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Rising Grain Exports by the Former Soviet Union Region

Causes and Outlook

Olga Liefert, oliefert@ers.usda.gov
William Liefert, wliefert@ers.usda.gov
Eric Luebehusen, eluebehusen@oce.usda.gov

Abstract

The three major grain-producing countries of the former Soviet Union—Russia, Ukraine, and Kazakhstan—have become a large grain-exporting region. During 2006-11, grain exports by the three countries together averaged 41 million metric tons a year, about 14 percent of the world total (including rice). According to USDA projections, by 2021 these three countries will provide 22 percent of the world's grain exports. Russia's wheat exports alone are projected to almost equal those of the United States, and total wheat exports by Russia, Ukraine, and Kazakhstan will exceed those of the United States by 87 percent. However, growth of the livestock sector within these countries, aided by government policy, could mitigate these developments as expanding livestock herds reduce feed grain surpluses available for export. Further growth of the region's grain exports will also require improvement in the infrastructure for storing and transporting grain.

Keywords: Russia, Ukraine, Kazakhstan, agriculture, grain, wheat, grain area, yields, trade, exports, World Trade Organization, input productivity, infrastructure, Russian agroholdings, weather

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Introduction

In the late Soviet period, the Soviet Union was a large grain importer. Following the breakup of the Union in December 1991, its successor countries began their transition from centrally planned to market economies. During the 1990s, the grain imports of the major grain-producing countries of the former USSR (Kazakhstan, Russia, and Ukraine, abbreviated as the KRU) largely ended, and these countries collectively became a small net grain exporter.

In the 2000s, the KRU countries emerged as a large grain-exporting region. Average annual (gross) KRU grain exports rose from 9 million metric tons (mmt) during 1996-2000 to 24 mmt during 2001-05, increasing during 2006-11 to 41 mmt. During this last 6-year period, the KRU countries contributed 14 percent of total world grain exports and 21 percent of world exports of wheat (fig. 1). The movement of the KRU region from large grain importer to net exporter has created a swing of over 50 mmt in the volume of grain available on the world market (comparing 2006-11 grain exports with 1987-91 imports; see table 1 and fig. 2).

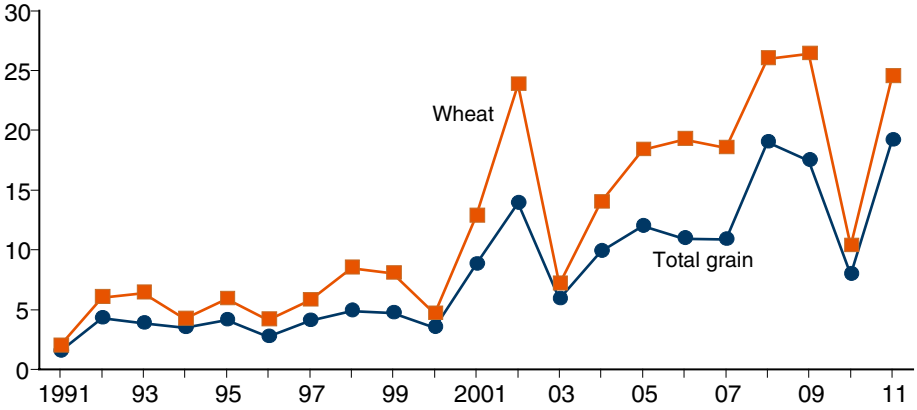
The main grain exported by the KRU region is wheat, accounting for more than 70 percent of its total grain exports during 2006-10, followed by barley with a 20-percent share (fig. 3). The main foreign markets for KRU grain are the European Union, North Africa, the Middle East, certain Asian countries, and other countries of the former Soviet Union.

The surge in world agricultural and food prices in 2006-08, and the further jump in 2011-12, raised concerns about the world's ability to feed an ever-growing population. Increasing the production of grain is central to meeting this challenge, both to provide sufficient food grain and to meet the demand for animal feed, especially as income growth in emerging market economies increases demand for meat and other livestock products. Many observers see

Figure 1

KRU region supplies a large share of world grain exports, especially wheat

Percent share of world exports



Note: KRU countries combined (Kazakhstan, Russia, and Ukraine). Exports are gross.

Source: FAS Production, Supply and Distribution Online (USDA PS&D), http://www.fas.usda.gov/psdonline/.

Table 1
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)
1996-2000	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)
1996-2000	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
1996-2000	26	2.7	1.6	0.1
2001-05	34	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
1996-2000	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: KRU region comprises Kazakhstan, Russia, and Ukraine. Figures are average annual values during 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 area, yield, production and trade exclude buckwheat, sorghum, and pulses. Meat covers beef, pork, and poultry broilers.

Source: FAS Production, Supply and Distribution Online (USDA PS&D). http://www.fas.usda.gov/psdonline/.

the KRU as a region with the potential to strengthen world food security by expanding grain production and exports (e.g., Swinnen and Van Herck, 2011).

This report assesses how the KRU countries became such large grain exporters and provides the outlook for KRU production and exports over the next 10 years. Although the report covers Ukraine and Kazakhstan to some degree, the focus is on Russia, the KRU region's biggest grain producer. However, many of the developments and issues related to the Russian grain economy and trade are shared by Ukraine and Kazakhstan.[1]

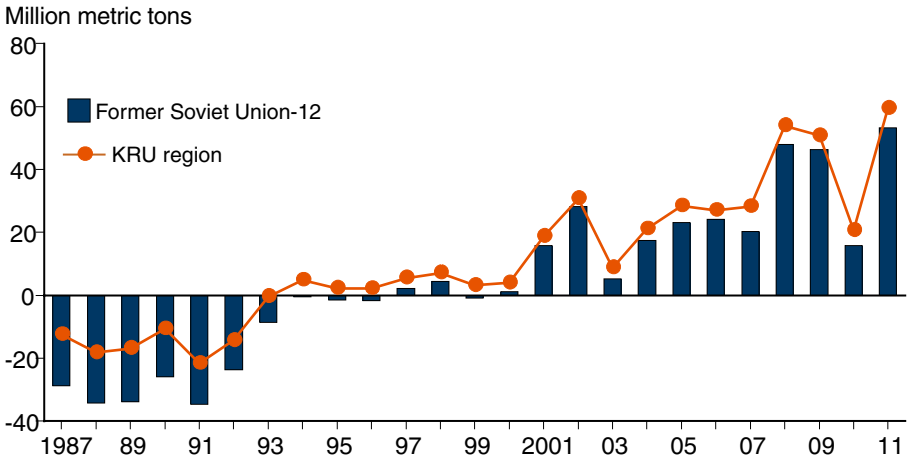
A key reason the KRU region has become a large grain exporter during the past decade is its increased grain output, which, along with slow growth in domestic grain consumption, created surpluses for export. Consequently,

[1]For thorough reviews of Russian, Ukrainian, and Kazakh agricultural developments during the transition period, see Liefert and Liefert (2008), Von Cramon-Taubadel et al. (2008), and Pomfret (2008), respectively. Petrick et al. (2011) provide a detailed examination of Kazakhstan's grain economy.

a major issue examined in the report is why grain production rose during the 2000s, with special attention on whether farm-level improvements have increased input productivity and yields.

Figure 2

KRU region has moved from big grain importer to large exporter



Notes:

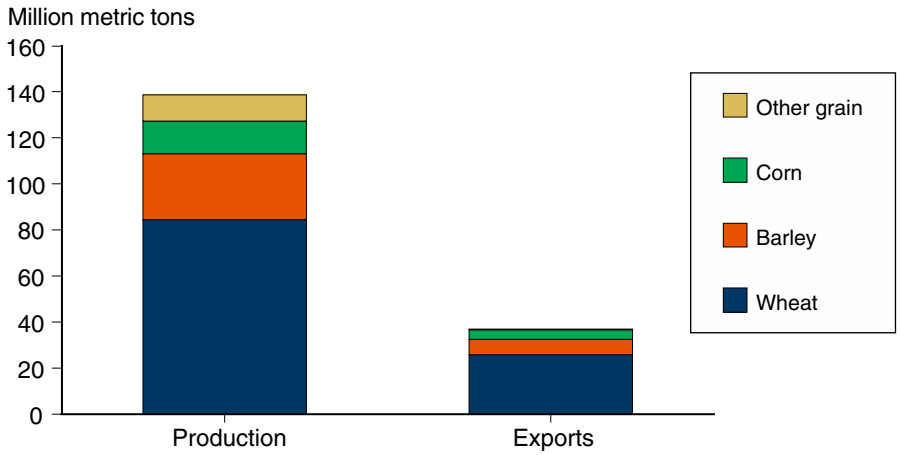
KRU region—Kazakhstan, Russia, and Ukraine.

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 Soviet Union minus Lithuania, Latvia, and Estonia.

Source: FAS Production, Supply and Distribution Online (USDA PS&D), http://www.fas.usda.gov/psdonline/.

Figure 3

Wheat dominates KRU grain production and exports



Note: KRU countries combined (Kazakhstan, Russia, Ukraine). The bars give average annual figures over 2006-10. Exports are gross.

Source: FAS Production, Supply and Distribution Online (USDA PS&D), http://www.fas.usda.gov/psdonline/.

The Economic Transition Restructured KRU Agricultural Production and Trade

There are two main reasons why the KRU countries became a large grain-exporting region in the 2000s. The first is the overall restructuring of their agricultural production, consumption, and trade as they moved to relatively open market economies in the 1990s, and the second is a big increase in grain production during the 2000s.

In the early 1970s, the Soviet Government began to expand the livestock sector, mainly to improve consumers' standard of living by increasing their consumption of meat and dairy products. Using large budget subsidies to both livestock producers and consumers, along with controlled prices and trade, the regime raised meat production between 1970 and 1990 by over 60 percent (Liefert, 2001; Liefert and Swinnen, 2002). By 1990, Soviet per capita consumption of meat and other livestock products was close to that of many wealthier developed countries, despite a Soviet per capita GDP that was—at most—half as much (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 grain and oilseed exporting countries such as the United States, Canada, and Australia

The move to a more market-based economy in the 1990s reversed the expansion of the livestock sector. Because of budget retrenchment, the huge government support to agriculture—especially to the livestock sector, which received the bulk of subsidies—was largely eliminated. Also, integration into world markets revealed that Russia had a comparative cost disadvantage in the sector (Liefert, 2002). From 1990 to 2000, KRU livestock herds and product output, in particular meat production (beef, pork, and poultry), were more than halved and meat imports began to rise (table 1).

The contraction of the livestock sector during economic transition is a key reason why the KRU countries moved from being grain importers to exporters. Rather than importing grain, soybeans, and soybean meal to feed a big livestock sector, Russia became a large meat importer, Ukraine and Kazakhstan became smaller net meat importers, and all three countries started to export grain. The decrease in the KRU need for animal feed was substantial enough to turn the region from a large grain importer during the Soviet time into a leading exporter in the 2000s, despite grain production that was lower than during the late Soviet period. KRU average annual grain output during 2006-10 was 139 mmt, down from 160 mmt during 1987–91 (table 1).

Russian Grain Production Increased During the 2000s

The second reason KRU grain exports grew so much during the 2000s is that, after large decline during the 1990s, grain production began to rise well beyond levels needed to serve domestic demand. KRU average annual grain output increased from 100 mmt during 1996-2000 to 125 mmt during 2001-05, and then to 139 mmt during 2006-10 (table 1). Grain production expanded primarily because of a rise in yield rather than area.

KRU Grain Area Fell During Transition

During the 1990s, grain area declined in all three KRU countries (table 2). To a large degree, the area drop corrected the Soviet policy of pushing grain production onto marginal land, which had resulted in much inefficient, high-cost production. Although grain area increased somewhat in Ukraine and Kazakhstan during the 2000s, in Russia it continued to fall during 2001-05, but then held steady during 2006-10. Total KRU grain area during 2006-10 was about equal to that of 1996-2000, although far below the level of the late Soviet period (76 percent of 1987-91 area).

The surge in world agricultural and food prices in 2006-08 and 2011-12 kindled interest, both in the KRU countries and abroad, in returning some of the idled KRU grain area to production. The area expansion might substantially increase world grain supplies, especially if combined with yield growth on existing grain area. This would put downward pressure on global prices, mitigating any future price jumps and benefiting the world's poorer consumers.

Given that Russia is the biggest KRU grain producer and that it has experienced the largest drop in grain area of the three KRU countries, most of the KRU grain area expansion would have to take place there. The Russian grain area did respond somewhat to the jump in world grain prices during 2006-08, with average grain area in 2008-09 rising 8 percent above that of the 3 previous years.[2] Yet for Russian (as well as Ukrainian and Kazakh) grain area to grow substantially, world prices would have to rise and remain above their current high level. Returning fallow land to production would require

[2]In 2010, Russian grain *harvested* area (as opposed to planted area) dropped by 10 percent, though this reflected mainly unfavorable weather conditions–i.e., winterkill followed by severe drought.

Table 2
KRU grain yield and area

	Yield			Area			
	Russia	Ukraine	Kazakhstan	Russia	Ukraine	Kazakhstan	KRU total
	Tons per hectare			*Million hectares*			
1987-91	1.61	3.27	0.89	59.4	13.3	23.3	96.0
1992-95	1.53	2.91	0.90	54.7	12.2	20.6	87.4
1996-2000	1.33	2.18	0.84	47.4	11.9	13.3	72.6
2001-05	1.79	2.62	1.04	42.7	13.0	13.9	69.6
2006-10	1.92	2.81	1.06	42.7	13.9	15.9	72.5

Note: KRU region comprises Kazakhstan, Russia, and Ukraine. Figures are average annual values during the period identified.
Source: FAS Production, Supply and Distribution Online (USDA PS&D). http://www.fas.usda.gov/psdonline/.

a high initial cost for clearing the land and making it suitable for farming. In addition, the KRU countries would have to invest more in improving the physical (hard) and commercial (soft) infrastructure for storing and transporting the grain, especially for production that expanded into remote areas.

KRU Grain Yields Also Dropped, but Then Rebounded

Given that KRU grain area did not rise during the 2000s, the production increase was due to growth in yields. Table 2 shows that grain yields in all three KRU countries fell during the 1990s but rebounded during the 2000s. The aggregate KRU grain yield increased from a yearly average of 1.37 tons per hectare during 1996-2000 to 1.80 tons per hectare during 2001-05 and to 1.91 during 2006-10.

Recent literature on Russian agricultural growth during the 2000s indicates substantial improvement in productivity, and the rising grain yields suggest that increased input productivity drove the yield growth. Bokusheva, Hockmann, and Kumbhakar (2012) calculate that during 1999-2008, total factor productivity (TFP) in Russian agriculture grew by about a quarter, while Swinnen, Van Herck, and Vranken (2012) compute that during 2000-07, TFP rose by an even more substantial 54 percent. These studies provide strong empirical support for the argument that productivity-enhancing farm-level improvements are occurring in Russian agriculture and contributing to rising output. A limitation of both studies for our purposes, however, is that they cover the agricultural sector as a whole rather than focusing on grain.

Table 3 provides evidence more specific to grain production that productivity rose during the 2000s. The table shows that Russian average annual grain output during 2006-10 was about 30 percent higher than during 1996-2000. Yet during 2006-10, the volume of inputs used in grain production was in general lower than in 1996-2000: grain area was down a tenth, agricultural labor was down about a fifth, grain combines and tractors were down about two-fifths (though labor and tractor data pertain to all

Table 3
Russian grain output and input use

Indices of	1990-91	1992-95	1996-2000	2001-05	2006-10
Grain output	100	88	66	80	87
Input use					
Grain area	100	92	80	72	72
Ag. labor	100	103	89	80	70
Grain combines	100	85	73	66	46
Tractors	100	96	75	59	45
Fertilizer	100	46	24	34	50
Oil-based fuel	100	54	27	21	18

Note: The table gives indices with the average annual value of the variable during 1990-91 = 100, except for grain output and area, where the average annual value of the variable during 1987-91 = 100. Combines and tractors are deliveries of units to farms per thousand hectares of sown area. Fertilizer use is tons per hectare of grain area. Area, combines, and fertilizer are specific to grain production, while ag. labor, tractors, and oil-based fuel apply to all agriculture.

Source: FAS Production, Supply and Distribution Online (USDA PS&D), http://www.fas.usda.gov/psdonline/; Russian Federal Service of State Statistics.

agriculture, not just grain production), and oil-based fuel (gasoline and diesel) was down by a third.

The one key input for grain production whose use increased during the 2000s was fertilizer. Table 3 shows that relative to 1996-2000, fertilizer use (measured as tons of fertilizer per hectare of grain area, excluding corn) rose during 2001-05 by 42 percent, and by 2006-10, its use had more than doubled over that of 1996-2000. However, calculations based on Russian fertilizer price data (Russian Federal Service of State Statistics, 2006) show that the share of fertilizer in the total value of Russian grain production in 2005 was only about 5 percent. Given this relatively low share and the fact that all the other inputs in table 3 show a decline in use during the 2000s (some by a large amount), one can conclude that the overall volume of inputs used in Russian grain production fell during the 2000s by a nontrivial degree. When combined with the large increase in grain output during the decade, the input decline indicates that input productivity, or effectiveness, rose substantially.

There is a second, complementary, way to assess whether input productivity grew in the Russian grain economy during the 2000s that provides some explanation as to why input use generally fell. The approach focuses on analyzing changes in the Russian grain market, where the volume of output is determined mainly by four key factors, or variables: (1) the price of grain; (2) the prices of inputs used in production; (3) government output or input subsidies; and (4) the technology of production, in which improvements increase input productivity. We define production technology to include farm organization and managerial and work practices as well as pure technology, covering any farm-level change that raises input productivity. If we can determine the direction and general magnitude of change in the first three variables, productivity-raising technological change becomes a residual and we can gain insight into its likely direction of change, order of magnitude, and impact on output.

We apply the analysis to the Russian grain market during 2001-05, a period of relative stability for agricultural output and input prices, as well as for the macroeconomy, for Russia (and the world in general). In contrast, the 2006-10 period is less amenable to analysis because of volatility in world grain output and input prices and in macroeconomic conditions, with the world economic crisis of 2008-09 hitting Russia very hard. As opposed to the turbulent 2006-10 period, the relative stability of 2001-05 allows us reasonably to determine the isolated effects of changes in key variables on Russian grain production. If the results indicate that productivity-raising technological change occurred during that time, the farm-level improvements responsible for the enhanced performance likely involved changes in farm management and behavior that were preserved beyond 2005 and perhaps even strengthened.

Table 4 presents the changes in the key variables that drove the Russian grain market. The figures give the average annual value in the variables during 2001-05 as a percent of change in the average annual value during 1996-2000. The table figures are specific to grain production, except for agricultural input prices (including fertilizer prices) and government subsidies, which cover all agriculture. The percentage changes given for prices and subsidies are based on values in real terms.

Table 4

Key variables driving changes in the Russian grain market, 2001-05 compared with 1996-2000

Variable	% change
Output	21
Area	– 10
Fertilizer use	42
Yield	35
Output prices	– 5
Agricultural input prices	13
Fertilizer prices	– 6
Government subsidies	– 26
Input subsidies affecting grain production	– 39
Fertilizer subsidies	– 11

Note: Figures give the percent change in the average annual value of the variable during 2001-05 compared with the average annual value during 1996-2000. Figures are specific to grain production, except for agricultural input prices, fertilizer prices, and Government subsidies, which cover all agriculture. Input subsidies affecting grain production involve such subsidies as fertilizer and seed use, crop insurance, and soil improvement. Fertilizer use is tons per hectare for all grain. Prices and subsidies are in real terms.

Source: FAS Production, Supply and Distribution Online (USDA PS&D), http://www.fas.usda.gov/psdonline/; Organization for Economic Cooperation and Development.

During 2001-05, Russian grain output prices, agricultural input prices in the aggregate (which cover material inputs such as fertilizer, machinery, and fuel, as well as certain agricultural services), and Government subsidies all moved in directions that would decrease, rather than increase, grain output. Grain prices fell 5 percent, input prices rose 13 percent, and agricultural subsidies dropped 26 percent. The increase in input prices contributed to the decline in input use, as revealed in table 3. Yet table 4 shows that during 2001-05, Russian average annual grain production was 21 percent higher than during 1996-2000. Our analysis therefore indicates that grain output growth occurred because of a rise in input productivity. The appendix presents a more detailed market analysis of the Russian grain sector in 2001-05.

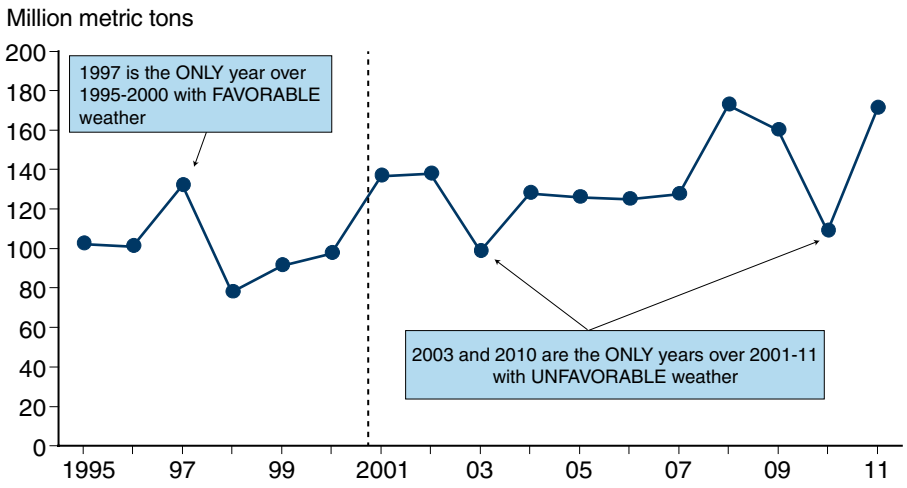
Did Favorable Weather During the 2000s Contribute to Grain Yield Growth?

Input productivity and yields can increase not only because of farm-level improvements, but also due to favorable weather. Good weather raises productivity and yields because more output can be produced from a given amount of area and material inputs. Although isolating the effect on yields and input productivity from farm-level improvements versus that from variable weather is difficult, we make a limited attempt to do so.

The continental climate of the KRU countries results in volatile weather conditions for grain production, especially in terms of rainfall. Figure 4 gives KRU annual grain production over 1995–2011. Grain output was low every year from 1995 to 2000 except for a big upward spike in 1997. On the other hand, grain production over 2001–11 was high every year except for plunges in 2003 and 2010. The weather indicators (mainly rain and temperature) show that in every year during the second half of the 1990s, the KRU region had unfavorable weather for grain production, *except for 1997*, while in every

Figure 4

KRU grain production and weather



Note: KRU countries combined (Kazakhstan, Russia, Ukraine).

Source: FAS Production, Supply and Distribution Online (USDA PS&D), http://www.fas.usda.gov/psdonline/.

year during the 2000s, it had good weather, *except for 2003 and 2010*. The correlation between the production level and weather during each of these years, as shown in figure 4, suggests that favorable weather played some role in the growth of KRU grain yields and production during the 2000s.

As noted, 1997 was the only year of good weather (and high grain yields and production) for the KRU region (including Russia) over the period 1995-2000. The World Agricultural Outlook Board (WAOB) of USDA (within the Office of the Chief Economist) tracks weather conditions in the major grain-producing regions of Russia (among other countries and regions of the world), such as precipitation and temperature. Of these weather indicators, probably the most important for grain yield is the spring precipitation pattern. Using the WAOB information on accumulated precipitation, we identify for 10 Russian wheat-producing regions the year in the 2000s when the spring precipitation pattern was closest to that in 1997. For each of the 10 individual regions, this year is 2004, and for our analysis we label 1997 and 2004 weather *analog years*.[3]

Table 5 gives wheat yields in the 2 analog years for the various regions. The ratios in the table give the yield in 2004 divided by the yield in 1997. The logic of our approach is that if yields for the regions in the 2 analog weather years are close, or if the 1997 yield exceeds that in 2004, we can conclude that major yield-increasing farm-level improvements did not likely occur between the 2 years. (If such improvements were made, then the 2004 yield should reflect that by being higher than the 1997 yield.) If this result holds, an extension of the analysis would be that any (positive) yield difference between a good weather year in the 2000s and bad weather year over 1996-2000 for a given region would be largely attributable to the favorable weather of the 2000s. However, if the yield in 2004 exceeds the 1997 yield, then productivity-raising farm improvements would appear to account for the higher yield, because we have controlled for (and thereby neutralized) weather as a possible explanatory variable.

[3]The purpose of this exercise is to arrive at a judgment as to whether farm-level improvements versus variable weather were the main cause of the increase in Russian grain yields and measured input productivity during the 2000s. In order for our analysis to hold, the second year of yield comparison (in the 2000s) cannot be too close to the first year (in the second half of the 1990s), nor too early in the 2000s. This is because some minimum period of time had to elapse for farms to make the improvements that could increase yields and output. It therefore helps our analysis that the 2 years of comparison are 7 years apart, and that 2004 is 4 years into the 2000s.

Table 5

Russian regional winter wheat yields in years with similar precipitation patterns

Year	Stavropol	Rostov	Krasnodar	Saratov	Volgograd	Voronezh	Kursk	Tambov	Kalmykia	Tatarstan
	14%	13%	12%	8%	8%	5%	3%	3%	2%	1%
1997	2.41	2.16	3.55	2.35	1.89	2.59	2.57	2.67	1.63	3.59
2004	3.49	3.59	4.34	2.15	2.85	2.40	2.41	2.15	2.41	2.53
Ratio	1.45	1.66	1.22	0.91	1.51	0.93	0.94	0.81	1.48	0.70

Note: The percent figure below each region gives the region's share in total Russian winter wheat area over 1996-2005. The ratio is the 2004 yield figure divided by the 1997 figure.

Source: Russian Federal Service of State Statistics; World Meteorological Organization; authors' calculations.

The yield figures in table 5 cover winter wheat produced in these 10 regions. Over 1996-2005, winter wheat (as opposed to spring wheat) accounted for 38 percent of total Russian wheat area and 52 percent of total wheat production. Winter wheat is grown in the more productive and higher yielding regions of Russia, especially in the southern European part of the country. Over 1996-2005, the average annual yield for Russian winter wheat was 2.44 tons per hectare, compared with 1.35 tons for spring wheat.

The percent figure in table 5 below each grain-producing region gives the region's share in total Russian winter wheat area during 1996-2005. The 10 winter wheat regions in the table cover over two-thirds (69 percent) of Russian winter wheat area during that time.

For 5 of the 10 regions in table 5, the 2004 yield figure is above the 1997 yield, while for the other 5 regions the 2004 yield is below its 1997 analog figure. However, the regions where the 2004 yield exceeds the 1997 figure include the largest winter wheat-producing regions of Russia (Stavropol, Rostov, Krasnodar, and Volgograd), all in the fertile far-south of European Russia. If we weight the 1996-2005 yield ratio for each region in the table by its share of the combined winter wheat area for the 10 regions, we get an aggregate ratio of 1.29. This means that the 2004 aggregate yield was 29 percent above the 1997 figure.

The substantially higher 2004 aggregate winter wheat yield suggests that productivity-raising farm-level improvements between 1997 and 2004 were the main cause of the winter wheat yield growth. A qualification of our analysis is that we use only one of a number of possible weather quality indicators, the accumulated precipitation pattern. In addition, our empirical work covers just one pair of analog years over 1996 to the present.

These qualifications notwithstanding, table 4 shows that the average annual total wheat yield for all Russia over 2001-05 was 35 percent higher than over 1996-2000. The fact that our calculated yield difference of 29 percent for the 2 years of similar precipitation (1997 and 2004) is so close to this 35-percent figure provides further evidence that, although favorable weather probably played some role in the rise of Russian grain yields in the 2000s, farm-level improvements that increased input productivity appear to have been the main driver of the yield growth. In the next section, we examine the farm-level changes that occurred in Russian agriculture during the 2000s that might have generated the rise in yields.

Farm-level Improvements Appear To Boost Russian Agricultural Input Productivity and Grain Yields

The dominant grain producers in Russia are the large former State and collective farms of the Soviet period. When Russia began its agricultural reform in the early 1990s, these farms were officially forced to reorganize. Most became corporate farms owned by their management and workers. At the beginning of the 2000s, the farms' system of internal management and work incentives was largely unchanged from the Soviet period, and the status of land reform in Russia was muddled, with property rights, land titling, and other institutional arrangements for land remaining either unsecured or incomplete (Buzdalov, 2009). A related problem was high transaction costs due to weak physical, commercial, and institutional infrastructure for agriculture (Wehrheim et al., 2000).

During the 2000s, however, a growing number of farms appear to have adapted successfully to their market environment by responding more strongly to price signals, cutting waste and other costs, and becoming more profit-oriented and efficient. In particular, a progressive element has entered Russian agriculture in the form of large agroholdings (Rylko et al., 2008; Gataulina et al., 2005; Serova, 2007). The new agroholdings are vertically integrated enterprises that typically combine primary agriculture, processing, and distribution. The agroholdings usually acquire a number of existing corporate farms and improve them, as well as bringing investment, superior technology, and better management practices into the entire agrofood system. These producers often introduce advanced technology through imports such as higher quality seeds, machinery, and animal breeding stock. They are especially interested in grain production because of the opportunities for profitable export. The agroholdings can be linked to our previous market analysis in that their superior management and concern for cost-cutting and profitability would motivate them to use all inputs, including fertilizer, more efficiently.

Although the data are not firm, the agroholdings currently control around 15-20 percent of Russian arable land. Similar agroholdings have arisen in Ukraine and Kazakhstan, many of them specializing in grain production, as in Russia (Demyanenko, 2008; Wandel, 2009).

Rylko et al. (2008) find that Russian agroholdings outperform other domestic agricultural producers, a conclusion supported by anecdotal evidence (FAO, 2009; Interfax). On the other hand, Gataulina et al. (2005) and Hockmann et al. (2009) find that agroholdings are not more productive or profitable than other large Russian agricultural enterprises. Critics of agroholdings argue that – independent of whether these enterprises outperform other types of producers – they have their own limitations, the main one being that they have become so large and unwieldy that they suffer from diseconomies of scale (Gataulina et al., 2005; Hockmann et al., 2009; Wandel, 2009). The benefit of reducing transaction costs through vertical integration must be weighed against the cost of becoming too large.

Another factor in the development of agroholdings has been the influence of regional governments. Regional officials worry about the viability of many of their large farms, especially the economic and social consequences if

the farms 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 more interested in the lucrative and manageable agribusiness activities of processing, distribution, and export and might be involved only reluctantly in messy primary agriculture—that is, in actually managing farms.

The limitations of agroholdings notwithstanding, a superior class of large farms has emerged in Russian agriculture that includes agroholdings and that appear to be improving productivity and overall performance. The Organization for Economic Cooperation and Development (OECD, 2007) supports this conclusion by finding that in 2002-04, 300 producers generated 70 percent of the profits earned by all Russian agricultural enterprises, despite comprising only 1.5 percent of all domestic agricultural producers and holding only 3.5 percent of farmland among enterprises in this category. Rylko et al.'s more general term "new operators," which covers a wider range of producers than just the agroholdings, might be more appropriate to describe these superior agricultural enterprises.

The rise of agroholdings/new operators can be viewed as a response to the serious problems and dysfunctions that persist in KRU agriculture, involving both farm operations and weak infrastructure (Rylko et al., 2008; Hockmann et al., 2009; Demyanenko, 2008). At present, the agroholdings appear to outperform most of the domestic competition. The new farm operators, and particularly the large agroholdings, will likely continue to expand in numbers and influence. Given that these operators apparently represent current best practice in KRU agricultural production, especially for grain, their expansion should boost both grain output and exports.

Government Policies Have Promoted Livestock Production Rather than Grain Exports

The preceding analysis focused on changes in grain productivity and output, arguing that growth in both elements during the 2000s increased grain surpluses for export. However, official KRU agricultural policies during the 2000s, in the form of subsidies and trade controls, favored growth of the livestock sector, thereby reducing exportable surpluses of grain.

Livestock Sector Policies

According to the Russian Government, the main objective of agricultural policy is to revive the livestock sector (Interfax). Table 4 shows that during 2001-05, Russian budget subsidies to agriculture fell in real terms by 26 percent (compared with 1996-2000). However, in 2005, the Government identified agriculture as a national priority area that would receive increased funding, along with health, education, and housing (Interfax). From 2005 to 2010, State support to agriculture (from both the federal and regional governments) more than tripled in nominal rubles, rising by 135 percent in real terms (Russian Federal Service of State Statistics). The livestock sector is receiving the bulk of the new subsidies (Interfax). By promoting growth of the livestock sector and thereby domestic demand for feed grain, the subsidies have had the isolated effect of reducing exportable surpluses of grain.

During the 2000s, agricultural subsidies in real terms also increased in Ukraine and Kazakhstan. However, unlike in Russia, the livestock sector was not necessarily favored in the distribution of the subsidies (OECD, 2007; Pomfret, 2008).

A draft of the State program for agriculture released by the Russian Ministry of Agriculture in November 2011 calls for a 77-percent increase in the annual federal budget for agricultural subsidies (in nominal rubles) from 2013 to 2020, with regional governments also continuing to contribute subsidies to the sector (Russian Ministry of Agriculture, 2011; see USDA (2011) for a review of the document). These subsidies would continue to favor the livestock sector. However, the Ministry of Finance might resist such a subsidy increase. Also, Russia joined the World Trade Organization (WTO) in 2012 (discussed later), and the terms of accession will constrain future growth in agricultural support.

Russian agricultural trade policy has also favored the livestock sector. The large contraction of the KRU livestock sectors during the economic transition of the 1990s coincided with the region, and especially Russia, becoming a big meat importer (table 1). During 2006-10, Russian and KRU net meat imports averaged 2.9 and 3.4 mmt, respectively. By the early 2000s, Russia's main meat import, in both volume and value, was poultry, with the United States the country's biggest foreign supplier and Russia the major foreign market for U.S. poultry meat.

The large meat imports motivated the Russian Government in 2003 to establish restrictive tariff rate quotas (TRQs) for imports of beef and pork, along

with a pure quota for poultry, converted in 2006 to a TRQ. In January 2009, the low tariff quotas for pork and poultry were reduced and the out-of-quota tariffs raised from 40 percent for both products to 75 and 95 percent, respectively. During the 2000s, Russia also imposed many sanitary-based restrictions, and often complete bans, on imports of meat (especially poultry) and other livestock products. The Russian Government has set the goal of ending all poultry imports before the end of this decade, as well as reducing pork imports (Interfax).

Supportive State policy has succeeded in reviving the KRU livestock sectors during the 2010s, though farm-level improvements have also probably played a role (as with grain production). Table 1 shows that KRU meat production (beef, pork, and poultry broilers) rose from an average annual volume of 5.6 million metric tons (mmt) during 1996-2000 to 7.2 mmt during 2006-10, with the rise in Russia from 3.5 to 4.9 mmt. Russian poultry production, in particular, has boomed, growing by more than 400 percent over this period.

By increasing domestic demand for animal feed, livestock sector growth has had a positive effect on grain production but a negative effect on exports. Russia's grain exports are mainly of food wheat, though of low quality, and strong substitutability exists between the use of low-quality wheat as either food or feed. A mitigating factor in the tradeoff between domestic feed use and export, though, is that Russia appears to be improving the efficiency of its feed use, getting more meat and other livestock product output per unit of feed. (During the Soviet period, feed efficiency was very poor by Western standards.) Although total Russian meat production rose from 1996-2000 to 2006-10 by 40 percent, grain used as animal feed increased by only 10 percent (USDA PS&D).

Grain Sector Policies

KRU grain trade policies have worked more to impede than to promote grain exports. The KRU Governments have sporadically banned or otherwise restricted grain exports. In Russia, regional governments have often forbidden the outflow of grain from their borders, typically after poor harvests that reduced local supply. In spring 2007, the Ukrainian Government responded to the surge in world grain prices by banning wheat exports. In 2008, Ukraine replaced the ban with an export quota, which it reinstated in 2010.

In 2008, both the Russian and Kazakh Governments put a tax on wheat exports, and the disastrous grain harvest of 2010 motivated Russia in August of that year to impose a complete ban on all grain exports, which remained in effect until the end of June 2011. The ban required Russian grain traders to abrogate their existing supply contracts with foreign buyers. The policy response, combined with variable weather, hurt the region's reliability as a grain supplier to the world market. In addition to reducing exports, the KRU grain export controls decreased the countries' production, mainly by depressing domestic prices. If the past is any guide, such restrictions likely will continue as a KRU policy option over the post-2010 decade.

In the 2000s, all three KRU countries established some sort of State or parastatal grain company. In Russia, Ukraine, and Kazakhstan, the companies are called the United Grain Company, Agrarian Fund, and State Food Contract

Corporation, respectively. The officially identified functions of these companies are to increase the State's involvement in the domestic grain market, increase grain exports, and improve the physical infrastructure for the grain sector (Interfax). However, the nature and full objectives of the companies are not yet clear.

Improving infrastructure is also necessary for increasing exports from existing grain-producing regions. Given that the former USSR was a net grain importer, infrastructure was developed to handle imports rather than exports (FAO, 2009). A particular problem is that grain storage was built up near large consuming centers, whereas export-oriented storage requires large capacities at export sites (mainly ports). KRU Governments have made improving infrastructure for their grain economies a priority.

WTO Accession

A development that could affect future Russian agricultural policy is its accession to the WTO. Russia, Ukraine, and Kazakhstan all officially began their WTO membership bids in the mid-1990s. Ukraine joined in 2008, while Russia did not join until August 2012. Kazakhstan is proceeding with its accession negotiations.

Two key pillars of the Agreement on Agriculture of the Uruguay Round are market access and domestic support. Ukraine's terms of accession in 2008 set an average import tariff ceiling (the bound rate) for agricultural products of 10.66 percent, which required a drop in average import tariff rates of about one-fourth (WTO, 2008). The WTO accession also fixed Ukraine's bound (maximum allowable) *trade-distorting* domestic support at $613 million a year.

In its accession terms, Russia has agreed to bind its average import tariffs for agricultural goods at 10.8 percent, a drop from its existing average tariff of 13.2 percent (WTO, 2011). Regarding domestic support, Russia agreed to a bound annual level of trade-distorting subsidies of $9 billion in 2012, to fall 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 Federal Service of State Statistics). However, the measure for agricultural support used by the WTO, called the Aggregate Measure of Support (AMS), does not include all the budget subsidies that Russia provides to agriculture (or that many WTO members also provide). Russia's pre-accession AMS-category support therefore is 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 reduce its AMS to $4.4 billion by 2018 will entail either a drop in trade-distorting support or limited potential to increase it.

Although the Russian agricultural establishment lobbies heavily for continued strong support to the livestock sector, WTO accession should constrain the country's ability to provide the sector with budget subsidies and trade protection. The isolated effect could be to free-up more grain output for export.

KRU Grain Production and Exports Projected To Rise Considerably

USDA projects that grain production and exports for Russia and Ukraine will grow steadily through 2021 (USDA, 2012).[4] We argued earlier that for KRU grain area to increase substantially over the next decade, world grain prices would have to rise and remain above their current high level. USDA projects that over the coming decade, world grain prices will remain fairly steady in real (inflation-adjusted) terms. Other impediments to KRU area expansion include the need to clear new land for production and develop the infrastructure (physical and commercial) for storing and transporting the grain, especially if production expands into remote regions.

USDA projects that Russian grain area will grow from 2006-10 to 2021 by a modest 5 percent, though Ukrainian grain area will increase by a higher 20 percent (tables 6 and 7). One reason Russian and Ukrainian grain area is projected to rise is that some lagged response exists between the recent grain price growth and area expansion. Another reason is that both countries, and especially Ukraine, are increasing area for corn, a crop that can be grown profitably in certain parts of the KRU region. Compared with 2006-10, corn area in Russia and Ukraine is projected to rise by 2021 by 46 and 91 percent.

KRU grain yields are projected to increase to a greater degree than grain area. Relative to 2006-10, Russian and Ukrainian grain yields are projected to rise to 2021 by 17 and 26 percent, respectively. The expected higher yields are consistent with our previous analysis that farm-level improvements in KRU agriculture, apparently led by the new agroholdings, will continue to raise input productivity and yields for at least the next decade.

The rise in both area and yields results in substantial projected growth in KRU grain production of 22 percent in Russia and 50 percent in Ukraine. For both countries, area, yield, and production for corn all increase to a greater degree than for wheat and barley, though in Russia corn output grows from a relatively small base.

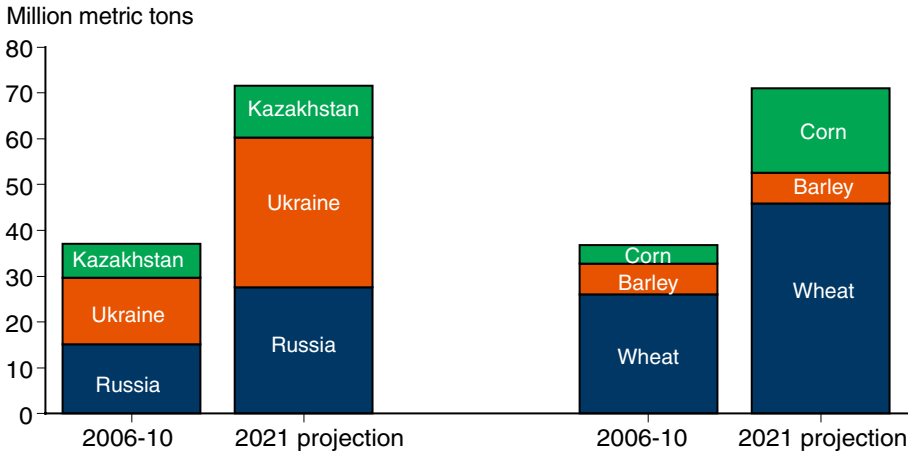
The growth in KRU grain production increases surplus output available for export. USDA projects that Russian and Ukrainian grain exports will rise considerably, by 82 and 129 percent, respectively. By 2021, KRU grain exports are projected at 71 mmt (fig. 5). Wheat will continue as the dominant grain export, though corn's share in KRU grain exports will rise to about a quarter. By 2021, the KRU region's share in total world grain and wheat exports will be 22 and 29 percent. KRU wheat exports are projected to exceed those of the United States by 87 percent, with Russia's exports of wheat alone almost surpassing the U.S. volume.

As previously discussed, growth in the KRU livestock sectors will have the isolated effect of reducing the size of exportable surpluses of grain by increasing KRU demand for animal feed. USDA projects that relative to 2006-10, Russian meat production will rise to 2021 by a substantial 48 percent and Ukrainian meat output by 28 percent. Russian poultry output is projected to almost double over this period. USDA projects that the livestock sector growth will increase both Russian and Ukrainian grain used as animal

[4]We do not provide detailed projections for Kazakhstan. The USDA models that generate the projections do not break Kazakhstan out as an individual country; rather, Kazakhstan is grouped with nine other FSU countries (Armenia, Azerbaijan, Belarus, Georgia, Kirghizstan, Moldova, Tajikistan, Turkmenistan, and Uzbekistan).

Figure 5

KRU grain exports projected to rise substantially



Note: KRU region comprises Kazakhstan, Russia, and Ukraine. The bars for 2006-10 give average annual gross exports during the period.

Source: U.S. Department of Agriculture, 2012.

feed over this period by about a quarter, adding 9 mmt to grain-feeding in Russia and 3 mmt in Ukraine. Without this countervailing development in the livestock sector, KRU grain exports over the next decade would rise by an even greater magnitude.

Note that USDA projects that Ukraine's grain exports will grow over the 2006-2021 period by a greater absolute volume than Russia's (18.5 versus 12.4 mmt). However, if the projected growth of grain used as animal feed (again in absolute volume) were the same for the two countries, the projected increase in grain exports by the countries would also be about the same. Ukraine's livestock sector is smaller than Russia's not only in absolute terms but also as a share of total agricultural output. In 2021, Ukraine is projected to use 27 percent of its grain production as domestic animal feed versus 42 percent for Russia.

Table 6

USDA projections for Russian grain economy

	2006-10	2021 projection	Growth rate (%)
Area (million hectares)			
Total grain	42.7	44.9	0.4
Wheat	26.0	28.1	0.6
Barley	9.2	9.0	-0.2
Corn	1.4	2.1	3.2
Yield (tons/hectare)			
Total grain	1.92	2.24	1.2
Wheat	2.01	2.32	1.1
Barley	1.78	1.99	0.9
Corn	2.94	3.87	2.1
Production			
Total grain	82.5	100.3	1.5
Wheat	52.3	65.0	1.7
Barley	16.6	17.9	0.6
Corn	4.2	8.1	5.2
Exports			
Total grain	15.1	27.5	4.7
Wheat	12.8	24.6	5.2
Barley	1.8	0.2	-15.6
Corn	0.4	2.4	15.1
Meat production	4.94	7.32	3.1
Beef	1.45	1.48	0.2
Pork	1.72	2.54	3.0
Poultry	1.77	3.30	4.9
Grain used as feed			
Total grain	33.6	42.6	1.8
Wheat	15.6	19.2	1.6
Barley	10.4	13.9	2.3
Corn	3.4	5.2	3.3

Note: The figures for column *2006-10* give average annual values during the period. The figures for column *Growth rate (%)* give the projected average annual growth rate from the 2006-10 average value to the value for 2021, with the growth rate beginning in 2008 (the mid-year of 2006-10). Total meat production covers beef, pork, and poultry. Grain production, exports, and use as animal feed and meat production are in millions of tons.

Source: FAS Production, Supply and Distribution Online (USDA PS&D), http://www.fas.usda.gov/psdonline/; U.S. Dept. of Agriculture 2012.

Table 7

USDA projections for Ukrainian grain economy

	2006-10	2021 projection	Growth rate (%)
Area (million hectares)			
Total grain	13.9	16.7	1.4
Wheat	6.3	7.3	1.1
Barley	4.6	4.4	-0.3
Corn	2.2	4.1	5.1
Yield (tons/hectare)			
Total grain	2.81	3.55	1.8
Wheat	2.86	3.13	0.7
Barley	2.20	2.50	1.0
Corn	4.37	5.75	2.1
Production			
Total grain	39.5	59.3	3.2
Wheat	18.3	22.9	1.7
Barley	10.1	11.0	0.7
Corn	9.5	23.8	7.3
Exports			
Total grain	14.3	32.8	6.6
Wheat	6.3	11.6	4.9
Barley	4.3	5.2	1.5
Corn	3.7	15.9	11.8
Meat production	1.63	2.09	1.9
Beef	0.49	0.38	-1.9
Pork	0.58	0.68	1.2
Poultry	0.56	1.03	4.8
Grain used as feed			
Total grain	12.6	15.9	1.8
Wheat	2.8	3.8	2.4
Barley	4.1	4.3	0.4
Corn	5.1	7.2	2.7

Note: The figures for column *2006-10* give average annual values during the period. The figures for column *Growth rate (%)* give the projected average annual growth rate from the 2006-10 average value to the value for 2021, with the growth rate beginning in 2008 (the mid-year of 2006-10). Total meat production covers beef, pork, and poultry. Grain production, exports, and use as animal feed and meat production are in millions of tons.

Source: FAS Production, Supply and Distribution Online (USDA PS&D), http://www.fas.usda.gov/psdonline/; U.S. Dept. of Agriculture 2012.

Conclusions

During the first decade of the 2000s, the KRU countries collectively became a large grain-exporting region, especially of wheat. Over 2006-11, the region provided 14 percent of total world grain exports (including rice) and 21 percent of wheat exports. The two main reasons for the region's grain export growth were restructuring of the countries' agricultural production and trade during the transition decade of the 1990s, in particular the downsizing of the livestock sector that reduced domestic demand for feed grain, and growth in grain production during the 2000s. Grain output rose because of apparent improvement in farm-level management and technology that increased productivity and yields, though favorable weather during most of the decade also was a contributing factor.

KRU wheat and overall grain exports should continue to grow during the coming decade. USDA projects that by 2021, the region's total grain and wheat exports will rise by 93 and 76 percent, respectively, relative to average annual volumes during 2006-10, boosting exports to 71.5 and 46 mmt. By 2021, the region is projected to supply 22 percent of the world's total grain exports and 29 percent of wheat exports. Russia's wheat exports alone are projected to almost equal those of the United States, and total KRU wheat exports will be 87 percent larger than those of the United States.

The main reason for the projected growth in KRU grain production and exports is expected further farm-level improvements that increase input productivity and yields. The improvements appear to be led by large new operators that have upgraded KRU agricultural technology and management. The new operators can be viewed as a response to the many problems and deficiencies within KRU agriculture, especially those involving high transaction costs. KRU Governments in particular must improve the physical, commercial, and institutional infrastructure for the grain economy, especially if production is to expand into more remote regions.

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Appendix: Assessing Productivity Growth in the Russian Grain Economy Using Output Market Analysis

Figure A can be used to analyze the effect of changes in the key market variables on Russian grain production during 2001-05 (relative to 1996-2000). For simplicity, we assume that grain is one generic product. D is the domestic demand curve for Russian grain, while S^1 is the initial domestic supply curve. During 1996-2000, Russia was a net grain importer of 3 million metric tons a year (on average). The market analysis begins with the assumption that P^2 is the world price for grain. This price sets the Russian domestic price, so that Q^3 and Q^4 are the quantities of grain domestically supplied and demanded and Q^3Q^4 the quantity of grain imported.

Our focus is on the supply curve. From a firm's profit function, we can derive its supply or output function, which is q = f (P, W), where q is output, P the output price, and W a vector of input prices (see Varian, 1978, chapter 1). Government subsidies can change the real "price" that producers receive for their output or pay for their inputs, and thereby also impact production. The three key price-related variables that affect grain supply, therefore, are the grain output price, input prices, and any possible subsidies to grain producers.

Table 4 (p. 9) shows that in 2001-05, the Russian grain output price fell by 5 percent relative to 1996-2000. In figure A, this drops the price from P^2 to P^1, with the isolated effect that production falls from Q^3 to Q^2.[1] Table 4 also shows that in 2001-05, Russian agricultural input prices rose in the aggregate by 13 percent. In the figure, higher input prices shift the supply curve from S^1 to S^2, so that output falls further to Q^1 (higher input prices reduce input demand and use, which in turn lowers output).

However, table 4 also shows that the price of fertilizer decreased by 6 percent.[2,3] This price drop helped motivate an increase in fertilizer use (per hectare of grain area) of over 40 percent, which had the isolated effect of shifting the supply curve for grain right rather than left, thereby increasing production. Yet, as mentioned earlier, during the 2000s, fertilizer's share in the total value of Russian grain production was only about 5 percent. Input prices for Russian grain production in the aggregate thus appear to have increased during 2001-05, with the total effect being a decline in production (leftward shift in the grain supply curve).

Table 4 shows that in 2001-05, Russian Government subsidies for all agriculture fell in real terms by 26 percent (compared with 1996-2000). For any producers receiving subsidies, this also shifted the supply curve left and reduced output. The effect on grain producers was probably not large, given that the bulk of subsidies went to the livestock sector. However, for grain producers did benefit from subsidies on the interest paid for loans and for fertilizer use.

A conclusion from this market analysis is that during 2001-05 (compared with 1996-2000), the key price-related variables that affect gain production—the grain output price, input prices, and subsidies—all moved in directions that decreased rather than increased output. The magnitude of change in these

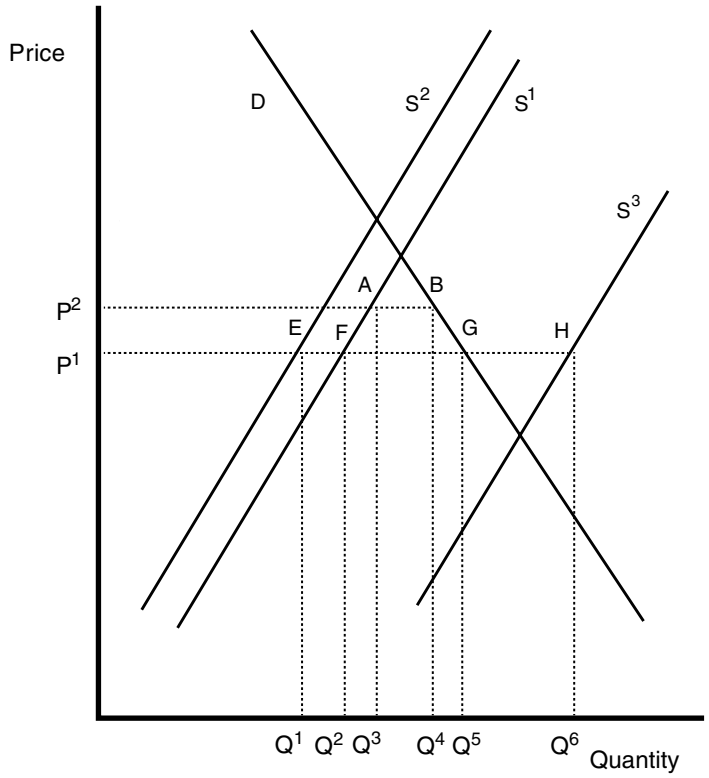
[1]The changes in output price and quantity and shifts in the supply curve shown in figure A do not necessarily reflect the actual magnitudes that occurred. Rather, the priority in drawing the figure was conceptual and visual clarity.

[2]One might wonder why fertilizer prices declined during 2001-05, given that in 2002 world energy prices began to rise and fertilizer prices are strongly affected by those for energy. The reason once again is that table 4 gives the change in variables in 2001-05 compared with 1996-2000. World energy prices were very high in 1996-97 and then dropped through 2001, before starting to rise again in 2002. High energy prices in 1996-97 thereby result in average annual fertilizer prices during 1996-2000 being higher than average annual fertilizer prices during 2001-05, despite the rise in world energy prices beginning in 2002.

[3]Russian fertilizer use fell heavily during the 1990s (table 3) because domestic fertilizer prices rose substantially, and fertilizer producers exported the bulk of their output (around 80 percent). To counter the difficulties faced by farms in obtaining fertilizer, Russian regional governments during 2001-05 often pressured fertilizer producers to increase deliveries to farms, and at reduced prices (Liefert et al., 2003). Without such government help, fertilizer use by grain producers during this time would not have increased as much, and prices might have risen rather than fallen.

Figure A

Changes in the market for Russian grain from 1996-2000 to 2001-05



variables indicates that the total negative output effect probably was not large, but what is most important is that the effect was not positive. This means that all the increase in output had to come from input productivity growth (resulting from either technological change/farm-level improvements or favorable weather). In figure A, these two effects combined are represented by a rightward shift in the supply curve from S^2 to S^3. The shift increases output from Q^1 to Q^6, and in 2001-05 it was large enough to move Russia from a net import to a net export position in grain (Q^5Q^6).

Table 4 shows that in 2001-05, Russian grain output rose by 21 percent over the output of 1996-2000. In figure A, this increase equals $(Q^6 - Q^3) / Q^3$. Consequently, our results indicate that during the period we analyzed, farm-level improvements that increased input productivity, combined with favorable weather, raised Russian grain production by a minimum of 21 percent.