A Grassroots Perspective on Land Privatization in Moldova," EC4NR Agricultural Policy Note #7 (October 1996), 10, 15.

[22] *See* R. Berry & W. Cline, *Agrarian Structure and Productivity in Developing Countries* (1979); Binswanger & Rosenzweig, "Behavioral and Material Determinants of Production Relations in Agriculture," 22 *Journal of Development Studies,* 3 (1986), 503-509; Binswanger & Kinsey, "Characteristics and Performance of Resettlement Programs: A Review," 21 *World Development* 9 (1986); and Binswanger, et. al., *supra* note 2.

[23] For a discussion of the theoretical disadvantages of agricultural production cooperatives, see Deininger, *supra* note 5, 10-18; Frederic L. Pryor, *The Red and the Green: The Rise and Fall of Collectivized Agricultures in Marxist Regimes*, 135-91 (1992).

The fact that monitoring of efforts in agricultural production is particularly difficult aggravates the problem.[24]

- Second, even if a collective achieved initial success, it would tend to change into capitalist enterprises or wage-labor operated state farms by successively substituting cheaper wage laborers for more expensive members.[25]

- Third, in collective farms, decisions to invest, save, and distribute profits are made jointly, and if there is no secondary market for equity, it is rational for members to under-invest, leading to disappearance of the capital stock over time.[26]

The above theoretical arguments infer limited efficiency and competitiveness of collective farms as compared to family farms. The empirical evidence worldwide supports those arguments. Three aspects of that empirical evidence concerning collective farms are worth noting: the small number of collective farms worldwide; the setting in which collective farms are established and maintained; and the economic inefficiency of collective farms.

First, collective farms occupy a very small percentage of the world's arable land outside of the former Soviet Union. Indeed, collective farms are virtually non-existent in other industrialized countries.[27]

Second, where collective farms do exist outside market economies, their formation was almost always non-voluntary[28] and their continued existence was often contingent on government subsidies of state monopolies in factor or output markets.[29]

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[24] Binswanger & Deininger, *supra* note 3, 80-81. See also Deininger, *supra* note 5, 10-12. If the remuneration of workers is based on effort, monitoring the work effort is typically very costly. Moreover, an agricultural production cooperative's ability to implement any given scheme of monitoring and differential awards that will not be perceived as arbitrary by its members is likely to be lower than that of an equivalent capitalist firm. *See also* Pryor, *supra* note 23, 139. "Effort", of course, means actual and effective work, not just standing around in the field or leaning on the hoe, in order to be awarded "work points" by supervisors who engage in superficial observation.

[25] Binswanger & Deininger, *supra* note 3, 47.

[26] *Id.,* 48. See also Deininger, *supra* note 5, 15-18.

[27] For a discussion of the infrequency of collective farms in industrialized countries, see Deininger, *supra* note 5, 19. Deininger notes that many of the large farms in industrialized countries which might appear from their name to be agricultural production cooperatives are actually family farms. For example, in the United States in 1992, 3.8% of all farms were organized as corporations, but 89% of these corporate farms were family farms organized as corporations. U.S. Department of Commerce, *Statistical Abstract of the United States 1997,* 666 (1997).

[28] *See* Pryor, *supra* note 23, 114-29.

[29] *Id.,* 216-17.

Finally, the empirical evidence indicates that collective farms are typically inefficient. One broad study on the agricultural performance of collectivized agricultures concluded that collectivized agricultures are associated with lower total factor productivity.[30] Another study of the experience with collective farms in Israel, Ethiopia, Nicaragua, Cuba, Peru, China, and Vietnam drew three main conclusions. First, collectivization of small farms was always associated with productivity losses.[31] Second, cooperative forms of production established as a consequence of the takeover of large farms were not efficient.[32] Third, reversal of collectivization facilitated gains in production and efficiency in a number of instances.[33]

A recent study in Macedonia by the University of Wisconsin's Land Tenure Center found that small private farms are more productive and profitable than state agricultural enterprises, despite institutional disadvantages facing small farms and institutional advantages enjoyed by state enterprises.[34] A related study found that socially owned farms had substantially higher total costs per hectare than private farms, despite generally low levels of input use, due to higher costs of management, maintenance, insurance, and interest payments on debt.[35]

IV. Determining Farm Size in a Market Economy

Farm size in a market economy is an economic variable that responds to market signals related to the scarcity of inputs (cost of inputs) needed by farms and the demand for products (prices received for products) produced by farms. Farm operators adjust farm size over time through a land market (by buying, selling, renting in, or renting out land) in order to increase the economic return to the farming operation. The farm operator seeks

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[30] *Id.,* 259.

[31] In Ethiopia in 1974-76, China in the late 1950s, and North Vietnam in 1958-71, collectivization of small farms significantly decreased productivity. Even the *kibbutzim* in Israel, probably the best-known case of voluntary formation of production cooperatives, are not a valid example to demonstrate the economic efficiency of cooperative production in agriculture as their establishment was heavily subsidized, they were allocated quotas for inputs and outputs and thus never had to compete with a domestic small-scale agriculture, and they now derive the majority of their income from industry rather than agriculture. Deininger, *supra* note 5, 19-20. Lack of fiscal responsibility on the kibbutzim has led to an accumulated debt of $4.5 billion, equivalent to $56,000 per member. "Israel: Average Kibbutz Member Owes $56,000," *Israel Business Today* (October 21, 1994).

[32] *Id.,* 20.

[33] *Id.*

[34] Peter Bloch, Jolyne Melmed-Sanjak, and Robert Hanson, "The Debate Over Agrarian Structure in Macedonia: Implications for Land Management," 910 (unpublished University of Wisconsin Land Tenure Center paper, 1997).

[35] Jolyne Melmed-Sanjak, Peter Bloch, and Robert Hanson, "Macedonian Agrarian Structure and Farm Productivity," 9 (unpublished University of Wisconsin Land Tenure Center paper, 1997).

the optimal balance of labor, land, and capital inputs. Where capital is expensive relative to labor, the operator will tend to substitute labor for capital, and use labor-intensive farming techniques. Yet in agriculture the costs of supervising large numbers of hired workers over a large area is high. The high supervision costs explain why agricultures in most market economies are dominated by family farms relying primarily on family labor supplemented by a few (often seasonal) hired workers.

Farm size in market economies is not dictated by administrative measures or government directives. Apart from the former Soviet republics, the United States has among the largest average farm size in the world. Size and degree of mechanization appear to be the defining characteristics of the efficient agriculture in the United States, so many policy makers and designers in other countries have focused on these characteristics.[36]

Farm size and mechanization, however, are not the cause of high productivity in US agriculture. Rather they are the effect of a dynamic resource allocation process set in motion by the unique factor endowment of the United States. In the United States, labor is the scarce factor, and thus expensive. Because land and capital are relatively abundant, land and capital (in the form of mechanization) are substituted for labor. Machines increase the productivity of limited (and thus costly) labor, allowing US farmers to work their land with fewer workers. In the United States, average farm size has gradually increased from 76 hectares after World War II to 190 hectares today, but more than 95% of these farms are still worked with family labor.[37]

In the economies of most former Soviet republics in the 1990s labor is inexpensive relative to capital, and the quantity of labor available for agricultural work is likely to increase for a period, as adjustment in the industrial sector proceeds.[38] Economic factors in these economies can thus be expected to create a tendency for small farms to have lower costs of production than large farms.

Another important aspect of the US experience (and that of most developed countries) is that increases in farm size occurred gradually as farmers responded to market signals, and not as a result of deliberate government policy and administrative measures. Relatively open markets for land, labor, capital, and products played an extremely important role in allowing farm operators to achieve optimal farm size.

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[36] Liu Ji, Vice-President of China's Academy of Social Sciences and advisor to President Jiang Zemin, recently stated, "In the US, you find 1,000-acre [415 hectare] farms all worked by tractors and machinery. You will not get the same efficiency and economies of scale in China, where family plots average about one mu [0.07 hectare] and the land is still mostly ploughed by man and beast." "Socialised Farming Can Solve Problems in China's Rural Economy," *The Straits Times,* May 4, 1996, available in LEXIS [database on-line].

[37] U.S. Department of Commerce, *Statistical Abstract of the United States 1997,* 666 (1997).

[38] Brooks, et. al, *supra* note 1, 25.

Finally, a crucial feature of the efficient agriculture of the United States, which policy makers and designers in the former Soviet Union should not ignore, is that despite their relative size, the great majority of US farms continue to be operated with the labor of a single family. Over 98% of US cropland is held by individuals, small partnerships, or families in the form of family corporations.[39] Less than one percent of the crop land is owned by non-family corporations.[40] Family farms dominate the agricultural sector of nearly all developed countries, even those with large average farm size such as the United States.

V. Conclusion

The view strongly held by some in the former Soviet republics that large corporate farms are more efficient and competitive than small or mid-sized farms is not supported by empirical evidence. Detailed analysis indicates that the empirical evidence for existence of economies of scale in agricultural production is very weak. Moreover, most studies examining the relationship between farm size and productivity show that smaller farms are more productive than large farms. Farms inherited from the Soviet period are not only huge, but are still managed as collectives, a farm organizational form which has proven to be extremely inefficient.

The farms inherited from the Soviet period are in desperate need of reorganization into smaller and more efficient units. Farm size in a market economy is an economic variable that reflects market signals. Providing a legal and policy framework in which individual farmers can adjust farm size to respond to market signals is crucial. In Russia and other former Soviet republics where the inefficient collective form still prevails and where current economic factors favor smaller farms, the policy implications are twofold.

First, the policy and legal framework of these countries should not only allow, but encourage farm reorganization into much smaller units. Individuals or small groups of farmers who wish to break away from large farms must be able to withdraw land of at least average quality in a relatively simple process. Such farmers must also be able to easily

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[39] U. S. DEPARTMENT OF COMMERCE, STATISTICAL ABSTRACT OF THE UNITED STATES 1997, 666. The United States Census of Agriculture (conducted every five years) classifies farms into four main categories according to their legal organization: sole proprietorship; partnership; corporation; and "other" (cooperative, estate or trust, and institutional). Most family farms are organized as sole proprietorships, but increasingly family members are organizing their farms as partnerships or closely-held corporations. Nevertheless, as of 1992 (the latest census of agriculture for which data is available), sole proprietorships remained the dominant form of farm ownership (86% of all farms) and the largest generator of farm sales (54% of total farm product sales). Partnerships, the large majority of which are family farms, comprise 10% of all farms. Only 3.2% of all US farms are organized as corporations, and 89% of those corporate farms are family held corporations. Non-family corporate farms comprise only 0.4% of all US farms and are responsible for only 6% of total farm product sales. *Id.;* <http://www.econ.ag.gov/briefing/fbe/struc/st3.htm>.

[40] *Id.*

withdraw machinery and other assets from the farm and should receive equal, if not preferential access to credit.

Second, the government must continue developing an open market for land and land shares so that individual farm operators can adjust farm size in response to market signals. In this process, some individual farm operators will purchase or lease-in land plots from other individual farm operators (or land share rights from pensioners and other collective farm members). Correspondingly, others will sell or lease-out their land or land share rights. Very few countries have developed successful agricultures without substantially protecting the right of people to hold and dispose of rights to land.

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