Applied Economic Perspectives and Policy (2012) volume 34, number 1, pp. 37–75.
doi:10.1093/aepp/ppr046

Featured Article

Russian Agriculture during Transition: Performance, Global Impact, and Outlook

William M. Liefert* and Olga Liefert

William M. Liefert and Olga Liefert are economists with the Market and Trade Economics Division of the Economic Research Service, U.S. Dept. of Agriculture.
*Correspondence may be sent to: wliefert@ers.usda.gov.

Commissioned March 2011; accepted December 2011.

Abstract *In the 2000s, Russia emerged as a major player in world agricultural markets, on both the supply (mainly grain) and demand side. This article examines Russia's agricultural transition experience, which has resulted in a complex system of diverse producers and institutions, as well as uneven performance. Using a model of transition agriculture, the article explores how key reform policies drove systemic change and commodity restructuring, and how the ensuing changes in the production, consumption, and trade of goods have affected world markets. The article also assesses the performance of Russian agriculture during transition, and provides an outlook for the future.*

Key words: Russia, transition, agricultural trade, grain, institutions, WTO accession.

JEL codes: F14, P27, P32, Q17.

Introduction

Russia's transition from a planned to a market economy, which began 20 years ago, has fundamentally altered the country's agricultural economy. Major systemic changes include replacing the state allocation of inputs and output with a mainly market-based system of distribution, as well as privatizing farms, other agro-food enterprises, and input suppliers. Yet in certain respects Russian agriculture during transition has been marked more by continuity than change. Large (and still largely unreformed) farms continue to dominate agricultural production, and the growth of small-scale family farming has been modest. The main problem facing Russian agriculture is arguably that the commercial support services and institutional infrastructure that a market-driven agricultural system needs remain seriously underdeveloped.

Reform has also substantially altered agriculture's commodity structure by changing the volumes and mix of production, consumption, and trade. During the 1990s, output plummeted, with the livestock sector contracting by about half. The large Soviet-era imports of grain, soybeans, and

Published by Oxford University Press, on behalf of Agricultural and Applied Economics Association 2012.

soybean meal required to support a large livestock sector were eliminated, and Russia became a big meat importer.

During the 2000s, however, agricultural production rebounded, and Russia became an important player in world agricultural markets on both the supply and demand side. Grain output and exports increased substantially, not only in Russia, but also Ukraine and Kazakhstan, such that the three countries collectively became a major world supplier of grain (and especially wheat). The surge in world food prices in 2006-08 and again in 2010-11 sparked speculation that this region might be able to expand grain production and exports further and thereby improve world food security. The livestock sector also began to revive, especially poultry output. Yet despite the rise in production, imports of agro-food products soared during this decade, and Russia became the second largest agricultural importer among the emerging markets economies, after China.

In this article, we examine the evolution and performance of Russian agriculture during the 20 years of its reform/transition experience. Key questions to be addressed include what policies have driven reform, what policy and economic developments have powered commodity restructuring (changes in the volumes and mix of production, consumption, and trade), and how has commodity restructuring affected world agricultural markets. The article also assesses the performance of Russian agriculture and provides a future outlook, focusing on three issues: farm level developments, market policies, and commodity developments and their global impact.

We also present a model of transition agriculture, which serves two main purposes. The first is that it helps analyze how transition policies have affected agricultural production, consumption, and trade. Second, the model helps determine how to measure the success of agricultural transition (and specifically, identify the appropriate performance indicators).

Although much of the agricultural reform experience the other countries of the former Soviet Union (FSU) have undergone is similar to Russia's, the present article focuses on Russia, whose agricultural and overall economy are by far the largest among the FSU countries, with respect to both production and trade. Russia's population, Gross Domestic Product (GDP), and agricultural output roughly equal those of the other 14 FSU countries combined. Also, to discuss and compare detailed reform developments for more than one country would dilute the article and create organizational difficulties. Yet, where appropriate, the discussion will sometimes include the next two most important agricultural countries of the FSU region–Ukraine and Kazakhstan–especially concerning their emergence in the 2000s as grain exporters.[1]

Even though we focus on Russia, the article is not intended to be a complete survey of the country's agricultural reform experience. Rather, it centers on the questions and issues that we identified three paragraphs earlier. Also, although the article cites many studies on Russian agriculture, it is not meant to be a full review of the literature. Often only the most germane work on a topic is cited.[2]

[1] *For reviews of these two countries' agricultural reform experience, see von Cramon-Taubadel, Nivyevskiy, von der Malsburg, and Movchan (2008) and Pomfret (2008).*

[2] *Swinnen and Rozelle (2006) cover much of the literature on transition agriculture, while von Cramon-Taubadel and Nivyevskiy (forthcoming) review the literature on transition agriculture from the point of view of topics and authorship networks.*

The article is organized as follows. In the second section, we present our model of agricultural transition, while in the third section we examine how the main agricultural reform policies have altered the systemic and institutional nature of Russian agriculture and its commodity structure. In the subsequent section, the model is used to assess the performance of Russian agriculture during reform, while in the section prior to the conclusions, the future outlook for Russian agriculture is examined, including the major challenges it faces and what global impact it might have.

A Model of Transition Agriculture

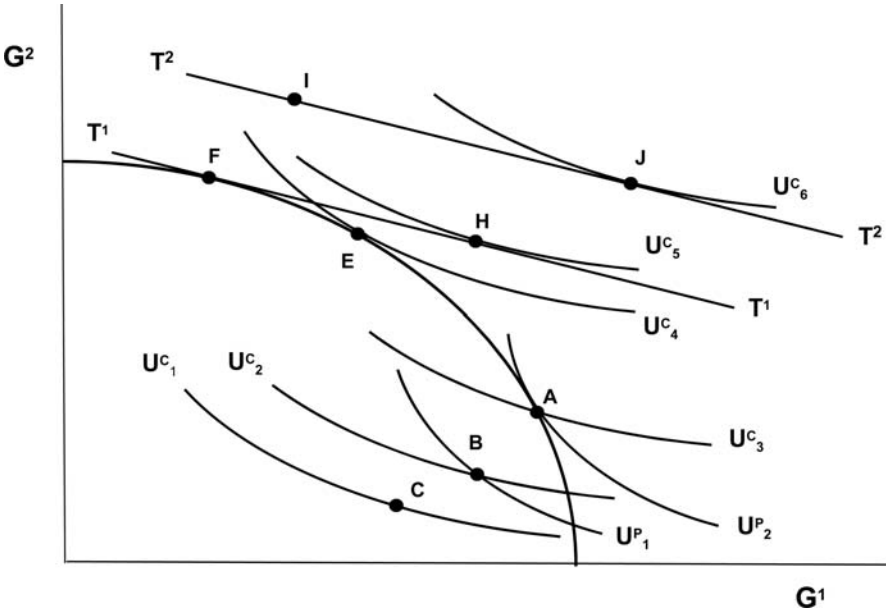
Our model examines how the transition from a planned to a market system can affect a country's economy, and specifically the production, consumption, and trade of goods and consumer welfare. It is consistent with the models of Swinnen and Rozelle (2006) and Lin, Cai, and Li (1996), which also examine how transition can affect an economy's behavior and performance (the latter model can also be found in Lin, Cai, and Li (2003)). Both the Swinnen/Rozelle and Lin et al. models, however, cover only production, and Swinnen and Rozelle examine only a single good, while Lin et al. cover more than one good. Our model, on the other hand, explicitly encompasses production for two goods (which could be expanded to *n*), consumption, trade, and consumer welfare. Parts of our model were first presented in Liefert, Lohmar, and Serova (2003), and our presentation in the current article draws heavily on Liefert (2008(b)).

The model itself is presented in figure 1. Although it could be used to analyze transition's effect on any sector of the economy, our focus is on the agro-food system. The curve concave to the origin is the economy's production possibilities frontier (PPF) for goods G^1 and G^2. We extend the concept of economy-wide social indifference maps for consumers to include an indifference map for planners in the planned period (who represent the interests of the political leadership). In our analysis, planners/leadership receive utility from goods from the ways they put them to use within their overall plan for the economy.

We assume that in a planned economy, planners and consumers have different preferences for goods, represented by different indifference maps. The large drop in production of military and heavy industrial goods and growth in consumer goods and services experienced by all the transition economies during their reform is general evidence of the difference in preferences between planners and consumers. For example, U_1^P, U_2^P, U_1^C, U_2^C, etc. are specific indifference curves within the indifference maps for planners and consumers. If the planners are utility maximizers, the planned economy's production and consumption point is A, where the planners' indifference curve U_2^P is tangent to the PPF.

Production at A assumes that the economy is technically efficient, that is, all producers are equally efficient in their use of inputs, and thereby none deviates from the best available domestic production practices. Given that producers within planned economies lacked the cost-minimizing pressure of competitive market economies, technical inefficiency was a likely feature of planned economies. Technical inefficiency is represented in figure 1 by production at point B inside the PPF, such that the planners' welfare is given by U_1^P rather than U_2^P.

Figure 1 Transition's effect on production, consumption, trade, and welfare



Production at point A also assumes that the economy is allocatively efficient in its use of inputs in production. This means that it is not possible to reallocate inputs among producers in a way that will increase the production of either G^1 or G^2 without decreasing the output of the other good. Given that planners in planned economies directly distributed inputs to producers without the benefit of market prices to determine the inputs' optimal use, input allocative inefficiency was also a likely feature of these systems. Input allocative inefficiency also is represented in figure 1 by production at point B inside the PPF.[3]

Our analysis also assumes that the planned economy is wholly autarkic and thereby does not engage in any foreign trade. Yet, all the planned economies of the former Soviet bloc did trade to some degree. Foreign trade's main purpose, however, was not to reap gains based on comparative advantage, but rather to import products that were necessary inputs for the production plan but could not be domestically produced in sufficient quantity or quickly enough (see Holzman 1974). The planning objective was to be as autarkic as possible.

Transition can have five main effects on the commodity structure of production, consumption, and trade and consumer welfare. The first effect is negative, in that the disruptions of moving from a planned to a market system, especially in the linkages between input suppliers and producers, can temporarily reduce production. Rather than planners specifying the flow of inputs and outputs in the production chain, producers/enterprises must establish these relationships themselves in a price-driven market system. This challenge is exacerbated by the fact that the move to a market economy will change the mix of goods produced, as well as result in

[3]*By putting production inside the PPF, the allocative inefficiency of planned economies not only made them poorer in the short run, but also reduced the resources for investment. This lowered economic growth (growth being represented in figure 1 by a rightward shift in the PPF). Lin, Cai, and Li (1996) discuss this problem for the Chinese economy.*

entirely new goods being produced. In figure 1, this disruption to and adjustment in resource flows is represented by the production point falling from B to C, with consumer welfare dropping from the level given by U_2^c to U_1^c. The re-establishment of these linkages would increase output, with the isolated effect being the jump in production from C back to B (assuming that reform had not yet changed the output mix).

Transition's second effect is that it can improve the technical efficiency of production. In figure 1, the elimination of all technical inefficiency would help move production from B to A on the PPF (assuming that planners' preferences still determined production). Moreover, consumer welfare would rise from U_2^c to U_3^c (the specific policy changes that would generate these effects will be discussed later in this section).

Transition's third effect is that it can improve allocative efficiency, of which there are two types. The first type (previously discussed) is input allocative efficiency, which exists when no reallocation of inputs among producers could generate more of one good without decreasing the output of some other good. In figure 1, eliminating all input allocative inefficiency would also help move production from B to A on the PPF.

The second type of allocative efficiency is output allocative efficiency, which occurs when the mix of goods produced and consumed maximizes consumer welfare. Complete output allocative efficiency would be achieved if the production and consumption point were to move from A to E, where the PPF is tangent to the consumer indifference curve U_4^c. Output allocative efficiency results in consumer welfare rising from U_3^c to U_4^c. The improvement in output allocative efficiency (from the consumers' point of view) results mainly from the shift from planners' to consumers' preferences being the driving force that determines what goods are produced and consumed.[4]

Transition's fourth effect is that it allows foreign trade based on comparative advantage. In figure 1, the slope of line T^1T^1 gives the world price ratio for G^1 and G^2. With free trade, the economy's consumption possibilities frontier switches from the PPF to line T^1T^1. Maximizing the gains from trade based on comparative advantage would result in moving the production point from E to F (where the PPF and T^1T^1 are tangent), and then trading along T^1T^1 to consume at H (where T^1T^1 is tangent to U_5^c). The economy exports G^2 and imports G^1. Trade based on comparative advantage raises consumer welfare from U_4^c to U_5^c.

Transition's fifth effect is to motivate technical change by exposing domestic producers to superior foreign technology and management practices, and by providing the systemic incentives to adopt it (competition and profit maximization). We define technical change broadly, to include not just the implementation of new technology, but also any basic change in producers' system of management and incentives that allows them to expand production beyond the (prior) maximum bound possible. Effective technical change would shift the PPF outward. To avoid too messy a figure, figure 1 does not show the new PPF. Assume, however, that the new PPF is tangent to the trade line (T^2T^2, parallel to T^1T^1) at I, the new production point. Technical change would shift production from F to I, and trade based on comparative advantage would move consumption to J. Consumer welfare rises from U_5^c to U_6^c.

[4]*The move from planners' to consumers' preferences does not guarantee full output allocative efficiency (from consumers' point of view), though it creates the conditions for it to be achieved.*

Economic indicators of reform success

The preceding analysis allows for a quick summary identification of the main economic performance indicators that can be used to measure how successful agro-food reform has been in the transition economies, where success is defined as increasing consumer welfare. The five main performance indicators are:

(1) technical efficiency
(2) input allocative efficiency
(3) output allocative efficiency
(4) trade based on comparative advantage
(5) technical change.

For these areas of performance, specific and well-defined measures exist, as well as methods to compute them. The only exception is output allocative efficiency, which is achieved when an economy is producing and consuming the mix of goods that maximizes total consumer welfare. The welfare levels associated with specific consumer indifference curves are not measurable in absolute terms, and gauging changes in relative welfare/utility is also empirically challenging. For these reasons, measuring changes in output allocative efficiency is very difficult. Also, for the other more empirically tractable performance measures, one cannot determine the degree to which welfare has changed in an absolute sense. Yet, as the preceding section has shown, these performance indicators are positively associated with rising consumer welfare.

Improvement in technical efficiency, input allocative efficiency, and the technology and management of production all increase the productivity of input use. Reversing the initial drop in output from the disruption in supply linkages and other temporary dislocations from transition would also increase productivity. Input productivity is therefore another (and broader) economic performance indicator that can cover technical efficiency, input allocative efficiency, technical change, and correcting short run disruptions from transition.

Reform policies

A second method exists for measuring the success of agro-food reform for a country: one identifies the policies that would lead to increasing welfare, and then measures the degree to which these policies have been implemented. The two approaches for measuring reform success–by the degree of policy implementation and the degree to which specific economic gains have been achieved–are complementary in that policy changes are the means to the end of achieving the economic gains.

We follow Liefert and Swinnen (2002) in maintaining that reforming the transition economies' agro-food sector involves four main sets of policies: (1) market liberalization; (2) farm reform and restructuring; (3) reform of upstream and downstream operations and services; and (4) the creation of an institutional infrastructure for a market economy. Market liberalization involves removing government control over the allocation of resources and output (basically ending the planned command economy), and allowing markets to become the main means of distribution. Two key sub-policies are domestic price liberalization and trade liberalization. Price liberalization entails the corollary policy of reducing or eliminating state

budget subsidies to producers and consumers that were used during the planned period to support the state-set price system (where consumer food prices were often set below production costs). Freeing prices and reducing subsidies are therefore crucial policy changes that enable consumers' preferences to replace planners' preferences as the driving force that determines what goods are produced, consumed, and traded.

Price liberalization's main economic performance-related effect is to increase allocative efficiency (both the input and output types). In figure 1, price liberalization helps drive the production and consumption point from B to A, and then from A to E. Consumer welfare increases first from U_2^c to U_3^c, and then from U_3^c to U_4^c. Trade liberalization ends the state's foreign trade monopoly and allows trade based on comparative advantage. With complete free trade, production moves to point F, consumption to H, and consumer welfare rises from U_4^c to U_5^c.

Successful implementation of the second major reform policy–farm reform and restructuring–would both improve technical efficiency and encourage technical change. Technical efficiency would arise from competitive pressure and farms' requirement to be self-financing, while exposure to superior foreign technology and management practices, combined again with the carrots and sticks of competition, would motivate technical change. As discussed earlier, the elimination of technical inefficiency would help move the production point from B to A and raise consumer welfare from U_2^c to U_3^c, while technical change would shift the PPF outward, move the consumption point from H to J, and raise welfare from U_5^c to U_6^c.

Reforming upstream and downstream operations and services extends the analysis of reform's effects on production, consumption, trade, and welfare from primary agriculture to the entire agro-food system. As such, it could be grouped with farm restructuring and reform to cover reform of all producers and enterprises within the agro-food economy, as well as those providing inputs and services. With respect to figure 1, goods G^1 and G^2 could now be processed and retail products as well as primary agricultural output, with PPF the corresponding production possibilities frontier–that is, the model depicted in figure 1 could apply to any stage in the agro-food production chain.

Institutional infrastructure covers the public services and systems that an agro-food market economy needs, such as market information and commercial law that protects property and enforces contracts, and which allow all the other reform policies to work better. Weak institutions increase transaction costs. These costs are especially high at the beginning of reform, and increase the challenge of correcting the disruption to the production chain that we identified as transition's first main effect on the agro-food system. In figure 1, the move in the production point from C to B (and rise in consumer welfare from U_1^c to U_2^c) in part captures the positive effect of creating market-supporting public institutions. More generally, solid institutions will facilitate all the reform-driven shifts in the figure that can move consumer welfare from U_1^c to U_6^c. The economic performance indicator that most captures the gains from stronger market institutions is productivity growth.

Table 1 summarizes the key reform policies and indicators of reform success, as well as the relationship between the policies and performance indicators. The table also identifies the welfare gains (with respect to figure 1) that successful policies, as measured by the indicators, could

Table 1 Reform policies, performance indicators, and welfare gains

Policy	Performance indicator	Welfare gain
Price liberalization	Input allocative efficiency (covered by productivity growth)	U_2^c to U_3^c
	Output allocative efficiency	U_3^c to U_4^c
Trade liberalization	Trade based on comparative advantage	U_4^c to U_5^c
Farm/enterprise restructuring	Productivity growth	
	technical efficiency	U_2^c to U_3^c
	technical change	U_5^c to U_6^c
Building institutional infrastructure	Productivity growth	U_1^c to U_2^c

generate. The relationship between policies and indicators as summarized in the table is more general than absolute. The identified policies could affect more than one indicator, while the economic gains as measured by the indicators could be affected by more than one policy.

Russian Agriculture during Transition

Market liberalization and commodity restructuring

The main objective of Soviet agricultural policy during the USSR's final two decades was to expand the livestock sector, to improve the population's standard of living by increasing their consumption of meat and dairy products. Using large budget subsidies to both producers and consumers, along with controlled prices and trade, the regime succeeded in raising meat production between 1970 and 1990 by over 60% (Liefert 2001; Liefert and Swinnen 2002). By 1990, Soviet per capita consumption of meat and other livestock products was close in volume to that of many rich developed countries, despite Soviet per capita GDP being at most half of developed countries' levels (Sedik 1993). Because the Soviet Union could not produce enough animal feed to support its growing livestock herds, it became a large importer of feed grain, soybeans, and soybean meal, to the benefit of bulk crop producers such as the United States, Canada, and Australia.

Developments during the 1990s

Immediately following the breakup of the USSR and independence in December 1991, Russia began its transition from a planned to a market economy. The reform policies that most quickly affected the agro-food system were those involving market liberalization. After just a couple years, Russia had largely ended central planning, the state allocation of resources, and the state's monopoly over foreign trade. For agriculture and most other sectors of the economy, markets became the primary means of allocating both inputs and output. Markets created *consumer sovereignty*, whereby consumers' preferences replaced planners' preferences as the dominant force in determining what goods were produced, consumed, and traded.

Reform and market liberalization substantially reduced the large subsidies enjoyed by Russian agriculture. During the planned period, Russian

Table 2 Agricultural output and input use

	1990	1993	1995	1998	2000	2003	2005	2007	2009
Russia									
Total agricultural output	100	83	67	55	61	65	68	72	81
Crops	100	92	79	64	77	84	91	94	109
Livestock products	100	77	60	50	50	53	53	58	62
Agricultural input use									
Sown area	100	95	87	78	72	67	64	64	66
Labor	100	99	97	94	93	80	76	71	68
Tractors	100	101	88	76	70	59	52	48	42
Fertilizer (mineral)	100	54	20	21	25	30	35	43	49
Oil-based fuel	100	61	33	27	22	21	19	na	na
Electricity	100	103	79	57	45	30	25	22	20
Ukraine									
Total agricultural output	100	81	65	52	53	53	63	61	70
Crops	100	94	73	59	65	62	81	75	92
Livestock products	100	70	56	46	43	46	49	49	51

Note: Table gives indices with 1990 = 100. Under agricultural input use, sown area and labor cover all types of agricultural producers, but tractors through electricity cover only agricultural enterprises (thereby excluding household plots and family farms). Tractors are deliveries of units to farms. Fertilizer is tons per hectare. Oil-based fuel covers gasoline and diesel, in tons. Electricity is kilowatts per hour. na means not available.
Source: Russian and Ukrainian Statistical Yearbooks.

(and all Soviet) agriculture had been heavily subsidized in three ways. The first was through state budget subsidies to the sector, which in 1990 equaled about 10% of Soviet GDP. The second was through price policy, whereby prices for agricultural inputs were set low relative to their production costs and to agricultural output prices. The third also was through price policy, in that output prices for many agricultural products, in particular livestock goods, were set high relative to world prices. For example, Liefert, Koopman, and Cook (1993) find that in 1986, Soviet producer prices for beef and poultry were about a quarter and two-thirds above world prices, respectively (using an economically meaningful exchange rate between the ruble and U.S. dollar).

Due to the collapse in state revenue during the first years of reform, the large Soviet-era budget subsidies to Russian agricultural producers and consumers were largely eliminated. Price liberalization also terminated the indirect subsidies that producers had received from the Soviet price system. When domestic prices jumped to reflect the real costs of producing goods, agricultural input prices rose relative to output prices, such that agricultural producers' terms of trade (output versus input prices) worsened dramatically. Trade liberalization then resulted in domestic prices for many agricultural goods moving downward toward world prices, further exacerbating producers' terms of trade vis-à-vis their domestic input suppliers.

From 1991 to 1997, the domestic terms of trade of Russian agricultural producers fell by about 75% (OECD 1999). For example, in 1992 Russian wheat producers had to sell on average 0.3 tons of output to purchase one ton of nitrogen fertilizer, whereas by 1997 they had to sell 1.4 tons of wheat (*Russian Statistical Yearbook*). Higher relative prices for inputs generated a severe drop in their purchase and use. Table 2 shows that compared

to 1990, the volume of tractor deliveries to farms and use of mineral fertilizer, oil-based fuel (gasoline and diesel fuel), and electric power by Russian agricultural producers in 2000 was down by 30%, 75%, 78%, and 55%, respectively.

Transition to a market economy during the 1990s severely reduced Russian agricultural output, especially in the livestock sector. The main reason is that, as just described, market liberalization substantially reduced or eliminated the huge subsidies (both direct and indirect) that Soviet/Russian agriculture, and particularly the livestock sector, received under the planned system. The ensuing large decline in input use decreased production.

From 1991 to 2000, Russian agricultural output dropped by almost two-fifths, while production of livestock products was cut in half (table 2). Average annual Russian meat production (beef, pork, and poultry) fell from 7.4 million metric tons (mmt) from 1989-91 to 3.5 mmt from 1996-2000 (table 3). Livestock herds also contracted heavily, with cattle and hog inventories in 2000 down by 52% and 55% compared to 1990 (*Russian Statistical Yearbook)*. During the 1990s, every country of the former USSR experienced a fall in agricultural output, and a severe downsizing of the livestock sector. For example, in Ukraine livestock output fell from 1990 to 2000 by 57% (table 2).

The huge downsizing of the livestock sector substantially reduced domestic demand for animal feed, such that the large Soviet-era imports of grain virtually disappeared (table 4), along with those of soybeans and soybean meal. Domestic feed grain requirements declined so much that Russian grain area and production also fell (tables 4 and 5). Average annual Russian grain output dropped from 95 mmt from 1987-91 to 63 mmt from 1996-2000.

Rather than importing animal feed to maintain a large and costly livestock sector, Russia during the 1990s became a large meat importer (table 3). Average annual Russian meat imports grew from 1.65 mmt from 1989-91 to 2.52 mmt from 1996-2000. The main foreign suppliers were the European Union (beef and pork), Brazil (pork and poultry), and the United States (poultry). The United States became Russia's biggest foreign supplier of poultry (broilers), and Russia the United States biggest foreign market for the product. In 1997 (before Russia's economic crisis of 1998-99), the United States supplied almost 90% of Russia's poultry imports, and Russia accounted for about 20% of U.S. poultry exports (USDA PS&D and World Trade Atlas). In that year, poultry provided about two-thirds of the total value of U.S. agricultural exports to Russia.

The Russian agricultural establishment regarded the severe contraction of the livestock sector as a disaster, to be reversed when the state finally had the resources to do so. Yet, the downsizing can be viewed largely as a painful though necessary part of the market-driven reallocation of resources away from an uncompetitive high cost sector, which had expanded during the planned period to levels that could not be maintained under market conditions. Put another way, given the high real cost of Russian livestock production and consumers' real incomes in the late Soviet period, the country was producing and consuming much more meat and other livestock products than it would with a market economy.

With respect to figure 1, Russian livestock products can be viewed as product G^1, meaning that the planners (reflecting the leadership's priorities) desired that more of these products be produced and consumed

Table 3 Russian meat production and imports

	Beef		Pork		Poultry		Total	
	Production	**Imports**	**Production**	**Imports**	**Production**	**Imports**	**Production**	**Imports**
				million metric tons				
1989-91	3.52	1.07	2.88	0.36	1.00	0.23	7.40	1.65
1992-95	2.87	0.51	1.95	0.31	0.56	0.41	5.38	1.23
1996-00	1.89	0.75	1.34	0.57	0.31	1.20	3.54	2.52
2001-05	1.61	0.75	1.38	0.67	0.70	1.29	3.69	2.71
2006-10	1.45	0.98	1.72	0.90	1.76	1.08	4.93	2.95

Note: Total production and imports cover beef, pork, and poultry broilers. Figures give average annual values over the period identified at the left. Imports are gross.
Source: USDA PS&D.

Table 4 KRU grain and meat production and trade

	Grain		Meat	
	Production	**Net trade**	**Production**	**Net trade**
		million metric tons		
Total KRU				
1987-91	160	(16.2)	12.2	(1.0)
1992-95	138	(2.1)	8.7	(1.0)
1996-00	100	4.0	5.6	(2.4)
2001-05	125	20.9	5.6	(2.8)
2006-10	139	35.8	7.2	(3.4)
Russia				
1987-91	95	(20.9)	7.4	(1.7)
1992-95	84	(7.9)	5.4	(1.2)
1996-00	63	(3.0)	3.5	(2.5)
2001-05	76	8.1	3.7	(2.7)
2006-10	82	14.1	4.9	(2.9)
Ukraine				
1987-91	43	0.1	3.7	0.4
1992-95	35	0.0	2.5	0.1
1996-00	26	2.7	1.6	0.1
2001-05	35	8.2	1.4	(0.0)
2006-10	39	14.3	1.6	(0.3)
Kazakhstan				
1987-91	21	4.6	1.1	0.2
1992-95	19	5.7	0.9	0.1
1996-00	11	4.3	0.5	(0.0)
2001-05	14	4.6	0.5	(0.1)
2006-10	17	7.4	0.7	(0.2)

Note: Figures are average annual values over the period identified at the left. Figures for grain are marketing year (July-June), and for meat calendar year. For meat production and trade, the first row for each country covers 1989-91, not 1987-91. Trade values in parentheses are net imports, without parentheses net exports. Grain excludes rice, sorghum, and pulses, while meat covers beef, pork, and poultry broilers.
Source: USDA PS&D.

Table 5 KRU grain yield and area

	Yield			Area			
	Russia	**Ukraine**	**Kazakhstan**	**Russia**	**Ukraine**	**Kazakhstan**	**KRU total**
	tons per hectare			*million hectares*			
1987-91	1.56	3.08	0.89	64.5	15.2	23.7	103.5
1992-95	1.49	2.76	0.90	58.5	13.9	21.1	93.4
1996-00	1.30	2.09	0.84	50.0	13.0	13.5	76.5
2001-05	1.75	2.54	1.04	44.9	13.9	14.1	72.9
2006-10	1.88	2.75	1.06	45.1	14.6	16.1	75.8

Note: Figures are average annual values over the period identified.
Source: USDA PS&D.

than did consumers. If consumers' preferences had determined output in the Soviet period, the production point would have been at E rather than A (assuming no technical or input allocative inefficiency), with less G^1

(livestock products) purchased and consumed. The end of planning and market liberalization (which entailed eliminating the three types of subsidies to agriculture) were the systemic and policy changes that allowed consumers' preferences to supplant planners' preferences, and consequently drove the fall in agricultural (and especially livestock) production. Domestic price liberalization and corresponding drop in agricultural budget subsidies moved the domestic production/consumption point from A to E. Trade liberalization, which revealed that the Russian livestock sector was uncompetitive on world markets, further reduced agricultural production from E to F, though the ensuing imports of meat and other products increased consumption of G^1 from F to H.

Developments during the 2000s

During the 2000s, Russian agricultural production began to rebound. From 2000 to 2009, total output rose by a third, with both the crop and livestock sectors expanding (table 2). From 1996-2000 to 2006-2010, average annual meat production increased almost 40%, from 3.5 to 4.9 mmt (table 3). Poultry production boomed, rising from 0.31 to 1.76 mmt. Beef production, though, continued its inexorable decline. Russia lacks a modern beef industry, with most output coming from culling dairy cows.

Grain production also rose substantially during the decade, not only in Russia but also in Ukraine and Kazakhstan.[5] Average annual grain output in Russia increased from 63 mmt from 1996-2000 to 82 mmt from 2006-10, and in the KRU region from 100 to 139 mmt (table 4; throughout this article, grain excludes rice, sorghum, and pulses). Russian production rose not because of an increase in area but in yield (table 5). Although average annual grain area fell from 50 million hectares from 1996-2000 to 45 million from 2006-2010, yields grew from 1.3 tons per hectare to 1.88 tons. In Ukraine and Kazakhstan, both grain yields and area rose during the decade.

The growth in grain production resulted in Russia and Ukraine becoming large grain exporters, and Kazakhstan a medium-sized one. Russia switched from being a small net grain importer from 1996-2000 to a net grain exporter of 14 mmt a year on average from 2006-10 (table 4). The KRU region moved from average annual net grain exports from 1996-2000 of 4 mmt to 36 mmt from 2006-10.

During the late Soviet period, the KRU countries had annual net grain imports of 16 mmt. By 2008-09, the region's grain trade reversal had created a huge swing of over 50 mmt of grain available on the world market (figure 2). Yet, the KRU region has moved from big grain importer to large exporter despite a *decline* in grain production from the late Soviet period. From 2006-10, total KRU grain production was 15% lower than from 1987-91, with output down in each KRU country (table 4). This again demonstrates the degree to which the KRU livestock sectors contracted during transition, thereby freeing up feed grain area to produce for export.

Wheat is the dominant KRU grain export, accounting for more than 70% of total grain exports from 2006-10, followed by barley with a 20% share (USDA PS&D). The region's average annual wheat exports of 36 mmt in the two marketing years (July-June) spanning 2008-10 surpassed

[5]*Throughout this article, Russia, Ukraine, and Kazakhstan sometimes will be abbreviated as the KRU countries, or KRU region, KRU being the conventional acronym for this grouping of countries.*

Figure 2 Net grain trade of KRU region

Note: Imports and exports are net of trade among the KRU countries, and net vis-à-vis the rest of the world. The FSU-12 are the republics of the former USSR minus Lithuania, Latvia, and Estonia.
Source: USDA PS&D.

the 26 mmt exported by the United States, the traditional leading wheat exporter since World War II. The main foreign markets for KRU grain are the European Union, North Africa, the Middle East, and certain Asian countries, such as Bangladesh and South Korea.

To what degree did policy, especially involving subsidies and market intervention, assist the rebound in Russian agricultural production during the 2000s? From 2000 to 2005, Russian annual budget subsidies to agriculture (from both federal and regional governments) declined in real terms by 26% (*Russian Statistical Yearbook*). However, in 2005 the Russian federal government identified agriculture as a national priority area that would receive increased funding (along with health, education, and housing). From 2005 to 2010, total state support to agriculture more than tripled in nominal rubles, rising by 135% in real rubles. The Russian government stated that the main objective of agricultural policy was to revive the livestock sector, which received the bulk of the new subsidies (Interfax).

The government also helped the livestock sector with trade protection. In 2003, Russia established restrictive tariff rate quotas (TRQs) for imports of beef and pork, and a pure quota for poultry, converted in 2006 to a TRQ. The annual quota for poultry was set at 1.05 mmt, and the low-tariff quota for beef and pork at around 0.45 mmt (Interfax). In comparison, poultry, beef, and pork imports in 2002 equaled 1.37, 0.50, and 0.60 mmt, respectively (USDA PS&D). The low in-quota tariff for beef and pork was kept at the previous rate of 15%, while the out-of-quota tariffs were fixed at 60% and 80%. Although the TRQ regime was liberalized a bit in 2005-06, in 2009 it was strengthened. The low-tariff quota volumes for pork and poultry were reduced and the out-of-quota tariffs were raised to 75% and 95%. During the 2000s, Russia also imposed many sanitary-based restrictions, and often complete bans, on imports of meat (and especially poultry) and other livestock products.

In the late 2000s, Russia also helped the livestock sector, and all grain consumers, by restricting grain exports. In response to the surge in world food prices in 2006-08, the Russian government imposed export taxes on grain (Ukraine and Kazakhstan also restricted grain exports during this time). In August 2010, Russia banned all grain exports, finally lifting it in July 2011. The ban was motivated mainly by the country's disastrous 2010 grain harvest, caused by severe drought and heat (which resulted in fires throughout European Russia). These adverse conditions cut the grain crop by about a third compared to the previous year and sent domestic grain prices soaring.

Despite the rebound in Russian agricultural output during the 2000s, Russian agro-food imports grew substantially during the decade, and the country was a large net agro-food importer (table 6). From 2000 to 2008, Russian agro-food imports increased from 7 to 33 billion U.S. dollars (nominal;[6] they did not grow from 2008 to 2010 mainly because of the economic crisis that hit the country in 2008-09). In 2008, agro-food imports were about four times as large as exports (33.3 versus 8.4 billion dollars). The negative agro-food balance results mainly from the fact that the country exports bulk crops (grain, sunflower-seed) and imports high value products (meat, fruits, vegetables, and processed foods).

Russia has become the second largest agro-food importer among emerging market economies, after China (figure 3). In 2010, agro-food imports by the KRU region of 41 billion dollars were about two-thirds those of China (with the bulk being imports by Russia), despite the KRU population being around 1/6 that of the Chinese behemoth. The top foreign agro-food supplier to Russia is the European Union (especially of processed foods), whose agro-food export share to the country in 2007 was 35%, followed by Brazil and the United States with 2007 export shares of 14% and 5% (World Trade Atlas).

There were two main causes of the large rise in Russian agro-food imports during the 2000s. The first was high GDP growth that averaged 4.8% a year, which increased consumer income and agro-food demand. The second cause of growing imports was the strong appreciation of the Russian currency (ruble) in real terms. Although the ruble was fairly stable during the decade vis-à-vis the dollar and other major currencies in nominal terms, Russia had higher price inflation than its major trading partners. This appreciated the currency in real terms, or in other words, decreased the prices of imported goods relative to competing domestic output (see Liefert, Liefert, and Shane 2009).

The meat import TRQ regime created in 2003, as well as other protectionist measures, were a response to the surging meat imports, and negative agro-food trade balance in general. Indeed, the measures were a major reason why Russian poultry imports fell from an annual average of 1.29 mmt from 2001-05 to 1.08 mmt from 2006-10 (table 3).

Farm reform and restructuring

By the late Soviet period, two types of large farms dominated agricultural production in the USSR–collective farms (kolkhozi) and state farms

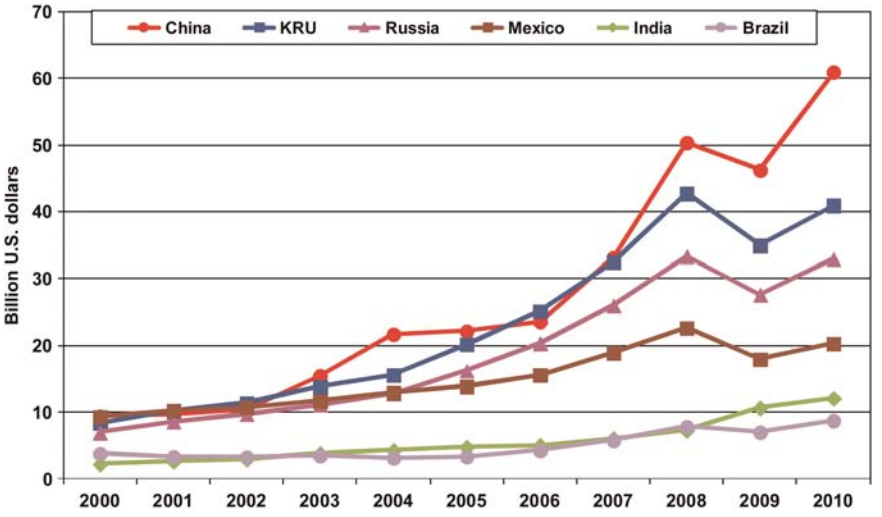
[6]*The import rise in nominal values overstates the growth in real (inflation-adjusted) terms, especially the jump from 2006 to 2008 when world agro-food prices increased substantially. However, the biggest price spikes were for bulk crops like wheat and rice, and Russia imports little of these products.*

Table 6 KRU agricultural trade

	Exports				Imports			
	Russia	**Ukraine**	**Kazakhstan**	**KRU total**	**Russia**	**Ukraine**	**Kazakhstan**	**KRU total**
				billions of U.S. dollars				
1997	1.4	1.8	0.9	4.0	12.8	0.9	0.6	14.3
2000	1.3	1.7	0.7	3.7	7.0	1.0	0.4	8.4
2002	2.2	2.4	0.6	5.1	9.7	1.1	0.5	11.4
2004	2.6	3.5	0.8	6.9	12.8	1.9	0.9	15.6
2006	4.8	4.7	1.0	10.6	20.4	3.2	1.7	25.2
2008	8.4	10.8	3.0	22.2	33.3	6.5	3.0	42.8
2010	8.0	10.0	2.0	20.0	33.0	5.8	2.3	41.1
				percentage				
Meat	0.2	0.7	0.1	0.4	21.6	13.1	4.2	19.1
Vegetables, fruit, and nuts	1.7	2.3	4.6	2.4	18.7	10.4	4.4	16.5
Grain and products	42.2	35.9	84.2	44.7	1.9	3.0	2.5	2.1
Fats and oils	11.0	18.0	0.6	13.0	4.8	9.5	9.2	5.8

Note: The percentage figures below the row for 2010 give the share of product groups in total exports or imports in 2008.
Source: World Trade Atlas, FAOSTAT.

Figure 3 Agricultural imports by major emerging markets



Source: World Trade Atlas.

(sovkhozi). Although their origins differ, by the late Soviet period these farms were very similar in both structure and behavior. Households on these farms also independently operated private plots, typically less than half a hectare in size. The households could either consume their plot output or sell it freely in farmers' markets (the only completely free markets in the Soviet system). The plots specialized in high value products such as livestock goods, fruit, and vegetables, and in 1990 produced 26% of total Soviet agricultural output (table 7; Russian Statistical Yearbook).[7]

During the transition period, three major types of agricultural producers existed – the former state and collective farms, household plots, and new private family farms.[8] The dominant producer (if not in total output, at least in institutional structure and influence) during transition has been the former state and collective farms. In 1993, these farms were officially forced to reorganize as corporate farms (though in tables 7 and 8 they are called agricultural enterprises). Many farms became "joint stock companies," while others became some sort of cooperative or collective association. As joint stock companies, the farms issued ownership vouchers to all workers and managers, which gave them a share in the farms' land and other assets. Individuals could use these vouchers to obtain land and leave the farm to work as private farmers, or sell their vouchers to the farm management and remain on the farm as hired labor. Most workers chose the latter option.

With the collapse of central planning, farm managers were given the freedom and responsibility to make their own production decisions, obtain inputs, and market their output. As a result, their position within the farms strengthened considerably. Farm management has been generally conservative, and on many farms into the 2000s little real change concerning internal organization, administration, and work incentives had occurred since the Soviet period.

[7]*For a review of Soviet agriculture, see Gregory and Stuart (1990).*
[8]*For surveys of Russian farm developments during transition, see Liefert (2001), Shagaida and Lerman (2008), and Wegren (2008).*

Table 7 Russian agricultural output and land by farm type

	1990	1995	2000	2005	2009
			percentage		
Share of output					
Agricultural enterprises					
Total output	73.7	50.2	45.2	44.6	45.4
Crops	75.9	45.1	47.9	44.0	43.8
Livestock products	72.0	56.0	42.2	45.2	46.9
Household plots					
Total output	26.3	47.9	51.6	49.3	47.1
Crops	24.1	52.4	47.8	46.5	44.6
Livestock products	28.0	42.7	56.0	52.0	49.5
Family farms					
Total output	**	1.9	3.2	6.1	7.5
Crops	**	2.5	4.4	9.6	11.6
Livestock products	**	1.4	1.8	2.9	3.6
Share of agricultural land					
Agricultural enterprises	98.1	89.4	86.1	78.4	71.3
Household plots	1.8	5.2	6.0	10.5	15.7
Family farms	**	5.4	7.9	11.1	12.9

*Note: ** means insignificant. Agricultural enterprises include farms that are part of agroholdings.*
Source: Russian Statistical Yearbook and Agriculture, Hunting, and Forestry in Russia 2009.

Table 8 Russian agricultural land by farm type, 2006

	Large enterprises	Small enterprises	Household plots	Family farms
Number of farms	27,787	20,392	22,799,400	285,141
Total land	107.4	24.5	9.6	24.1
Average farm size	3,864	1,203	0.42	85

Note: Total land is millions of hectares, and average farm size is hectares. Large enterprises include farms that are part of agroholdings.
Source: Russian Agricultural Census 2006.

In 2009, the corporate farms (agricultural enterprises) held 71% of farmland and produced 45% of agricultural output (table 7). These farms remain large, with the biggest having thousands of hectares (table 8), and account for most of the country's production of bulk crops.

Workers on large corporate farms retained control over their household plots, with the right either to consume or sell their output on free markets. The total amount of agricultural land used by the plots increased during transition, to 16% by 2009 (table 7). Expansion has occurred not from growth in the size of the plots, but from the plot-holders' ability to lease from the local government–or simply use for free–public meadows and pastures to graze their livestock.[9] The rise in the plots' share in agricultural land also includes growth in garden plots tended by the general population.

The share of the household plots (including garden plots) in the country's agricultural output grew substantially during transition. Holding

[9]*In table 8, the figure of 0.42 hectares for the average size of household plots in 2006 does not include these meadows and pastures used by the plots.*

only 6% of total agricultural land area, by 2000 the plots/gardens produced over half of the country's total agricultural output, though by 2009 their output share had fallen somewhat to 47% (table 7). This apparently stellar performance requires some qualifications. One is that during transition, output by the former state and collective farms dropped. Also, given that corporate farms must pay profit taxes while household plots do not, the former have an incentive to underreport their production (Ioffe 2005), which thereby understates their output share in official statistics. Another point is that the plots specialize in high value products such as meat and other livestock goods, and fruits and vegetables. Lastly, the plot-holders have a symbiotic (parasitic) relationship with their parent farms through which they obtain inputs (such as animal feed) inexpensively or for free (often by just taking it).

The third type of agricultural producer in Russia are private family farms, which were created mainly by workers on the former state and collective farms who used their ownership vouchers to obtain land and break away as independent farmers. By 2000, almost 300,000 family farms existed, with the number remaining relatively unchanged for the next 10 years (table 8). By 2000, these farms held 8% of Russia's agricultural land and produced only about 3% of the sector's output, though by 2009 their production share had risen to 7-8% (table 7). Like the corporate farms, family farms specialize in bulk crop production such as grain and sunflower-seed.

Throughout the transition period, Russia has lacked clear and consistent laws and regulation concerning land ownership and land markets (especially the latter). During the 1990s, a plethora of parliamentary legislation, presidential decrees, and special governmental resolutions were passed on land issues, much of them contradictory (Shagiada and Lerman 2008). Two key pieces of legislation in the 2000s were the Law on Agricultural Land Transactions of 2003, and Amendments to the Mortgage Law of 2004. The former established the legal basis for ownership and transactions in agricultural land, while the latter sanctioned the mortgaging of land. As discussed above, some farmers have taken advantage of the opportunity to acquire their own land.

Russian laws and bureaucracy have made owning agricultural land easier to achieve than buying and selling it. Although official legislation exists for the market sale of land, major impediments await those who try. The obstacles include weak administrative and technical infrastructure (such as the absence of a public registry of plans and maps) and arbitrary hurdles created by local officialdom (Shagaida and Lerman 2008). Buzdalov (2009) describes land relations as being legally and commercially "quite muddled," such that well-functioning agricultural land markets do not exist. Consequently, transactions costs for market sales are high. Given that there are economies of scale in dealing with transaction costs, small farms are at a disadvantage compared to large enterprises.

Reform of upstream and downstream operations and services

During the 1990s, input supply, agricultural wholesaling, and food processing were almost wholly privatized. However, largely as a legacy of the planned period, most of these operations are heavily concentrated.[10]

[10]*For concentration among input suppliers, see Serova and Shick (2008).*

Consequently, these enterprises can exert market power on farms as either buyers or sellers.

Throughout the transition period, the Russian agro-food system has suffered from weak (or in some cases non-existent) service industries. These include equipment rental and repair, veterinary care, banking and finance, and legal services. Finance has been particularly deficient. The Russian banking industry has been reluctant to lend to farms, whether large or small. Major borrowing impediments faced by the big corporate farms are large existing debt and high default risk, while the private family farms suffer from a lack of collateral (which the absence of effective land markets exacerbates), as well as high transaction costs (especially relative to their small size) from the complexity of loan procedures (Yastrebova, Subottin, and Epshtein 2008).

Creation of institutional and physical infrastructure

A market-driven agricultural economy also requires strong supporting public institutions. These include a commercial legal system that protects property and enforces contracts, a market information system, and programs for agricultural education, extension, and research. Throughout the reform period, all these public support services in Russian agriculture have been weak. A major study on Russian agriculture in the late 1990s (Wehrheim, Frohberg, Serova, and von Braun 2000) argues that the main problem facing the sector is deficient commercial and institutional infrastructure and support. Although some progress was made during the 2000s, major deficiencies still exist. Russian agriculture also suffers from inadequate physical infrastructure, especially involving transportation and storage.[11]

Weak infrastructure increases transaction costs, segments domestic regional markets away from each other, and cuts them off from the world market. These negative effects particularly hurt small producers, and help explain why private family farming has developed so modestly during transition. In fact, all the major weaknesses of Russian agriculture that we have discussed particularly afflict small and vulnerable private farms. The complicated and contradictory laws and procedures for owning and selling land make it difficult for an individual to secure a private farm, much less expand it. Commercial services and public support institutions are weak or nonexistent, and the farms face concentrated market power from input suppliers, wholesalers, and processors. Further, private farms must often contend with unsympathetic, if not hostile, local and regional governments and organized crime. In the rough and tumble world of the Russian economy and agriculture, small private farmers can be squeezed from all sides.

Rise of agroholdings

Around 2000, a new and apparently progressive type of agricultural enterprise entered Russian agriculture in the form of large agroholdings (Rylko, Khramova, Uzun, and Jolly 2008; Gataulina, Uzun, Petrikov, and Yanbykh 2005; Serova 2007). These agroholdings can be viewed as a

[11] *For problems in southern European Russia, see FAO (2009).*

response and antidote to many of the deficiencies that exist in Russian agriculture.

Agroholdings are vertically-integrated enterprises that typically combine primary agriculture, processing, distribution, and sometimes retail sale. Such agroholdings usually acquire a number of existing corporate farms and improve them by cutting waste and other costs and generally transform them into more profit-oriented and efficient producers. Coming mainly from outside agriculture, the agroholdings' top administration bring investment, superior technology, and better management practices into the entire agro-food system. These managers often introduce advanced technology through imports such as higher quality seeds, machinery, and animal breeding stock. The agroholdings are especially interested in grain production because of the opportunities for profitable export. Although the data are not firm, the agroholdings currently control between 15-20% of Russian arable land. Vertically-integrated enterprises resembling agroholdings also appear to have been the driving force in the 2000s behind the emergence of large, modern meat-producing enterprises, especially in the poultry and pork industries (FAO 2009). Agroholdings have also appeared in Ukraine and Kazakhstan (see Demyanenko 2008, and Wandel 2009).

The agroholdings' large size and vertical integration can be seen as a protective response to the deficient infrastructure (physical, commercial, and institutional), high transaction costs, market concentration, and other forms of organized power that trouble Russian agriculture. Within a system that remains dysfunctional in many ways, the agroholdings appear to be a major reason for the rise in Russian grain, meat, and overall agricultural output during the 2000s.

Measuring the Performance of Russian Agriculture during Transition

In our examination of Russian agriculture during transition, we made some general statements about the sector's performance. We now investigate this issue more deeply. In discussing our model of transition agriculture, we identified two different though complementary approaches for assessing performance – measuring to what degree reform policies have been implemented, and measuring the degree to which specific economic gains have been achieved, such as growth in input productivity and improving allocative efficiency. Recall that table 1 provides the main reform policies, economic performance indicators, and the relationship between them. Since policy change can be the means to the end of improving economic performance and reaping economic gains, we begin by assessing Russia's success in implementing agro-food reform policies.

Evaluating the implementation of agro-food reform policies

For every year from 1997-2005, the World Bank graded the agricultural reform progress of the transition economies of the former Soviet bloc (including Russia). The World Bank identified five sets of agricultural reform policies, and graded every country from 1 (the lowest) to 10 (the

Table 9 The World Bank evaluation of Russia's transition agro-food policies

Policy	1997	2000	2003	2005
Price and market liberalization	7	6	6	6
Land reform and privatization	5	6	6	6
Privatization and reform of agro-food processing and input supply enterprises	7	7	7	9
Rural finance	6	6	6	7
Institutional reform	5	4	4	5
Average	6.0	5.8	5.8	6.6

Note: The scores are from 1 (lowest) to 10 (highest).
Source: Csaki and Fock (2000) and Csaki, Kray, and Zorya (2006).

highest) for each policy area.[12] The reform policies graded by the World Bank are: (1) price and market liberalization; (2) land reform and privatization; (3) privatization and reform of agro-processing and input supply enterprises; (4) rural finance; and (5) institutional reform. These policy sets are similar to the four we use in this article: (1) market liberalization; (2) farm reform and restructuring; (3) reform of upstream and downstream operations and services; and (4) creation of institutional infrastructure. The only major difference between our set and the Bank's policy set is the latter's addition of rural finance. Within our policy scheme it could be added to the third reform area–creation of upstream and downstream operations and services.

The World Bank's evaluation for Russia in 1997 equaled 6.0, which meant the Bank judged that Russian agriculture at the time was about three-fifths of the way toward a wholly reformed agricultural system (table 9). The average score then fell to 5.8 in the early 2000s, though by 2005 it had increased to 6.6, indicating that the agro-food system was roughly two-thirds of the way toward full reform. Russia's 2005 score of 6.6 is marginally above the grade for both Ukraine and Kazakhstan of 6.2, though it compares favorably to the average score for the other countries of the former USSR of 5.4 (excluding Lithuania, Latvia, and Estonia, which by 2005 had made enough reform progress to graduate out of the evaluation).

The Bank's evaluation for price and market liberalization fell from 1997 to 2005 by a point. The drop is consistent with our previous discussion, which revealed that during the 2000s Russian agricultural policy became more market interventionist and protectionist. If we extended the evaluation for price and market liberalization to 2010, we would further reduce the score.

On the other hand, the Bank's score for land reform and privatization rises from 1997 to 2005 by a point. As discussed earlier, Russian agricultural output grew substantially during the 2000s, and it appears that the rise of agroholdings contributed substantially to that positive outcome. The World Bank definition of policy reform progress emphasizes formal mechanisms and developments, particularly in privatization and the existence of markets. Our conception of farm reform and restructuring includes the development of new types of producers (such as

[12] *Csaki and Nash (1998) was the first report in the World Bank's annual publication series to present these evaluations, with Csaki, Kray, and Zorya (2006) being the last report.*

agroholdings), which might lie outside the Bank's narrower definition for land reform and privatization. If the score for our concept of farm reform and restructuring in 1997 were a 5, for 2010 we would give a grade at least as high as 7.

The Bank's evaluation for processing and input supply, finance, and institutional reform all improve from 2000 to 2005, with processing and input supply rising by 2 points to a high score of 9. These grades appear contrary to our previous discussion and evaluation that commercial services (including finance) and public institutions are a major weakness of the Russian agro-food system. Once again, the Bank's scores seem to reflect their definition of reform that emphasizes formal changes. Although some legitimate progress probably was made in these reform areas during the period covered, for our conception of reform of upstream and downstream operations and services and creating institutional infrastructure, we would assign lower scores.

Evaluating the economic gains from agricultural reform

We next evaluate Russia's agricultural reform performance with respect to specific economic gains achieved, using the quantitative performance indicators identified earlier (see table 1). Note that the performance indicators in the table do not include agricultural output. This is because the switch from planners' to consumers' preferences that was an inherent part of reform caused a major drop in agricultural production. As we argued earlier, the output decline was an inevitable correction of the planners' overexpansion of the agricultural sector (and especially the high value livestock industries) compared to what could be maintained in a market economy (given existing consumer incomes and comparative advantage in world markets at the time).

A drawback of the empirical work involving these performance indicators for Russian agriculture is that most of it covers the 1990s rather than the 2000s. Of the indicators identified in table 1, most work done for Russian agriculture during transition has been on measuring technical efficiency. Such studies include Sotnikov (1998); Sedik, Trueblood, and Arnade (1999); Voigt and Uvarovsky (2001); Grazhdaninova and Brock (2004); Grazhdaninova and Lerman (2005); Lerman and Schreinemachers (2005); Osborne and Trueblood (2006); Bokusheva and Hockmann (2006); and Brock, Grazhdaninova, Lerman, and Uzun (2008). Most of this work covers some period in the 1990s, and the most recent year for which any results are given is 2002 from Brock et al. (2008). Also, all these studies cover only agricultural enterprises, which means they exclude performance on family farms and household plots. However, agricultural enterprises include farms that are part of agroholdings.[13]

The technical efficiency studies identified above estimate either a production function or frontier for some set of commodities, farms, and regions within Russia, using either stochastic frontier or data envelopment analysis. With both procedures, actual performance is measured against the value of 1. A performance grade of 1 means that all farms are

[13]*The points made in the last two sentences also hold for the work we review that measures farm performance concerning input allocative efficiency, technical change, and productivity growth.*

technically efficient, in the sense that all employ the best available domestic production practices.

In aggregate, the results show that Russian agriculture during the 1990s suffered from substantial technical inefficiency. An un-weighted average of the efficiency scores from each of the above studies in the last year for which they report results provides a value of 0.67.[14] If roughly accurate for Russia, this means that farms were performing at only two-thirds of their possible level of efficiency. Russia could have raised its agricultural output by half, without having to use more inputs, by eliminating all its technical inefficiency. Another conclusion from this work is that technical efficiency did not improve during the decade, and in fact it worsened a bit. Some studies compute efficiency at both the beginning and end of a time period; most of these studies show that efficiency worsened rather than improved over time. For these studies, the un-weighted average of the technical efficiency scores at the beginning of the period of calculation is 0.73, which falls to an average of 0.69 for end period efficiency.

Because the policies that most directly affect technical efficiency performance also affect performance with respect to technical change (specifically farm and enterprise reform), we next examine the empirical record with respect to technical progress. The only studies we could find that measure technical change in Russian agriculture during transition are Voigt and Uvarovsky (2001) and Voigt (2006). Both studies estimate a production function for farms in 75 of Russia's 88 oblasts and territories using data from 1993-98. Using these functions, both found that technical change worsened, and according to Voigt and Uvarovsky it worsened by approximately 20%.

The main study of the allocative efficiency of input use for Russian agriculture during transition was the USDA-funded BASIS project on Russian agriculture. Most of the project's empirical work covers corporate farms in the three oblasts of Rostov, Ivanovo, and Nizhni Novgorod in 2001. The main test of allocative efficiency is the relationship between input prices and the value of the inputs' marginal product (VMP).

Liefert (2008(a)) summarizes the project's empirical work on allocative efficiency by drawing from Liefert, Gardner, and Serova (2003); Grazhdaninova and Lerman (2005); Liefert (2005); Liefert, Lerman, Gardner, and Serova (2005); Grazhdaninova and Lerman (2008); Epshtein (2008); and Uzun (2008). Liefert found that intermediate inputs tended to be overused (prices were greater than VMP), while the specific inputs of labor, fertilizer, and spare parts were underused (wages or prices less than VMP). Yet for these last three inputs, either data or methodological issues bias the results in the direction of underuse. Liefert concluded that the empirical evidence does not indicate that inputs in the aggregate were seriously overused or underused, and that Russia's performance with respect to the allocative efficiency of input use appeared fairly respectable.

[14]*In computing these averages, we exclude the studies by Grazhdaninova and Brock (2004) and Grazhdaninova and Lerman (2005). These works are part of the USDA-funded BASIS project on Russian agriculture, and are based on data for Russian farms in the three oblasts of Rostov, Ivanovo, and Nizhni Novgorod in 2001, obtained from a project survey. Brock, Grazhdaninova, Lerman, and Uzun (2008) provide a summary of the BASIS project work on technical efficiency, and thereby use the same database as the above two studies. To avoid "double counting" work based on this specific database, we include in the average technical efficiency calculation only the results from Brock et al. (2008).*

Another relevant study was undertaken by Osborne and Trueblood (2006), who computed the allocative efficiency of Russian agricultural input use in crop production from 1993-98. The authors found worse performance than the BASIS study. According to their results, the elimination of allocative inefficiency in 1998 would have decreased the cost of agricultural production by 30% without reducing output.

As discussed earlier, technical efficiency, technical change, and input allocative efficiency can all be captured by the indicator of productivity growth. Lerman, Kislev, Biton, and Kriss (2003) computed that from 1992-97, total factor productivity (TFP) in Russian agriculture rose by 7.4%. Using data from the Russian Statistical Service, Brooks and Gardner (2004) calculated that Russian agricultural TFP rose by 8% from 1992-2000, and using data from FAO, they found somewhat higher TFP growth. On the other hand, Voigt and Hockmann (2008) estimated that from 1993-2000, agricultural TFP fell 15-20%, while Swinnen, Van Herck, and Vranken (forthcoming) calculate that from 1990-2000, agricultural TFP dropped 11% (the data necessary to compute an 11% fall were obtained directly from the authors).

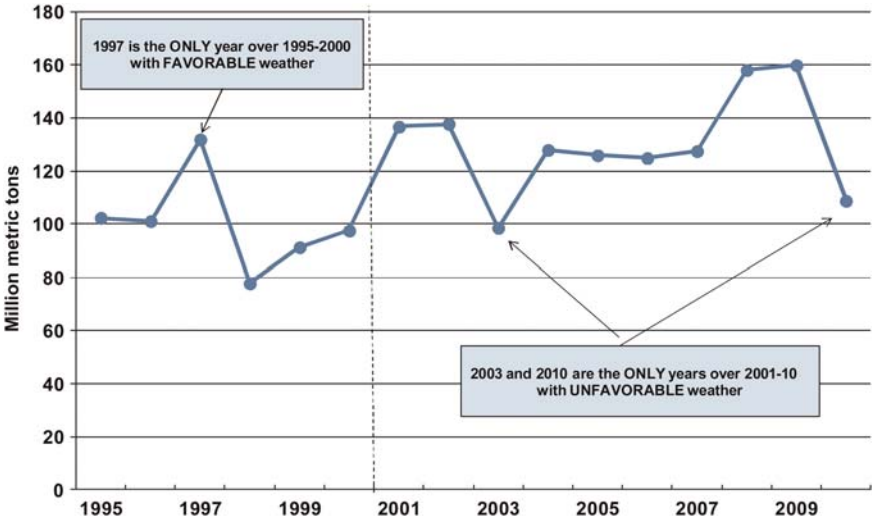
Even if the studies that show productivity rose rather than fell during the 1990s are accurate, the gains were modest. This is especially true relative to expectations about Russian agriculture at the start of transition. In the early 1990s, Russian agriculture was perceived as suffering from substantial waste, technical inefficiency, input allocative efficiency, and technical backwardness inherited from the Soviet period. Most observers therefore felt that the potential for productivity gains was large. During the 1990s at least, such expectations for improvement were not met.

None of the abovementioned studies involving any of the performance indicators cover a period beyond 2002. Yet during the 2000s, Russian agricultural output increased substantially, with the new agroholdings being a probable contributing cause. Does any empirical evidence exist showing that Russian agricultural productivity rose during the decade, thereby explaining output growth? The only two studies we could find are Bokusheva, Hockmann, and Kumbhakar (forthcoming) and Swinnen, Van Herck, and Vranken (forthcoming). The former authors calculate that from 1999-2008, TFP in Russian agriculture grew by about a quarter, while the latter authors compute that from 2000-07, TFP rose by a substantial 54%. Although more research is needed on productivity growth in Russian agriculture since 2000, these studies provide strong quantitative evidence that major productivity-enhancing farm level improvements that are raising output are likely occurring in Russian agriculture.

Yet, any assessment of Russian farm-level performance and productivity growth during the 2000s must take into account that during that decade, Russia enjoyed generally favorable weather for crop production, especially grain. Figure 4 shows that Russian grain output was low every year from 1995-2000 except for a big upward spike in 1997, while from 2001-10, production was high every year except for plunges in 2003 and 2010. The weather indicators show that in every year during the second half of the 1990s, Russia had unfavorable weather for grain, *except for 1997*, while in every year since 2000, it has had relatively good weather, *except for 2003 and especially 2010*.

We could find no studies that measure the output allocative efficiency of Russian agriculture during transition. This is understandable, given

Figure 4 KRU grain production and weather



Source: USDA PS&D.

that such studies would have to measure changes in consumer welfare (utility), for which no easily useable substitute exists. Nonetheless, the substantial restructuring of Russian agricultural production, consumption, and trade during transition, as shown by tables 2-4, suggests that major changes, and likely improvement, have occurred in the output allocative efficiency of Russian agriculture. As discussed earlier, the move from a planned to a market economy allowed consumers' preferences to determine what goods would be produced, consumed, and traded, and thus created the systemic means (based on markets) for the economy to respond to consumers' preferences.

The only study we could identify that empirically measures Russia's performance with respect to trade based on comparative advantage is Liefert (2002), who found that Russia's trade in agricultural output and inputs in the late 1990s was generally consistent with its comparative advantage. Liefert's results indicate that Russia had a comparative disadvantage in meat relative to bulk crops (grain and sunflower-seed), and a general disadvantage in agricultural output vis-à-vis key inputs (such as oil-based fuel and fertilizer). The results are consistent with and can help explain the major changes in Russian agricultural production and trade during transition. These results include the severe contraction of the livestock sector, the large increase of meat imports, the termination of the substantial Soviet-era imports of grain and oilseeds used as animal feed, the large grain exports in the 2000s, and the exportation of the bulk of the country's fertilizer (while domestic use of the input plummeted; see table 2).

An overall assessment of Russian agricultural reform during the 1990s is that market liberalization resulted in the fairly quick and substantial (though also painful) reallocation of resources to new market-driven uses. Most of the input allocative efficiency and comparative advantage studies show fairly good performance in reallocation, though less than the welfare-maximizing amount that could have been achieved. However, both the World Bank measures for land reform/farm restructuring and

the quantitative work on technical efficiency, technical change, and productivity growth indicate that farm level reform during the decade was disappointing. Performance was also weak concerning the provision of commercial services and institutional infrastructure for agriculture.

During the 2000s, some progress was made at the farm level, which was likely led by the new agroholdings. Calculations made by Bokusheva, Hockmann, and Kumbhakar suggesting that input productivity increased during the main part of the decade by about a quarter, and calculations from Swinnen, Van Herck, and Vranken suggesting that it rose by about a half, can help explain the decade's substantial growth in agricultural output. Yet during the same decade the Russian government increased subsidies to agriculture and adopted increasingly protectionist measures for the livestock sector. Although these policies contributed to output growth, they were a step backward from the point of view of market liberalization.

The Outlook for Russian Agriculture

We next examine the future outlook for Russian agriculture with respect to three issues: farm level developments and challenges, market policies, and commodity agriculture and the effect on world markets.

Farm level developments and challenges

Given that the most progressive farm level development in Russian agriculture during the 2000s was the rise of agroholdings, the outlook for this subject depends largely on future prospects for these enterprises. The agroholdings appear to be a positive force that has improved farm management and performance. Yet some controversy exists as to whether agroholdings in fact outperform other large producers. On the one hand, Rylko, Khramova, Uzun, and Jolly (2008) find that land and labor productivity of agroholdings is about double that of all Russian corporate farms. The Food and Agriculture Organization (2009) states that in the four main grain-producing oblasts of southern Russia – Rostov, Volgograd, Krasnodar, and Stavropol – agroholdings occupy 9-12% of arable farm area but produce one-third to one-half of grain output. On the other hand, Gataulina, Uzun, Petrikov, and Yanbykh (2005) find that vertically integrated producers are not necessarily more profitable than non-integrated ones, while Hockmann, Bokusheva, and Bezlepkina (2009) conclude that agroholdings are not more productive than other large Russian agricultural enterprises.

We believe that the agroholdings are a progressive element in Russian agriculture that have set a higher standard of performance. Yet even if the agroholdings are not *more* productive than other large Russian farming enterprises, a superior class of large farms has emerged in Russian agriculture, including agroholdings, which appears to be improving productivity and overall performance. Perhaps Rylko et al.'s (2008) more neutral term "new operators", which can cover a wider range of producers than just the agroholdings, might be more appropriate for describing these enterprises.

The critics of agroholdings also argue that, independent of whether these enterprises represent current best production practices in Russian agriculture, they have serious limitations (Gataulina, Uzun, Petrikov, and Yanbykh 2005; Hockmann, Bokusheva, and Bezlepkina 2009; Wandel 2011). Some observers even raise the question of whether they will last

over the long run. Recall that a major reason for the agroholdings' emergence was to counter the high transaction costs and supply uncertainty that existed because of weak physical, commercial, and institutional infrastructure and support services for agriculture. Yet the agroholdings might have become so large and unwieldy that they suffer from diseconomies of scale. The benefit of reducing transaction costs through vertical integration must be weighed against the cost of being too large.

Another factor behind the agroholdings' development is the influence of regional governments. Regional officials are worried about the viability of many of their large farms, and especially the economic and social consequences if they go out of business. Local officials have strongly encouraged the agroholdings to take direct ownership and responsibility for the farms that supply their primary product, perhaps even making this a requirement for the enterprises to operate in local processing and distribution. In return, the governments might provide soft loans, tax relief, and other assistance. Yet the agroholdings are interested in the more lucrative and manageable agribusiness activities of processing, distribution, and export, and might not want to be involved in messy primary agriculture (actually managing farms).

The agroholdings can be viewed as a "second best" response to the serious problems and dysfunctions that continue to exist in Russian agriculture, involving both farm operations and weak infrastructure and support services (Rylko, Khramova, Uzun, Jolly 2008; Hockmann, Bokusheva, and Bezlepkina 2009; Demyanenko 2008; Koester 2007). Although the long run future of the agroholdings might be questionable, they probably will continue not only to function, but also expand in numbers and influence for at least another decade, to the benefit of Russian agriculture.

A major challenge facing Russian agriculture, regardless of what type of farm structure dominates, is the shortage of skilled workers (Bogdanovskii 2008; FAO 2009). Skilled labor is lacking in the fields of machinery use and repair, animal care (including knowledge of modern feeding and breeding practices), and low- to middle-level management practices. This shortage of skills is exacerbated by the fact that a disproportionate share of the migrants moving out of agriculture during transition have been younger and better educated workers.

Another challenge is what happens to weak and unprofitable large corporate farms that cannot compete, to say nothing of the workers. The overexpansion of Soviet agriculture during the planned period created many high-cost farms, especially those in the inhospitable regions of northern Russia that would not exist in a market economy. What to do with chronically-inefficient and unprofitable former state and collective farms has probably been the biggest challenge of Russian agricultural reform. Many farms manage to remain solvent through a combination of state subsidies, debt write-offs by state or parastatal lenders, and ad hoc help from local officials (such as in procuring inputs).

Although a shortage of skilled workers exists in Russian agriculture, there is a surplus of poorly skilled labor. In order for large marginal farms to have any chance to be competitive, they have to shed these workers. Yet an array of impediments exists to workers finding jobs outside of the farms that currently employ them. These include the relative isolation of many farms, which makes local alternative jobs scarce, and the obstacles

that many urban authorities create for people who want to settle within their jurisdiction.

Although workers in general have not been completely forced off of farms, Bogdanovskii (2008) finds that for many farms and their workers, a compromise of limited detachment has been made. Millions of workers and their families have become subsistence producers, in that they no longer work on and receive wages from the farms, but are left to live off their small household plots. The workers, though, still receive some benefits from their former employing farm, such as continued access to its social-welfare services (health, education, and housing), and use of the farm as a conduit for inputs for plot use. Many of these subsistence farmers are elderly or at least past their prime working years. For the rest, such a grim life provides strong motivation to find an alternative.

Further challenges, regardless of the future organizational structure of Russian agriculture, are the deficient physical and institutional infrastructure, and commercial support services. These weaknesses raise transaction costs and uncertainty for all producers. However, improvement in these areas is especially necessary if small-scale private farming is to expand, much less prosper.

Ioffe (2005) presents a bleak picture for the future of Russian agriculture, one in which a minority of large farms prospers like an archipelago within an overall depressed and dying rural economy. Workers on the weak farms (with many now reduced to being just plot-holders) will continue to be plagued by demoralization, alcoholism, and a lack of respect for private property (with the resulting theft being a nontrivial cost to their parent farms). Although Ioffe's vision might represent a pessimistic extreme for Russian agriculture, sadly, many farms and workers could suffer this fate even in the most optimistic future scenario for the sector.

Agricultural market policies

As mentioned earlier, the main objective of Russian agricultural policy in the 2000s was to revive the livestock sector, and this priority will likely continue. A draft of the state program for agriculture released by the Russian Ministry of Agriculture in November 2011 calls for a 77% increase in annual federal budget subsidies for agriculture (in nominal rubles) from 2013 to 2020, with regional governments also continuing to contribute subsidies to the sector (Russian Ministry of Agriculture (2011), with USDA (2011) providing a review of the document). The subsidies would continue to favor the livestock sector. However, the Ministry of Finance might resist such an increase, and if Russia joins the World Trade Organization (WTO), its terms of accession would limit future agricultural subsidies. The government also is trying to help the livestock sector by improving the quality of the animal breeding stock, mainly by investing heavily in importing superior animals (Karlova, Mokshina, Serova, Tikhonova, and Shick 2006).

Russian agricultural policy clearly favors livestock producers over consumers and grain producers. As discussed earlier, in 2009 the government raised the out-of-quota tariff for poultry imports to 95%. Such a high tax will either choke off any imports beyond the low-tariff quota volume, which would raise domestic poultry prices, or if imports are above the low-tariff quota, the high out-of-quota tariff will set the domestic price.

Russia's grain export taxes during the rise in world agricultural prices in 2006-08 and complete export ban of grain in 2010-11 sacrificed the interests of grain producers to help purchasers, mainly livestock producers (though as opposed to trade protection for the livestock sector, these restrictions also helped the grain-consuming public). The ban drove Russian domestic grain prices far below those on world markets. The Russian government acknowledged that a strong motive behind the grain export ban was to help the livestock sector (Interfax).

On the other hand, in 2009 Russia established a parastatal grain enterprise called the United Grain Company. This company's official functions include increasing the state's involvement in the domestic grain market, increasing grain exports, and improving the physical infrastructure of the grain sector (Interfax). However, the nature and full objectives of the company are not yet clear.

The Russian government's favoring of the livestock sector at the expense of the grain economy is contrary to the country's apparent comparative advantage vis-a-vis the world across major agricultural commodities. The policies diminish the country's integration with world agricultural markets; they reduce imports of meat and other livestock products, and by increasing domestic demand for animal feed, decrease grain exports. Although Russia has become a large grain exporter, it continues to be a large net agricultural importer in value terms, mainly because it imports high value products. The government is highly displeased with the negative trade balance in agriculture and appears determined to reduce it. In particular, the government has set the goal of eliminating poultry imports (Interfax).

The Russian government has not supported the development of biotechnology for agriculture, and is not likely to change its policy in the near to medium term (Interfax). In particular, the state has opposed the use of genetically modified organisms (GMOs) in domestic production.

A development that could affect future Russian agricultural policy is the country's accession to the WTO. Russia, Ukraine, and Kazakhstan all officially began their WTO membership bids in the mid-1990s. Ukraine joined in 2008, and Kazakhstan is continuing its accession negotiations. By early 2011, Russia had concluded bilateral talks with almost all WTO members, and the country made major accession progress in November of that year. In December 2011, Russia was accepted for membership (though the Russian government must still officially accept the WTO's invitation to join).

Two key "pillars" of the Agricultural Agreement of the Uruguay Round are market access and domestic support. Concerning market access, Russia agreed in November 2011 to an average import tariff ceiling for agricultural products of 10.8% (the bound rate), a drop from its existing average tariff for agricultural imports of 13.2% (WTO 2011). Regarding domestic support, Russia agreed to a bound level for *trade-distorting subsidies* of $9 billion in 2012, and to decrease this amount to $4.4 billion by 2018. In comparison, Russian agricultural subsidies in 2010 (from both the federal and regional governments) equaled $8.6 billion (Russian Statistical Yearbook). However, the measure for agricultural support used by the WTO, the Aggregate Measure of Support (AMS), does not include all the budget subsidies that Russia provides to agriculture (or that many existing WTO members also provide). Russia's pre-accession AMS-category

support is therefore not as close to the $9 billion bound level for 2012 that the 2010 $8.6 billion subsidy figure suggests.

Nonetheless, Russia's commitment to reducing its AMS to $4.4 billion by 2018 will entail either a drop in trade-distorting support or limited potential to increase it. In addition to the bounds placed on future agricultural import tariffs and market-distorting agricultural subsidies, Russia's agricultural trading partners would benefit from its WTO accession by gaining an official forum for challenging the country's sanitary and phytosanitary import restrictions.

WTO accession could benefit the Russian economy and its consumers by lowering prices for import-competing goods, motivating domestic producers to become more efficient (due to increased competition from imports), and increasing foreign investment. However, the gains to domestic producers from improved access to foreign markets could be limited. Although Russia exports some industrial and agricultural products for which market access gains are possible, such as steel, chemicals, fertilizer, and grain, the bulk of its export earnings come from energy (oil and natural gas). Most of the Russian economy is import-competing. Major sectors of the economy have lobbied strongly against WTO accession, including aviation, furniture production, financial services, telecommunications, and agriculture (Cooper 2008). This helps to explain the slow pace of Russia's accession effort.

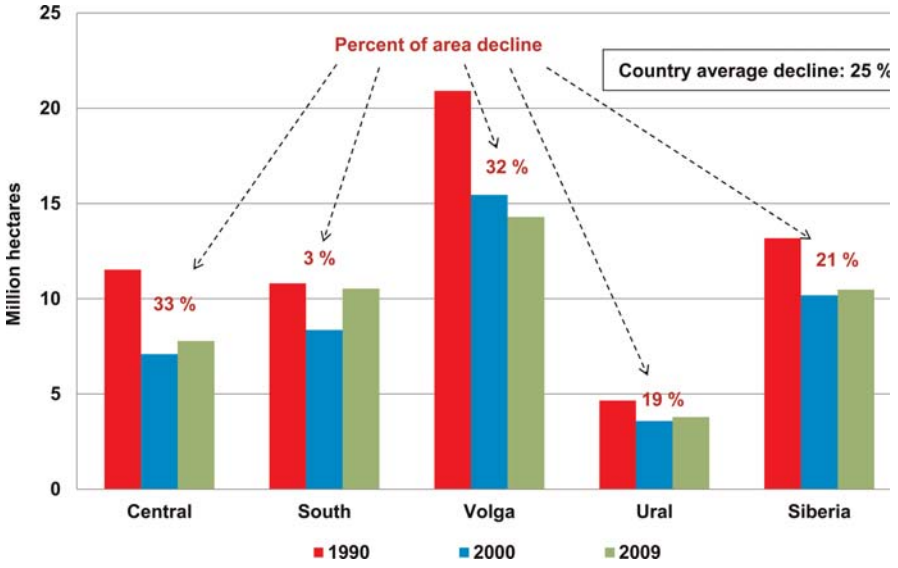
Commodity agriculture and global markets

The outlook for Russian grain exports depends mainly on whether productivity and yields in grain production continue to grow, thereby increasing surplus output for export. This in turn depends largely on whether the agroholdings keep growing in numbers and influence, and more generally whether the improvements in the overall Russian grain economy that have coincided with the agroholdings' emergence will continue. Based on our discussion in a previous section, we believe that such developments are likely, at least to a limited degree, such that over the next decade Russia will become an even larger grain exporter.

Future Russian and KRU grain output will depend not only on yields, but also area. As discussed earlier, during the 1990s Russia's grain area fell substantially, and even continued to decline during the 2000s (see again table 5). Grain area also dropped during the 1990s in Ukraine and especially Kazakhstan, though it began to rise in both countries in the 2000s. However, from 2006-10, Ukrainian and Kazakh grain area was still below the level from 1987-91. The surge in world agricultural and food prices from 2006-08 and 2010-11 has kindled interest, both in the KRU region and the world, in returning this idled KRU grain area to production. Some observers have argued that the area expansion might substantially increase world grain supplies, especially if combined with yield growth on existing KRU grain area. This could improve overall world food security by putting downward pressure on world grain prices, mitigating any future price jumps, and benefiting the consuming poor of the world.

Given that Russia is the largest KRU grain producer, and that of the three KRU it has experienced the largest drop in grain area (in absolute terms), most of the KRU grain area expansion would have to come in that country. Figure 5 shows that the grain area decline in Russia occurred in

Figure 5 Russian grain area changes by main producing regions



Note: Area decline percentages are 2009 relative to 1990. The Central and South regions are in European Russia.
Source: USDA PS&D.

all its main regions, which indicates that area expansion during the Soviet period was pushed throughout the country. However, the best agricultural region–southern European Russia (which includes the especially fertile northern Caucasus territory)–experienced the smallest grain area decrease (from 1990 to 2009), and since 2000 grain area there has rebounded to almost the late Soviet level.

For the KRU's grain area to grow substantially, world prices would have to rise above even the high "new plateau" that currently exists. Returning fallow land to production would also require a high fixed cost of initially clearing the land and making it suitable for farming. The KRU countries would have to invest heavily in building the physical and commercial infrastructure for storing and transporting the grain, especially for production expanded into remote areas.

Improving infrastructure is also necessary to increase exports from existing grain-producing regions. A special challenge that arose when the KRU region became a large grain exporter during the 2000s, given that the USSR was a grain importer rather than exporter, is that the shipping ports were geared toward importing rather than exporting (FAO 2009). For example, grain storage was built up near the large consuming centers, but export-oriented storage requires large capacity at the export sites (mainly ports). KRU governments have prioritized improving infrastructure for their grain economies, and infrastructure investment has increased substantially in recent years.

The USDA (ERS International Baseline Data) projects that Russian production of grain will rise from an average annual volume of 82 million metric tons (mmt) from 2006-10 to 104 mmt by 2020. Total (average annual) KRU grain production will rise over this time (2006-10 to 2020) from 139 to almost 180 mmt. By 2020, Russian and total KRU wheat

output is projected to be 68 and 110 mmt, respectively. Most of the projected increase in Russian grain output will come from a rise in yields, with Russian grain area projected to increase by only 4% from 2006-10 to 2020.

The USDA (ERS International Baseline Data) also projects that Russian net grain exports over this time will increase from 14 mmt (average annual) to 24 mmt, and KRU net grain exports from 36 to 70 mmt. The KRU region will become a particularly large supplier of wheat to the world, with Russia and the KRU region providing, by 2020, 15% and 30% of total wheat exports, respectively. By 2020, Russian wheat exports are projected to be just slightly below those of the United States (traditionally the world's top wheat exporter), and total KRU wheat exports would almost double those of the United States.

The progressive developments in the Russian meat industries during the 2000s should also persist. Poultry production should continue to grow strongly, and the recent turn-around in pork output will likely accelerate. A key to these industries' success is that they have increased feed efficiency, an activity in which Soviet agriculture performed particularly poorly. The bulk of Russia's domestic grain use is for animal feed. From 2000 to 2009, Russian meat production increased 63%, but domestic grain use rose only 14% (Russian Statistical Yearbook). Russia's heavy investment in upgrading breeding stock for cattle and pork should also pay off to some degree, and thereby contribute to rising meat output. The Russian meat and other livestock product industries will also benefit from expanding state subsidies and high trade protection.

The USDA (ERS International Baseline Data) projects that Russian meat production (beef, pork and poultry) will increase from an average annual volume of 4.9 mmt from 2006-10 to 6.8 mmt by 2020. Over this time (2020 compared to 2006-10), annual poultry and pork output will grow by 70% and 49%, though beef production will drop by 16%. Total KRU meat output is projected to rise from 7.2 mmt from 2006-10 (average annual) to 9.7 mmt by 2020.

Continued growth in the KRU livestock sectors would to some degree mitigate the rise in the region's grain exports. Russia's grain exports are mainly food wheat, though of low quality, and some substitutability exists between growing low quality food grain versus feed grain. Ukraine, on the other hand, exports mainly feed grain (feed wheat, barley, and corn). By increasing domestic demand for animal feed, expanding the KRU livestock sectors should motivate some shift in grain area toward producing more feed for internal use. On the other hand, this effect will be countered somewhat by likely continuing improvement in KRU animal feed efficiency. Perhaps the main source of uncertainty for future Russian/KRU grain exports is how the expected growth in the livestock sector will affect domestic feed demand and the trade-off between producing food grain for export versus feed grain for domestic use.

The growth in Russian meat and other livestock products, and especially the trade protection given to these industries, will have the isolated effect of reducing imports. On the other hand, imports will be stimulated by expected growth in GDP and consumer income. The USDA projects that from 2011-20, Russian GDP will rise at an average annual rate of 3.4% (ERS International Macroeconomic Data Set). Russia is also forecast to have higher price inflation than its main trading partners. This will

continue to stimulate imports by making them less expensive relative to domestic output (or in other words, appreciate the currency in real terms). Although meat imports might not increase over the next 10 years, rising GDP and consumer income, along with relatively high inflation, could well result in continued growth in aggregate agro-food imports, particularly of high value processed foods, fruits, and vegetables.

The USDA (ERS International Baseline Data) projects that Russian (gross) imports of beef, pork, and poultry (broilers) will decrease from an average annual volume of 3.0 mmt from 2006-10 to 1.5 mmt by 2020. Poultry imports will fall over this time (2020 compared to 2006-10) by almost 90%, to 0.14 mmt, while pork imports will drop by about half, to 0.45 mmt.

Conclusion

Although this article has focused on Russia, much of that country's agricultural reform experience is similar to that of Ukraine and Kazakhstan. A summary of Russia's main reform outcomes and remaining challenges largely applies to these two countries as well.[15] All three KRU countries replaced the state allocation of resources with markets, and privatized farms and other agro-food enterprises. However, the large former state and collective farms stayed quite intact, with most officially reorganized as corporate farms but remaining largely unreformed in operational terms into the 21st Century. Many of these farms are weak and chronically unprofitable. Small scale family farming has not flourished, land reform is muddled, and land markets are poorly functioning. Yet in the 2000s large agroholdings arose in the KRU region, which brought investment, new technology, and better management into the agro-food sector. Russian and KRU primary agriculture is a complicated blend of huge agroholdings, other large corporate farms, struggling family farms, and small household plots and gardens.

All three KRU countries experienced a large drop in agricultural output during the 1990s, especially in the over-expanded livestock sector, though only Russia became a big meat importer. The large decline in domestic feed grain demand from the contraction of the livestock sector eliminated the large Soviet-era imports of grain, soybeans, and soybean meal and decreased domestic grain area and production.

After the difficult decade of the 1990s, all three KRU countries had greater agricultural success during the 2000s. On the one hand, the combination of rising consumer income from GDP growth and currency appreciation in real terms stimulated agro-food imports, especially by Russia. On the other hand, grain production increased substantially, such that the KRU region became a major grain exporter, and the livestock sector began to rebound. The agroholdings and other new and modern agro-food enterprises appear to have played a role in these positive developments,

[15] *A qualification to this statement is that transition has affected Kazakh agriculture differently in the northern and southern parts of the country. The agricultural transition experience for northern Kazakhstan, which borders Russia and specializes in grain production, has been similar to that of Russia and Ukraine. However, transition has changed Kazakh agriculture in the south, which specializes in cotton and rice production, more than in the north, one major development being that the large former state and collective farms were broken up (Pomfret 2008).*

though the Russian livestock sector has also benefited from policy favoritism. A key outlook question is the degree to which the revival of the KRU livestock sectors will cut into the countries' exports.

Even in the most optimistic future scenario for Russian/KRU agriculture, the sector faces major challenges. These include what to do with nonviable large farms, a glut of unskilled workers, a shortage of skilled labor, and deficient commercial services and public institutions to support the sector. The new agroholdings appear to be a "second best" response to the many dysfunctional aspects of KRU agriculture, with their own innate weaknesses. Some specialists even question whether they will last in the long run. Key outlook questions therefore are whether the agroholdings will continue to expand, can they further improve their performance, and how long will they exist. Over the next decade, Russian and KRU agriculture is likely to remain a complicated mix of continuing improvement and success for some aspects and entities, and continuing dysfunction and struggle for others.

Acknowledgments

The authors thank the following for helpful information and comments: Levin Flake, Keith Fuglie, Richard Pomfret, Nicholas Rada, Scott Reynolds, Dmitri Rylko, Eugenia Serova, Yelena Vassilieva, Paul Westcott, Sergiy Zorya, an anonymous referee, and the editor. Nevertheless, the authors are responsible for any remaining deficiencies. The views expressed in this article are those of the authors, and may not be attributed to the Economic Research Service or the U.S. Dept. of Agriculture.

References

Bogdanovskii, V. 2008. Rural and Agricultural Labor Markets. In *Russia's Agriculture in Transition: Factor Markets and Constraints on Growth*. Z. Lerman, ed., pp. 199–241. Lanham, MD: Lexington Books.

Bokusheva, R., and H. Hockmann. 2006. Production Risk and Technical Efficiency in Russian Agriculture. *European Review of Agricultural Economics* 33(1): 93–118.

Bokusheva, R., H. Hockmann, and S.C. Kumbhakar. Dynamics of Productivity and Technical Efficiency in Russian Agriculture. *European Review of Agricultural Economics*, forthcoming. Advanced Access published November 16, 2011; doi:10.1093/erae/jbr059.

Brock, G., M. Grazhdaninova, Z. Lerman, and V. Uzun. 2008. Technical Efficiency in Russian Agriculture. In *Russia's Agriculture in Transition: Factor Markets and Constraints on Growth*. Z. Lerman, ed., pp. 353–71. Lanham, MD: Lexington Books.

Brooks, K., and B. Gardner. 2004. Russian Agriculture in the Transition to a Market Economy. *Economic Development and Cultural Change* 52(3): 571–86.

Buzdalov, I. 2009. Land Reform: A Look Through the Prism of Intentions. *Problems of Economic Transition* 51(12): 42–57.

Cooper, W.H. 2008. *Russia's Accession to the WTO*. CRS Report for Congress, Order Code RL31979, Congressional Research Service, Washington, DC. Available at: http://www.au.af.mil/au/awc/awcgate/crs/rl31979.pdf.

Csaki, C., and J. Nash. 1998. *The Agrarian Economies of Central and Eastern Europe and the Commonwealth of Independent States: Situation and Perspectives, 1997*. World Bank Discussion Paper No. 387, World Bank, Washington, DC.

Csaki, C., and A. Fock. 2000. *The Agrarian Economies of Central-Eastern Europe and the Commonwealth of Independent States: An Update on Status and Progress*. Working Paper No. 24, (ECSSD) Environmentally and Socially Sustainable Development, World Bank, Washington, DC.

Csaki, C., H. Kray, and S. Zorya. 2006. *The Agrarian Economies of Central-Eastern Europe and the Commonwealth of Independent States: An Update on Status and Progress in 2005.* Working Paper No. 46, (ECSSD) Environmentally and Socially Sustainable Development, World Bank, Washington, DC.

Demyanenko, S.I. 2008. *Agriholdings in Ukraine: Good or Bad?* Policy Paper Series, AgPP No. 21, German-Ukrainian Policy Dialogue in Agriculture, Kiev. Available at: http://agribusiness.kiev.ua/img/zstored/files/Agroholdings.pdf.

Economic Research Service (ERS). International Baseline Data. U.S. Dept. of Agriculture, Washington, DC. Available at: http://www.ers.usda.gov/data/internationalbaseline/, accessed November 2011.

——. International Macroeconomic Data Set. U.S. Dept. of Agriculture, Washington, DC. Available at: http://www.ers.usda.gov/Data/macroeconomics/, accessed November 2011.

Epshtein, D. 2008. Allocative Efficiency of Corporate Farms in Leningrad Oblast. In *Russia's Agriculture in Transition: Factor Markets and Constraints on Growth.* Z. Lerman, ed., pp. 347–52. Lanham, MD: Lexington Books.

Food and Agriculture Organization (FAO). FAOSTAT, Rome. Available at: http://faostat.fao.org/default.aspx, accessed September 2011.

——. 2009. *Russian Federation: Analysis of the Agribusiness Sector in Southern Russia*, Rep. Series No. 13, FAO Investment Centre/EBRD Cooperation Programme, Rome. Available at: http://www.fao.org/docrep/012/aj281e/aj281e00.HTM.

Gataulina, E.A., V.Y. Uzun, A.V. Petrikov, and R.G. Yanbykh. 2005. Vertical Integration in an Agroindustrial Complex: Agrofirms and Agroholdings in Russia. In *The Dynamics of Vertical Coordination in Agrifood Chains in Eastern Europe and Central Asia, Case Studies*. J.F.M. Swinnen, ed., pp. 45–71. Working Paper No. 42, The World Bank, Washington, DC.

Grazhdaninova, M., and G. Brock. 2004. Grain and Sunflower on Russian Farms in 2001: How Efficient is Crop Production? *Post-Communist Economies* 16(3): 297–305.

Grazhdaninova, M., and Z. Lerman. 2005. Allocative and Technical Efficiency of Corporate Farms in Russia. *Comparative Economic Studies* 47(1): 200–13.

——. 2008. Allocative Efficiency of Corporate Farms: Evidence from the 2003 BASIS Survey. In *Russia's Agriculture in Transition: Factor Markets and Constraints on Growth*. Z. Lerman, ed., pp. 327–33. Lanham, MD: Lexington Books.

Gregory, P.R., and R.C. Stuart. 1990. *Soviet Economic Structure and Performance*, 4th Ed. New York: Harper Collins.

Hockmann, H., R. Bokusheva, and I. Bezlepkina. 2009. Agroholding Membership: Does that Make a Difference in Performance? *Quarterly Journal of International Agriculture* 48(1): 25–46.

Holzman, F.D. 1974. *Foreign Trade under Central Planning*. Cambridge, MA: Harvard University Press.

Interfax. *Food and Agriculture Report*. Moscow, Russia, weekly.

Ioffe, G. 2005. The Downsizing of Russian Agriculture. *Europe-Asia Studies* 57(2): 179–208.

Karlova, N., P. Mokshina, E. Serova, T. Tikhonova, and O. Shick. 2006. Russian Agrifood Sector: Basic trends in 2005. In *Russian Economy in 2005: Trends and Outlook* (Issue 27), 218–43. Institute for the Economy in Transition, Moscow.

Koester, U. 2007. Super-large Farms: The Importance of Institutions. Paper presented at the EAAE Seminar on Superlarge Farming Companies: Emergence and Possible Impacts, Moscow, May 17-18. Available at: http://ageconsearch.umn.edu/bitstream/10018/1/sp07ko01.pdf.

Lerman, Z., Y. Kislev, D. Biton, and A. Kriss. 2003. Agricultural Output and Productivity in the Former Soviet Republics. *Economic Development and Cultural Change* 51 (4): 999–1018.

Lerman, Z., and P. Schreinemachers. 2005. Individual Farming as a Labour Sink: Evidence from Poland and Russia. *Comparative Economic Studies* 47(4): 675–95.

Liefert, W.M. 2001. Agricultural Reform: Major Commodity Restructuring but Little Institutional Change. In *Russia's Uncertain Economic Future*. J. Hardt, ed., pp. 253–81. U.S. Congress, Joint Economic Committee, Washington, DC. Available at: http://bulk.resource.org/gpo.gov/prints/107/s_76171.pdf#page=275.

——. 2002. Comparative (Dis?)Advantage in Russian Agriculture. *American Journal of Agricultural Economics* 84(3):762–67.

——. 2005. The Allocative Efficiency of Material Input Use in Russian Agriculture. *Comparative Economic Studies* 47(1): 214–23.

——. 2008(a). The Allocative Efficiency of Input Use in Russian Corporate Farms. In *Russia's Agriculture in Transition: Factor Markets and Constraints on Growth*. Z. Lerman, ed., pp. 305–26. Lanham, MD: Lexington Books.

——. 2008(b). Measuring the Success of Agricultural Transition: An Application to Russia. In *Agricultural Economics and Transition: What was Expected, What we Observed, the Lessons Learned*. C. Csaki, and C. Forgacs, eds., pp. 44–54. Halle, Germany: IAMO.

Liefert, W.M., R. Koopman, and E. Cook. 1993. Agricultural Reform in the Former USSR. *Comparative Economic Studies* 35(4): 49–68.

Liefert, W.M., and J.F.M. Swinnen. 2002. *Changes in Agricultural Markets in Transition Economies*. Agricultural Economic Report No. 806, Economic Research Service, U.S. Dept. of Agriculture, Washington, DC. Available at: http://www.ers.usda.gov/publications/aer806/aer806.pdf.

Liefert, W.M., B. Gardner, and E. Serova. 2003. Allocative Efficiency in Russian Agriculture: The Case of Fertilizer and Grain. *American Journal of Agricultural Economics* 85(5): 1228–33.

Liefert, W.M., B. Lohmar, and E. Serova. 2003. Transition and Food Consumption. Paper presented at International Conference of Agricultural Economists (IAAE), Durban, South Africa, August 16-22. Available at: http://ageconsearch.umn.edu/bitstream/25844/1/cp03li01.pdf.

Liefert, W.M., Z. Lerman, B. Gardner, and E. Serova. 2005. Agricultural Labor in Russia: Efficiency and Profitability. *Review of Agricultural Economics* 27(3): 412–17.

Liefert, W.M., O. Liefert, and M. Shane. 2009. *Russia's Growing Agricultural Imports: Causes and Outlook*. Outlook Report WRS-09-04, Economic Research Service, USDA, Washington, DC. Available at: http://www.ers.usda.gov/Publications/WRS0904/WRS0904.pdf.

Lin, J.Y., F. Cai, and Z. Li. 1996. The Lessons of China's Transition to a Market Economy. *The Cato Journal* 16(2): 201–31.

——. 2003. *The China Miracle: Development Strategy and Economic Reform*, Revised Edition. Hong Kong: The Chinese University Press.

Organization for Economic Cooperation and Development (OECD). 1999. *Agricultural Policies in Emerging and Transition Economies*. Paris, France.

Osborne, S, and M.A. Trueblood. 2006. An Examination of Economic Efficiency of Russian Crop Production in the Reform Period. *Agricultural Economics* 34(1): 25–38.

Pomfret, R. 2008. Kazakhstan. In *Distortions to Agricultural Incentives in Europe's Transition Economies*. K. Anderson, and J.F.M. Swinnen, eds., pp. 219–63. The World Bank, Washington, DC.

Russian Federal Service of State Statistics. 2008. *Osnovnie Itogi Vserossiiskoi Sel'skokhoziaistvennoi Perepisi 2006 Goda (Basic Results of the All-Russian Agricultural Census of 2006)*. Moscow, Russia.

——. *Rossiiskii Statisticheskii Ezhegodnik (Russian Statistical Yearbook)*. Moscow, Russia.

——.2009. *Sel'skoe Khoziaistvo, Okhota i Lesovodstvo v Rossii (Agriculture, Hunting, and Forestry in Russia)*. Moscow, Russia.

Russian Ministry of Agriculture. 2011. *Gosudarstvennaia Programma Razvitiia Sel'skovo Khoziaistva i Regulirovaniia Rynkov Sel'skokhoziaistvennoi Produktsii, Syr'ia i Prodovol'stviai na 2013-20 Gody (State Program for the Development of Agriculture and Regulation of the Markets for Agricultural Products, Inputs, and Food in 2013-20)*. Draft November 11, 2011, Moscow, Russia.

Rylko, D., I. Khramova, V. Uzun, and R. Jolly. 2008. Agroholdings: Russia's New Agricultural Operators. In *Russia's Agriculture in Transition: Factor Markets and Constraints on Growth*. Z. Lerman, ed., pp. 95–133. Lanham, MD: Lexington Books.

Sedik, D.J. 1993. A Note on Soviet Per Capita Meat Consumption. *Comparative Economic Studies* 35(3): 39–48.

Sedik, D.J., M. Trueblood, and C. Arnade. 1999. Corporate Farm Performance in Russia, 1991-1995: An Efficiency Analysis. *Journal of Comparative Economics* 27(3): 514–33.

Serova, E. 2007. Vertical Integration in Russian Agriculture. In *Global Supply Chains, Standards and the Poor: How the Globalization of Food Systems and Standards Affects Rural Development and Poverty*. J.F.M. Swinnen, ed., pp. 188–206. Wallingford, England: CAB International.

Serova, E., and O. Shick. 2008. Markets for Purchased Farm Inputs. In *Russia's Agriculture in Transition: Factor Markets and Constraints on Growth*. Z. Lerman, ed., pp. 243–56. Lanham, MD: Lexington Books.

Shagaida, N., and Z. Lerman. 2008. Land Reform and Development of Land Markets. In *Russia's Agriculture in Transition: Factor Markets and Constraints on Growth*. Z. Lerman, ed., pp. 137–84. Lanham, MD: Lexington Books.

Sotnikov, S. 1998. Evaluating the Effects of Price and Trade Liberalization on the Technical Efficiency of Agricultural Production in a Transition Economy: The Case of Russia. *European Review of Agricultural Economics* 25(3): 412–31.

Swinnen, J.F.M., and S. Rozelle. 2006. *From Marx and Mao to the Market: The Economics and Politics of Agricultural Transition*. Oxford: Oxford University Press.

Swinnen, J.F.M., K. Van Herck, and L. Vranken. Agricultural Productivity Paths in Central and Eastern European Countries and the Former Soviet Union: The Role of Reforms, Initial Conditions and Induced Technological Change. In *Productivity Growth in Agriculture: An International Perspective*. K.O. Fuglie, S.L. Wang V.E. Ball, eds. Oxfordshire, UK: CABI International, forthcoming.

Ukrainian State Statistical Committee. *Statistichnii Shchorichnik Ukraini (Statistical Yearbook of Ukraine)*, Kiev, Ukraine.

U.S. Department of Agriculture, Foreign Agricultural Service. FAS Production, Supply and Distribution Online (USDA PS&D). Available at: http://www.fas.usda.gov/psdonline/.

——. 2011. *Russia Releases Draft of Agricultural Development Program, 2013-2020*. Gain Report No. RS1143. Post: Moscow, Russia. Available at: http://gain.fas.usda.gov/Recent %20GAIN%20Publications/Russia%20Releases%20Draft%20of%20Agricultural%20Development%20Program%202020_Moscow_Russian%20Federation_9-9-2011.pdf.

Uzun, V. 2008. Allocative Efficiency of Corporate Farms: Evidence from National Data. In *Russia's Agriculture in Transition: Factor Markets and Constraints on Growth*. Z. Lerman, ed., pp. 335–45. Lanham, MD: Lexington Books.

Voigt, P. 2006. Russia's Way from Planning Toward Market: A Success Story? A Review of Economic Trajectories, Transition Progress, and Putin's Merits. *Post-Communist Economies* 18(2): 123–38.

Voigt, P., and V. Uvarovsky. 2001. Developments in Productivity and Efficiency in Russia's Agriculture: The Transition Period. *Quarterly Journal of International Agriculture* 40(1): 45–66.

Voigt, P., and H. Hockmann. 2008. Russia's Transition Process in the Light of a Rising Economy: Economic Trajectories in Russia's Industry and Agriculture. *European Journal of Comparative Economics* 5(2): 251–67.

Von Cramon-Taubadel, S., O. Nivyevskiy, E.E. von der Malsburg, and V. Movchan. 2008. Ukraine. In *Distortions to Agricultural Incentives in Europe's Transition Economies*. K. Anderson, and J.F.M. Swinnen, eds., pp. 175–217. The World Bank, Washington, DC.

Von Cramon-Taubadel, S., and O. Nivyevskiy. Twenty Years of Research on Transition in Agricultural Economics Journals. *European Review of Agricultural Economics*, forthcoming. Advance Access published April 28, 2011; doi:10.1093/erae/jbr008.

Wandel, J. 2009. *Agroholdings and Clusters in Kazakhstan's Agro-food Sector*. Discussion Paper No. 126, Leibniz Institute of Agricultural Development in Central and Eastern Europe, Halle, Germany. Available at: http://econstor.eu/bitstream/10419/32793/1/613840038.pdf.

——. 2011. Business Groups and Competition in Post-Soviet Transition Economies: The Case of Russian "Agroholdings." *Review of Austrian Economics* 24: 403–450.

Wegren, S.K. 2008. Land Reform in Russia: What Went Wrong? *Post-Soviet Affairs* 24(2): 121–48.

Wehrheim, P., K. Frohberg, E. Serova, and J. von Braun. 2000. *Russia's Agro-food Sector: Towards Truly Functioning Markets*. Dordrecht, Netherlands: Kluwer Academic Publishers.

World Trade Atlas, Global Trade Information Services.

World Trade Organization (WTO). 2011. Working Party Seals the Deal on Russia's Membership Negotiations. WTO 2011 News Item, Accessions, November 11, 2011. Available at: http://www.wto.org/english/news_e/news11_e/acc_rus_10nov11_e.htm.

Yastrebova, O., A. Subottin, and D. Epshtein. 2008. Farm Finances and Access to Credit. In *Russia's Agriculture in Transition: Factor Markets and Constraints on Growth*. Z. Lerman, ed., pp. 257–301. Lanham, MD: Lexington Books.