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Changing Crop Area in the Former Soviet Union Region

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Abstract

Total planted area in the major agricultural countries of the former Soviet Union—Kazakhstan, Russia, and Ukraine—as well as area for grain within that total, fell during the transition decade of the 1990s, and substantially so in the first two countries. Although total planted area and area for grain have rebounded somewhat in Ukraine and Kazakhstan, they are currently far below the levels of the late Soviet period in Russia and Kazakhstan. However, since 2000, area for oilseeds (tallied separately from grain throughout this report) has risen in all three countries, while corn area has increased substantially in Ukraine and modestly in Russia. These developments reflect the severe contraction of these countries' livestock sectors during the 1990s and the government-supported revival that began around 2000. Because most of Russia's abandoned grain area was in regions with high production costs, it is unlikely to be returned to production. Grain area in Russia and Ukraine is likely to grow 5-10 percent over the next decade, while oilseed area in both countries should expand by much more.

Keywords: Former Soviet Union, FSU, Russia, Ukraine, Kazakhstan, KRU, grain exports, wheat, corn, grain planted area, oilseeds

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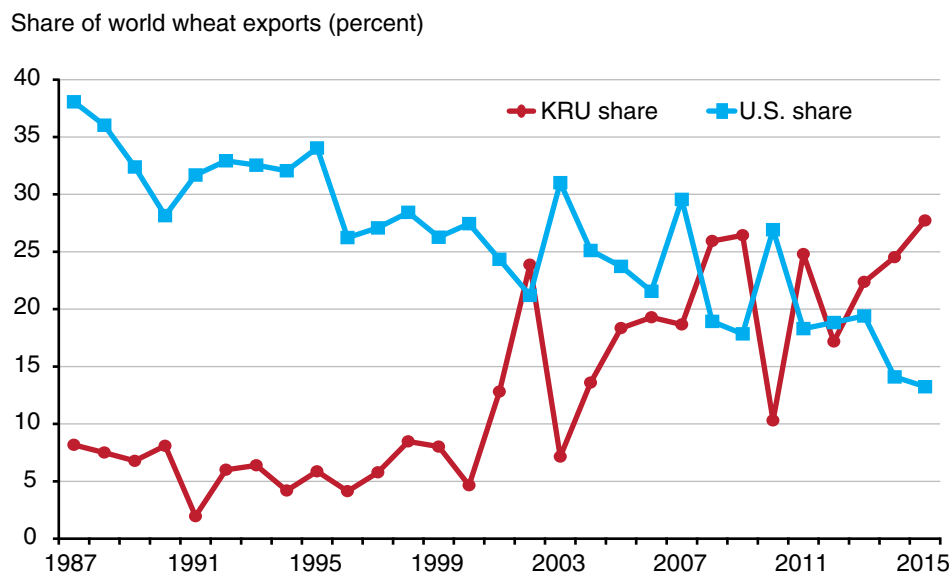
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Introduction

Since 2000, the major agricultural countries of the former Soviet Union—Kazakhstan, Russia, and Ukraine (the KRU)—have become a large grain-exporting region. During 2011-15, KRU annual exports of grain averaged 65 million metric tons (mmt), 21 percent of total world exports.¹ Within grain, during 2011-15, KRU annual wheat exports averaged 37 mmt (23 percent of world exports) and annual corn exports, 20 mmt (17 percent of world exports) (figs. 1 and 2).

KRU grain exports have risen mainly because a steady increase in production created surpluses for export (fig. 3). Given that crop output equals yield times area, yield and area are the two determinants of output. From the end of the Soviet period in 1987-91 to 1996-2000, average annual grain yield in the KRU region fell by 10 percent, but then grew by 58 percent by 2011-15 (fig. 4). Liefert et al. (2013) and Liefert and Liefert (2015 (c)) examine possible reasons KRU grain yields have increased substantially since 2000, including the increased productivity of input use in KRU agriculture (more output produced per unit of input). For example, Bokusheva et al. (2012) estimate that, from 2000 to 2008, overall productivity in Russian agriculture increased by about 25 percent, while Swinnen et al. (2012) estimate that, from 2000 to 2007, it rose by 54 percent.

Figure 1
KRU region has surpassed United States as wheat exporter



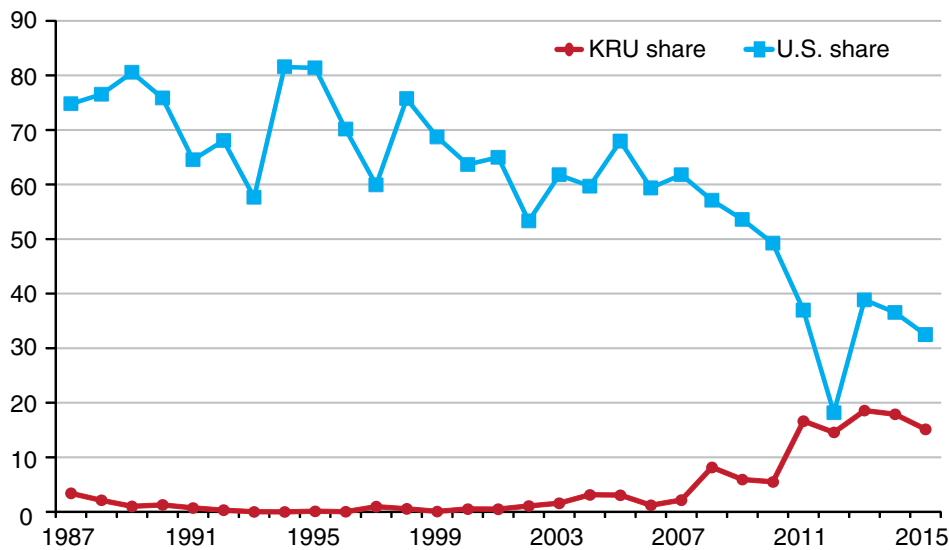
Note: Exports are gross. Years are grain-marketing years, each of which starts in July and ends in June of the following year. KRU = Kazakhstan, Russia, and Ukraine.
Source: USDA, Production, Supply and Distribution Online.

¹ This report gives data for KRU grain exports and area, both planted and harvested. The sources for planted grain area are the Kazakh, Russian, and Ukrainian state statistical agencies, while the source for harvested area and exports is USDA PS&D. All sources include the following in grain: wheat, corn, barley, rye, oats, and millet. The KRU sources also include buckwheat, pulses, and rice (though KRU planted area for rice is miniscule, and KRU rice exports nil). On the other hand, USDA PS&D includes sorghum, mixed grains, and milled rice.

Figure 2

KRU region's share in world corn exports has risen since 2000, as the U.S. share falls

Share of world corn exports (percent)



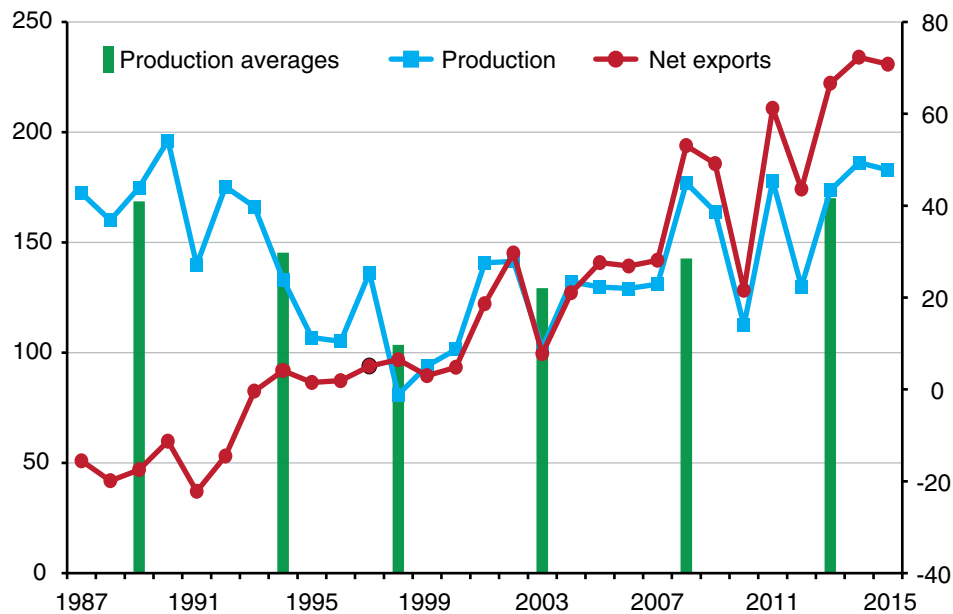
Note: Exports are gross. Years are grain marketing years, each of which starts in July and ends in June of the following year. KRU = Kazakhstan, Russia, and Ukraine.
Source: USDA, Production, Supply and Distribution Online.

Figure 3

KRU grain production and and exports have been rising in tandem

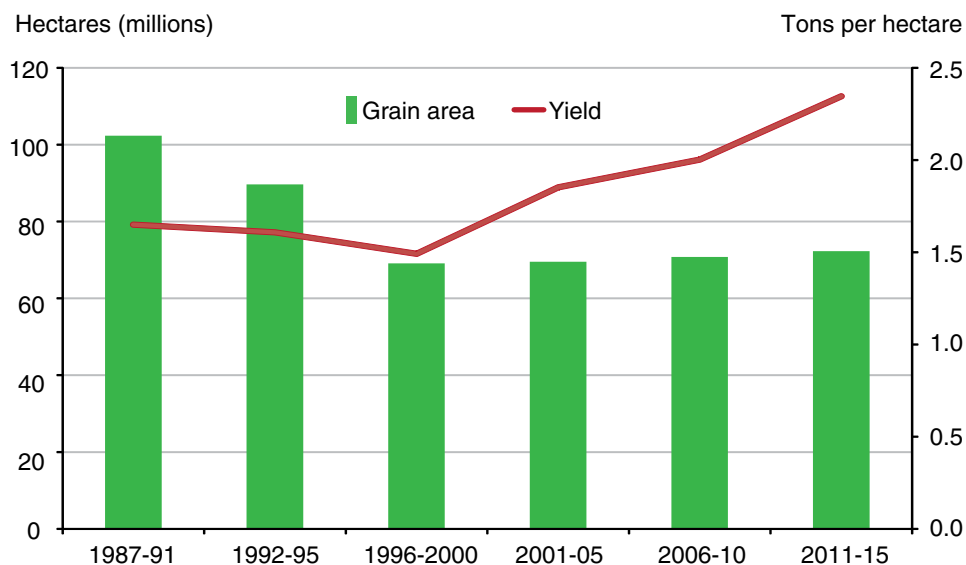
Production (million tons)

Net exports (million tons)



Note: The bars give average annual grain production over the periods 1987-1991, 1992-95, 1996-2000, 2001-05, 2006-10, and 2011-15. Negative net grain exports are net imports.
Source: State Statistics of Kazakhstan, Russia, and Ukraine (KRU); USDA, Production, Supply and Distribution Online.

Figure 4
KRU grain yields have risen since 2000



Note: Area is harvested not planted. The bars give average annual values over the periods identified. Annual yield is calculated as total Kazakhstan, Russia, and Ukraine (KRU) grain output divided by total KRU area.

Source: USDA, Production, Supply and Distribution Online.

On the other hand, KRU grain area fell substantially during the 1990s, by 32 percent from 1987-91 to 1996-2000, and then rose by a modest 5 percent by 2011-15. KRU planted area for all crops followed the pattern for grain area, as it dropped by 33 percent from 1987-91 to 2001-05 (using average annual values), and then expanded by a slight 2 percent by 2011-15. Current total planted area in Russia and Kazakhstan and grain area within that total are far below levels of the late Soviet period, while in Ukraine, total planted area is below the late Soviet levels but grain area is slightly above.

Could the KRU region increase grain output and exports further by returning to cultivation the land lost to grain production since the Soviet period? Such a development would be important for U.S. and world agricultural trade. By increasing world supplies, additional nontrivial growth in KRU grain production and exports would put downward pressure on the prices received by U.S. and other grain exporters. Because of the high growth in KRU wheat exports, the region has already surpassed the United States as a wheat exporter, and KRU corn exports (mainly by Ukraine) rose from a very small volume in 2000 to about half the U.S. level in 2011-15 (see figs. 1 and 2). Ukraine has become the world's third largest corn exporter, after the United States and Brazil.

The KRU region successfully competes with the United States in grain exports to specific foreign markets, especially in Africa, the Middle East, and Asia. Ukraine has been expanding exports to China (corn and barley), Thailand, Korea, the Philippines, and Indonesia. Russia has expanded exports to Bangladesh and Nigeria (wheat). China and Nigeria in particular are important U.S. markets. Egypt—a major foreign market for U.S. grain for much of the post-WW II period—is currently the world's biggest wheat importer as well as a large corn importer. However, sizeable Russian and Ukrainian grain exports to Egypt (mainly of low quality milling wheat and corn)

have contributed to a sharp decline in U.S. grain exports to the country. From 2000-04 to 2011-15, average annual Russian/Ukrainian wheat exports to Egypt rose from 0.9 million metric tons (mmt) to 6.8 mmt, while U.S. wheat exports to the country fell from 2.8 mmt to 0.7 mmt. Also over these two time periods, average annual U.S. corn exports to Egypt dropped from 3.7 mmt to 1.1 mmt, while Ukrainian corn exports to the country increased from almost nil to 2.7 mmt (USDA PS&D and World Trade Atlas).²

Further growth in KRU grain exports might also be important for world food security. The surge in world agricultural and food prices in 2007-08 and again in 2011-12 raised concerns about the ability to feed an expanding population. Although world prices (such as for grain) have dropped substantially since 2012, agricultural specialists still have concerns about whether agricultural production will be able to meet growing world demand. Writing in *Science*, Godfray et al. (2010) state that the Earth's population is projected to rise to about 9 billion by 2050 (from almost 7 billion in 2010), which could require an increase in food output of 70-100 percent. The value of food consumption should rise by a greater proportion than population because growing world affluence increases demand for high-value products, such as livestock goods and processed foods, especially in emerging markets such as China and India, which have high consumer income growth. Given the heavy feed requirements for livestock production, the long-term upward pressure on prices for grain and other crops could hurt the world's poorest consumers.

Many observers see the KRU—and especially Russia, the region's biggest grain producer—as having great potential (and perhaps more than any other region) to strengthen world food security by expanding grain production and exports. For example, a 2008 report by the European Bank for Reconstruction and Development (EBRD) and Food and Agriculture Organization (FAO) argues that the KRU region has strong potential to expand grain output by increasing not only yields but also area.

This report examines why KRU grain and overall crop area fell during the 1990s, as well as the potential to return the lost grain area to production. Using regional grain production costs for Russia, the report finds that the abandoned grain area was in regions with high production costs. Returning most of this idled land to cultivation therefore appears economically unfeasible, a judgment that probably also holds for Kazakhstan. The report also examines the changing composition of KRU crop area and discusses why area for certain crops, in particular oilseeds and corn, has increased rather than decreased. Lastly, the report presents USDA projections to 2025 for area and production for Russian and Ukrainian grain and oilseeds. Grain area for both Russia and Ukraine is projected to grow by 7-8 percent, and grain output in the two countries by 14 percent and 19 percent, respectively. Oilseed area and production for the two countries are projected to increase by even higher percentages.

Although the report's figures cover all three KRU countries (except for figs. 12 and 13), the report prioritizes its focus, in terms of information and analysis, on Russia, Ukraine, and Kazakhstan—in that order. This ordering reflects both the availability of information concerning these countries and their relative importance for U.S. and world agricultural trade. Another reason Russia receives the most attention is that, among the three KRU countries, it is generally viewed as having the most potential to increase crop (especially grain) area, production, and exports.

² One reason, though, why the United States is losing wheat market share to the KRU and other countries is because U.S. producers are shifting away from wheat to the more profitable crops of corn and soybeans (Liefert et al., 2010).

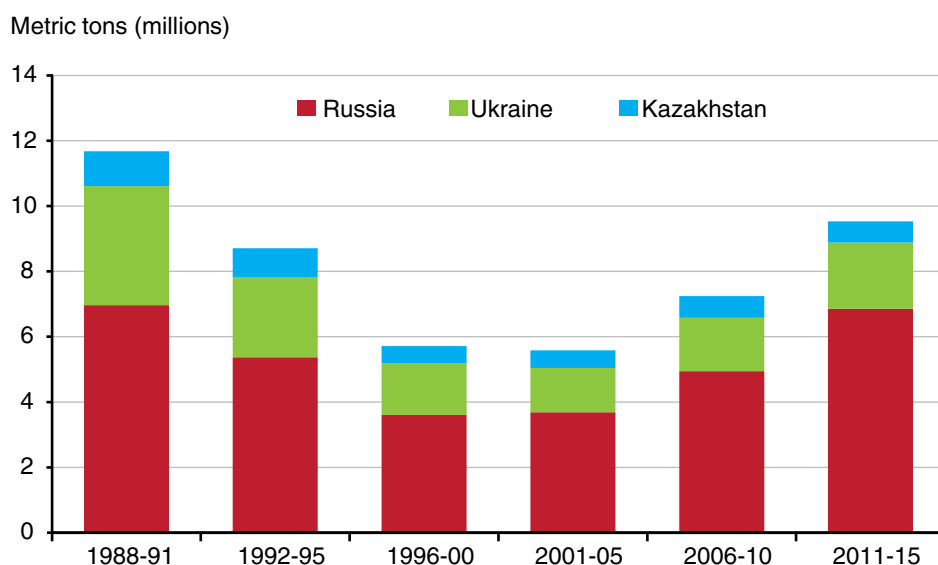
KRU Area Fell in 1990s Because Livestock Sector Contracted

The grain economies of the KRU countries have been closely linked to their livestock sectors. During the last decades of the Soviet Union, the main goal of state agricultural policy was to expand the production and consumption of meat and other animal products, in order to raise the country's standard of living. Between 1970 and 1990, a policy built on large subsidies to both producers and consumers succeeded in increasing Soviet meat production by more than 60 percent (Liefert and Swinnen, 2002).

The move from a planned to a market economy in the 1990s reversed the growth of the livestock sector. Because of severe financial constraints, the large budget subsidies to agriculture—and especially the previously favored livestock sector—were mostly terminated. Price reform also ended the indirect subsidies that agriculture had enjoyed during the Soviet period, whereby output prices were set high relative to input prices (Liefert and Swinnen, 2002). For example, from 1990 to 2000, the terms of trade for Russian agricultural producers (the ratio of output to input prices) fell by about 75 percent (calculated from Russian Federal Service of State Statistics), such that a set of agricultural goods sold in 2000 could buy, on average, only about a quarter of the inputs that it could purchase in 1990.

During the 1990s, livestock herds and product output fell in all three KRU countries by about 50 percent or more. From 1988-91 to 1996-2000, average annual meat output declined in Kazakhstan by 51 percent, in Russia by 48 percent, and in Ukraine by 57 percent (fig. 5). With such a major contraction, the demand for animal feed fell sharply. Given that the bulk of KRU planted area (grain, oilseeds, hay) produced feed and fodder for animals rather than food or technical crops (such as flax or cotton), KRU planted area also declined substantially. For a more detailed look at KRU agriculture, see box, "Agriculture in the KRU Region."

Figure 5
Decline in KRU meat production reversed after 2005



Note: The bars give average annual figures over the period. KRU = Kazakhstan, Russia, and Ukraine.
Source: USDA, Production, Supply and Distribution Online.

BOX: Agriculture in the KRU Region

All of the KRU countries (box fig.) have large areas well suited to agriculture. Virtually all of Ukraine is agriculturally rich, and the country possesses some of the best cropland in the world, the “black soil” (*chernozem*). Kazakhstan has two main agricultural regions (though not delineated on the map). One is the northeast that borders Russia (beginning at the Ural district and running east to the border with China), and the other is the southeast. The northeast is Kazakhstan’s grain producer, while the southeast specializes in fruit and vegetables.

Russia contains 70+ governmental units (mostly called *oblasts*, though in this report they are called “regions”). The map (box fig.) combines these regions into five districts, following the grouping scheme used by the Russian Federal Service of State Statistics (Rosstat) in its publications. However, we make one change to the Rosstat scheme. Where Rosstat shows three districts—Northwest, Central (smaller than the Central district in the map), and Volga, which covers the eastern part of the map’s Central and North districts—we regroup these into two districts, our new North and Central districts, with the dividing line roughly being the 56th parallel (on which Russia’s capital city of Moscow lies).

The northern part of Russia’s South district contains the country’s best crop land, as it is an extension of Ukraine’s quality land, while the southern part of the South (the northern Caucasus Mountain area) specializes in fruit and vegetables. Much of the Central district also has fairly good agricultural land, while the southern part of Siberia that appears in the map bordering Kazakhstan also has some reasonably good soil and weather conditions for grain production, similar to the grain-producing Kazakh acreage across the border discussed earlier. In 2011-14, 35 percent of Russia’s grain production was in the South district, and 41 percent in the Central. The limited agricultural activity of the North district focuses on livestock products.

Box figure
The KRU Region



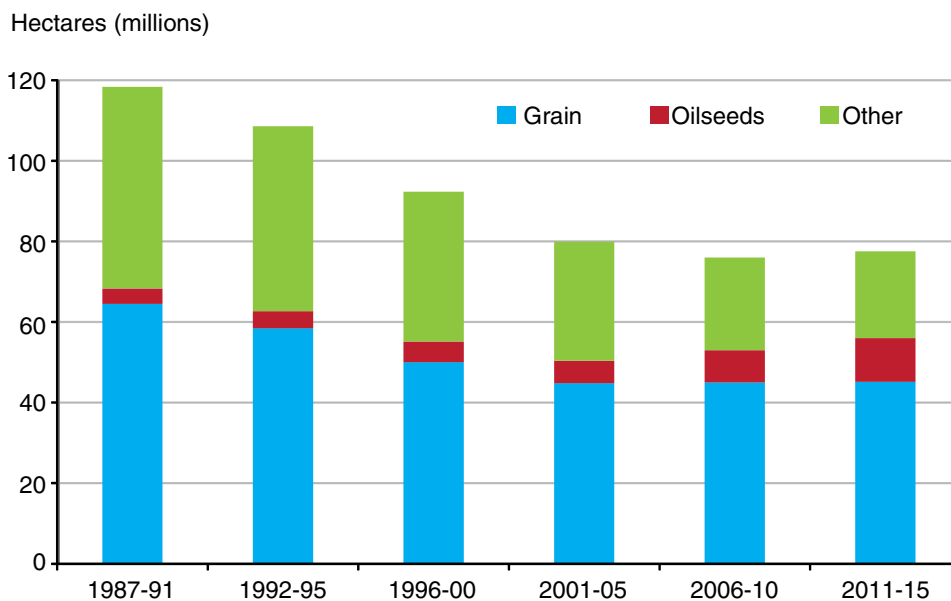
Source: USDA, Economic Research Service.

Changes in Structure of KRU Area

In each KRU country, planted area for crops other than grains and oilseeds has fallen dramatically since the Soviet period, with fodder crops (such as hay and corn for silage) and pasture grasses in particular taking a big hit (figs. 6-8). Oilseeds is the one major crop group whose area did not contract. Since 2000, oilseed area in all three KRU countries has grown substantially. From 1996-2000 to 2011-15, planted oilseed areas in Russia, Ukraine, and Kazakhstan approximately doubled, tripled, and quintupled, respectively (though in Kazakhstan from a very small base). In 2011-15, planted oilseed areas as shares of total planted area were as follows: Russia (14 percent), Ukraine (28 percent), and Kazakhstan (9 percent). Most of the oilseed area growth in absolute terms has come from sunflowerseed; however, the *growth rate* of soybean area has exceeded that of sunflowerseed. By 2011-15, soybean area equaled almost a quarter of sunflowerseed area in both Russia and Ukraine. Because of Kazakhstan's more arid climate, soybeans are not grown in that country.

In all three KRU countries, grain area has had generally the same trajectory as total planted area. During the 1990s, grain area in Russia and Kazakhstan declined substantially, while in Ukraine the drop was less severe. After bottoming out in 1996-2000, grain area in Ukraine and Kazakhstan rebounded somewhat, while in Russia it fell and then held steady in the 21st Century.³

Figure 6
Russian planted area fell and then leveled off

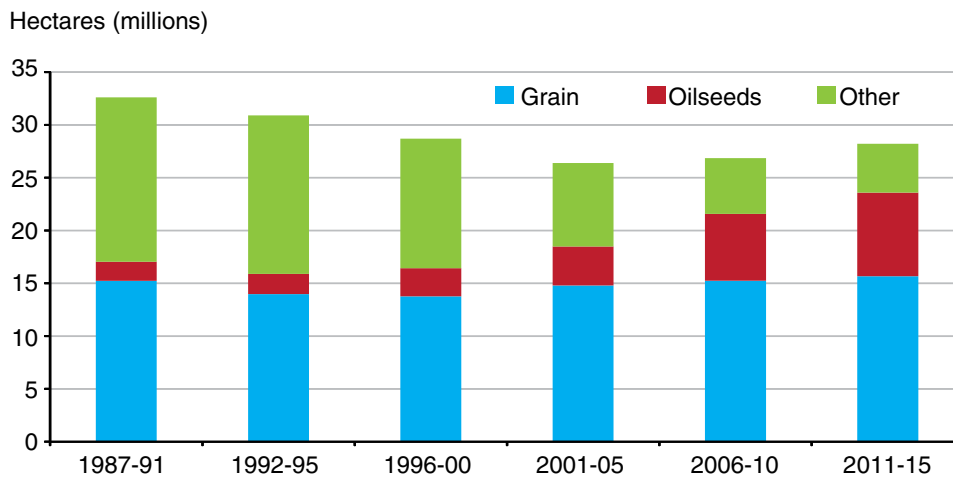


Note: The bars show the annual average area planted over the periods specified.
 Source: Russian Federal Service of State Statistics.

³ Figure 11 masks that since 2009 Kazakh wheat area has been declining. The figure shows that average annual Kazakh harvested wheat area during 2006-10 and 2011-15 was pretty similar at about 13 million hectares. However, after increasing from 2000 to 2009, Kazakh harvested wheat area fell from 13.0 million hectares during 2006-10 to 11.6 million hectares in 2015.

Figure 7

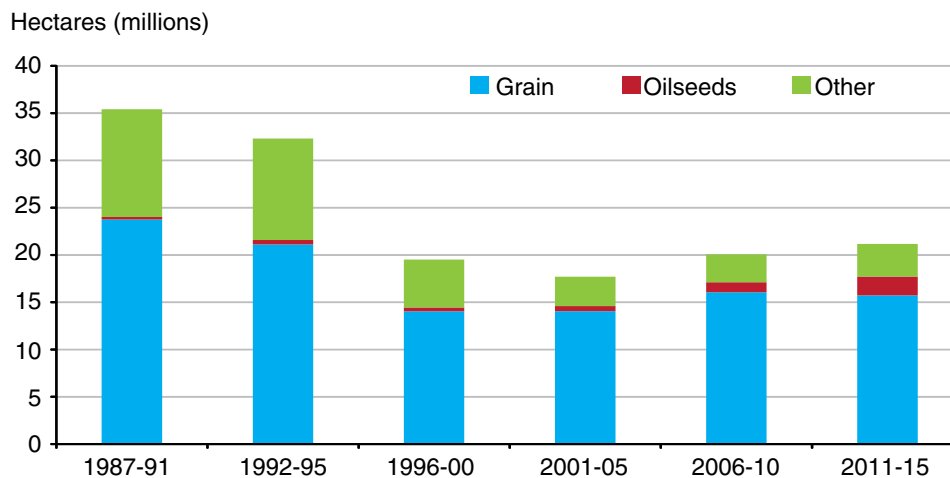
Ukrainian planted area fell, but then rose modestly



Note: The bars show the annual average area planted over the periods specified.
Source: Ukrainian State Statistics Service.

Figure 8

Kazakh planted area plunged, but then rebounded moderately

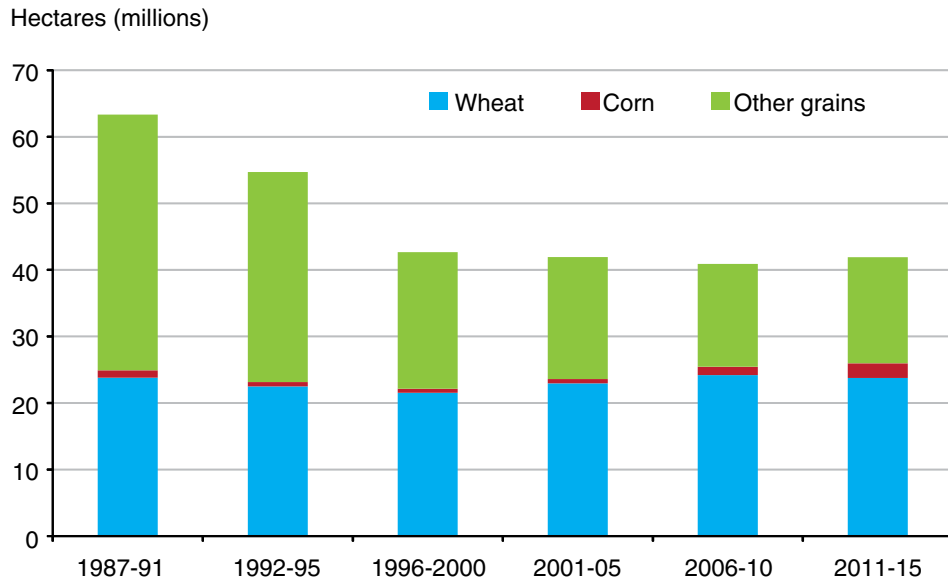


Note: The bars show the annual average area planted over the periods specified.
Source: Kazakhstan Republic Statistical Agency.

Area for grain crops other than wheat and corn has plunged for all three countries, though for Ukraine only recently (figs. 9-11).⁴ In Russia and Ukraine, wheat area has remained fairly steady since the Soviet period, while in Kazakhstan it fell during the 1990s, but has since made up more than half the loss since the late Soviet time. In Russia since 2000, a shift has occurred from spring wheat to winter wheat. The share of winter wheat in total wheat area rose from 38 percent during 2001-05 to 45 percent during 2011-15. Since 2000, corn area in Russia has risen modestly, while corn area in Ukraine has mushroomed, rising from 0.98 million hectares during 1996-2000 (average annual) to 4.4 million hectares in 2011-15. The main positive changes in KRU area

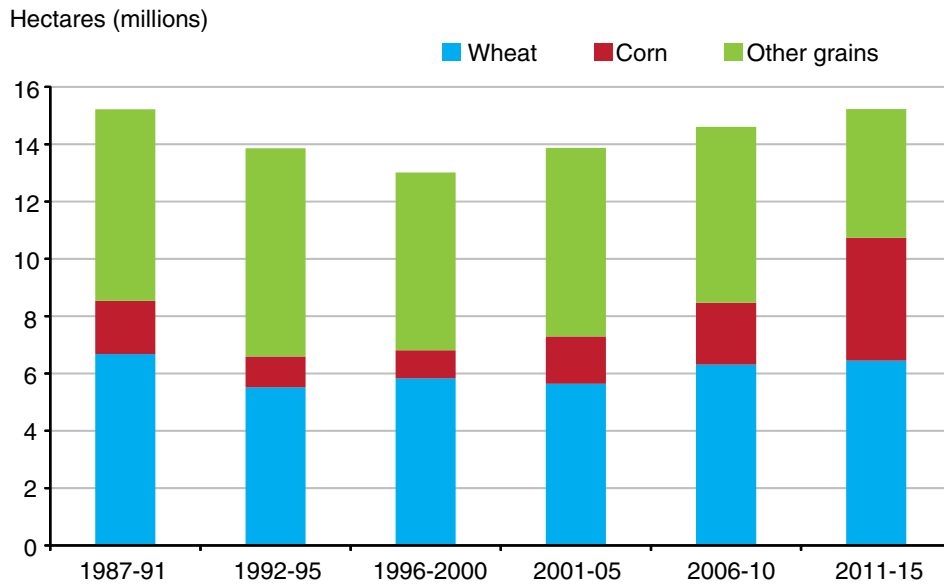
⁴ Although figures 6-8 present planted area (including for grain), figures 9-11 present *harvested area* for grain. The reason is that planted area for wheat and corn area for all three KRU countries is not available throughout the period 1987-2015. Figure 4 also gives harvested, rather than planted, area, in this case because the available yield data are for harvested area.

Figure 9
Russian wheat area since 2000 has remained fairly steady



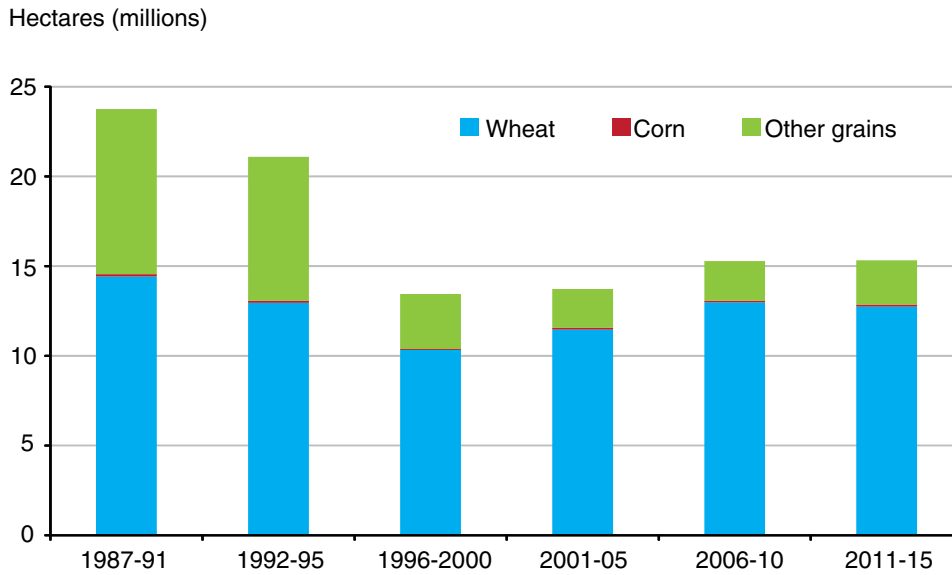
Note: The bars show the annual average harvested (not planted) area over the periods specified.
 Source: Russian Federal Service of State Statistics.

Figure 10
Ukrainian corn area has grown substantially



Note: The bars show the annual average harvested (not planted) area over the periods specified.
 Source: Ukrainian State Statistics Service.

Figure 11
Kazakh grain area still far below late Soviet level



Note: The bars show the annual average harvested (not planted) area over the periods specified.
 Source: Kazakhstan Republic Statistical Agency.

during the transition period, therefore, have been the substantial growth in oilseeds and corn area in Ukraine beginning around 2000, smaller though still significant growth of oilseeds in Russia, and in Russia, the swing from spring to winter wheat. Given that corn has high yields among the grains, and winter wheat yields are twice those of spring wheat, the area shifts to these higher yielding crops account for a nontrivial part of the increase in KRU grain yields since 2000 (as shown in fig. 4).

Economic Factors Driving Area Shifts Since 2000

Both demand- and supply-side developments have driven the expansion of Ukrainian and Russian area for oilseeds and corn. Although it might be argued that the severe contraction of the KRU livestock sector during the 1990s was a necessary though painful part of the restructuring of an overdeveloped and costly agricultural economy, the governments and agricultural establishments of these countries viewed the downsizing as a disaster that needed to be reversed when possible (Interfax). Aided by renewed subsidies in all three countries and strong trade-protectionist policies in Russia (see Liefert and Liefert, 2015 (b)), the livestock sector in the KRU countries has rebounded to a fair degree. From 2000 to 2015, average annual meat production rose in Kazakhstan (39 percent), Russia (116 percent), and Ukraine (50 percent) (see fig. 5). The growth of the livestock sector increased demand for quality feed like that from oilseeds and corn. Yet, this demand growth has been attenuated by improvements in KRU animal feed efficiency.

The rise in KRU demand for protein-rich animal feed since 2000 coincided with growing world demand for feed. Rising incomes in major emerging markets—and in particular China—increased consumer demand for livestock products, which in turn fueled demand for feed (Trostle and Seeley, 2013; Hansen and Gale, 2014). Consequently, much of the growth in Russian and Ukrainian grain output has been exported. For example, in 2011-14, Ukraine exported about two-thirds of its corn output (USDA PS&D).

On the supply side, agronomic, managerial, and commercial improvements in Ukrainian and Russian agriculture since around 2000 helped to drive the expansion of oilseed and corn area and production. Oilseeds, and in particular soybeans, require a mild climate and fairly highly skilled labor and handling, not only in production but also processing. Compared with other grains, corn is challenging to produce, as the crop is sensitive to soil and climate and requires soil-suitable fertilizer, quality hybrid seeds, and more agronomic skill and human capital.⁵

Around 2000, agriculture in Russia and Ukraine began progressing in technology and knowledge (including changing the composition of crop structure), which resulted in higher-yielding grains and growing oilseed production for both domestic animal feed and export. But why were these advances not made earlier, and what events finally triggered these improvements? (For discussion of the first question, see box, “Impediments to Expansion of Corn and Oilseeds Production During the Soviet Period.”)

Beginning around 2000, agricultural producers in Ukraine and Russia began to make the investment and changes involving seeds, fertilizer use, education, and skills necessary to expand oilseeds and corn area and output.⁶ The main institutional change that drove this positive agricultural development, as well as many others, was the emergence of new agricultural operators. Coming mainly from outside agriculture, the top administration of these new enterprises in all three KRU countries brought investment, superior technology, and better management practices into the entire agro-food system (Rylko et al., 2008). These new profit-oriented operators cut costs and waste and transformed their operations to be modern and more efficient. Moreover, the new operators had the motivation and mentality to make the improvements needed to expand cultiva-

⁵ Much of this agronomic information is from Acquah (2004).

⁶ Kazakhstan produces just a small amount of oilseeds, mainly because most of its agricultural regions lack the soil and climate suitable for that crop group.

Impediments to Expansion of Corn and Oilseeds Production During the Soviet Period

During the last decades of the Soviet Union, Russia and Ukraine (as well as the USSR in general) were fairly small producers of oilseeds and corn. In the Soviet planned economy, central planners largely decided what farms throughout the country would produce and what their allocated input mix would be. The planned economy lacked flexibility and initiative at the farm level. Possible improvements in technology and likely beneficial adjustments of output targets and input allocation for farms and enterprises were often not encouraged or pursued, because they would require reformulating the plans that determined the flow of inputs and outputs throughout the economy. Contributing to this inertia was that the Soviet agricultural research establishment was conservative and not a generator of innovation (Csaki, 1998).

Under Khrushchev in the late 1950s, there was an attempt to expand corn area throughout the country. From 1954 to 1962, Soviet corn area increased from 4 million hectares to 37 million hectares. However, the campaign was not a success, and much of the increase in corn area did not last. The hasty program neglected the importance for successful corn cultivation of quality seeds, soil conditions, fertilizer, and agronomic labor skills (Gregory and Stuart, 1987). The corn campaign's failure reinforced the conservatism of Soviet agricultural thought and planning.

Policy-driven expansion of the Soviet livestock sector during the last decades of the USSR substantially increased demand for animal feed, such that the country became a large importer of feed grain, soybeans, and soybean meal, to the benefit of U.S. farmers (Liefert and Swinnen, 2002). Although in its last years the Soviet Union produced about one-third of the world's sunflowerseed, the country could have produced even more oilseeds. It could be argued that the Soviet agricultural system neglected domestic production of that crop group, as well as of corn, as potential providers of high quality feed. For the reasons just discussed, the Soviet Union apparently was incapable of making the agronomic improvements needed to produce these crops effectively.

The move from the planned to a market economy that began in the early 1990s freed KRU agriculture from the constraints just examined and provided the opportunity and commercial market motivation for Ukraine and Russia to increase oilseeds and corn area and production. Yet, the 1990s were a decade of severe dislocation and retrenchment for these countries' agricultural sectors, such that little progressive development occurred in any aspect of their agricultural systems.

tion of oilseeds and corn. In particular, they pushed the large-scale importation of high-yielding hybrid corn seeds (though non-GMO). The new operators have likely been a major driving force behind the growth in KRU agricultural productivity since 2000.

An important subclass of the new operators are the large agroholdings, which are vertically integrated enterprises that can combine production, processing, distribution, and even retail sale (Gataulina et al., 2005; Serova, 2007). The agroholdings typically acquire existing large farms and improve them. The agroholdings' large size gives them advantages over smaller competitors in dealing with the market imperfections and other dysfunctionality in KRU agriculture. Davydova and Franks (2015) call these advantages "economies of scope."

The Potential To Increase Russian Grain Area

We showed earlier that since the Soviet period, area for crops other than grain and oilseeds has fallen substantially in all three KRU countries, while total grain area steeply declined in Russia and Kazakhstan. Given that much of the lost area for crops other than grain and oilseeds was probably of relatively low quality, the lost grain area was likely of higher quality. What is the potential for Russia and Kazakhstan to return most of their lost grain area to production?

In a 2012 speech at the Global Forum for Food and Agriculture in Berlin, the President of the European Bank for Reconstruction and Development stated that “vast areas of land (in Eurasia) can be returned to production at limited environmental costs,”⁷ a view supported by Rau (2012) specifically for Russia. At the Global Forum in Berlin in 2011, Russian agricultural specialists discussed the possibility that Russian grain area might move not just to the level of the late Soviet period, but to its historical peak during 1961-65 of 80 million hectares, 24 percent above the level of 1987-91 and 78 percent above that in 2011-15.⁸

How economically rational and therefore likely is a major expansion of Russia’s grain area? To address the question, we examine the structure of grain production cost within Russia by region, using data from the late Soviet period.⁹ The 1996 annual publication by the Russian Ministry of Agriculture and Food provides the *sebestoimost’* of producing a metric ton of grain in all 70+ of the country’s governmental regions (mostly called *oblasts*) in 1990. *Sebestoimost’* (translated as “production cost”) was the standard Soviet measure of the cost of producing goods and included the value of labor, material inputs such as fertilizer and fuel for agriculture, and capital depreciation. Although *sebestoimost’* excluded an interest charge on physical capital, it covered the bulk of costs that market-generated prices would encompass (Bornstein, 1987).¹⁰

The Soviet planning and pricing system generally assigned the same price to any specific material input allocated to state and collective farms throughout the country, with the addition of a transportation charge that varied by region. The average (*sebestoimost’*) cost of producing grain or any other commodity within a region was calculated as the average cost of production among all producers within the region. A commodity’s production cost within a region served as the basis for the good’s state-set price, with price generally equaling cost plus a profit markup (which could be interpreted as covering the interest charge on physical capital used in production). Liefert (1990) and Liefert (1991) are examples of published research that has used *sebestoimost’* to deter-

⁷ “The Food Crisis and the Role of Eastern Europe and Central Asia,” found at www.ebrd.com/pages/news/speeches/mirow.

⁸ Although Power-Points rather than papers were presented at this session (titled “Russia’s Role in World Food Supply”), the session titles and presenters can be found at <http://www.aht-group.com/indx.php?id=348>. Russian grain area reached a high level during the early 1960s under Khrushchev’s virgin lands program, during which grain production was expanded onto previously uncultivated marginal land in Russia and Kazakhstan. However, much of this new area was later abandoned (Gregory and Stuart, 1987).

⁹ The following discussion draws heavily from Liefert and Liefert (2015 (a)), which examines more deeply the analytical approach used.

¹⁰ The reason *sebestoimost’* excluded a capital charge is because it was based on the Marxian labor theory of value, which claimed that only labor can add value to goods. The value of material inputs and capital depreciation covered the past (or embodied) labor required to produce these goods. In the late 1980s, the share of labor in total value added in the Soviet economy was estimated at 50-55 percent (IMF et al., 1991). However, labor’s share was apparently higher in agriculture, with CIA (1990) calculating labor’s share at six times that of capital.

mine economically meaningful cost-generated values for Russian agricultural goods, and then employed these values in empirical economic analysis.

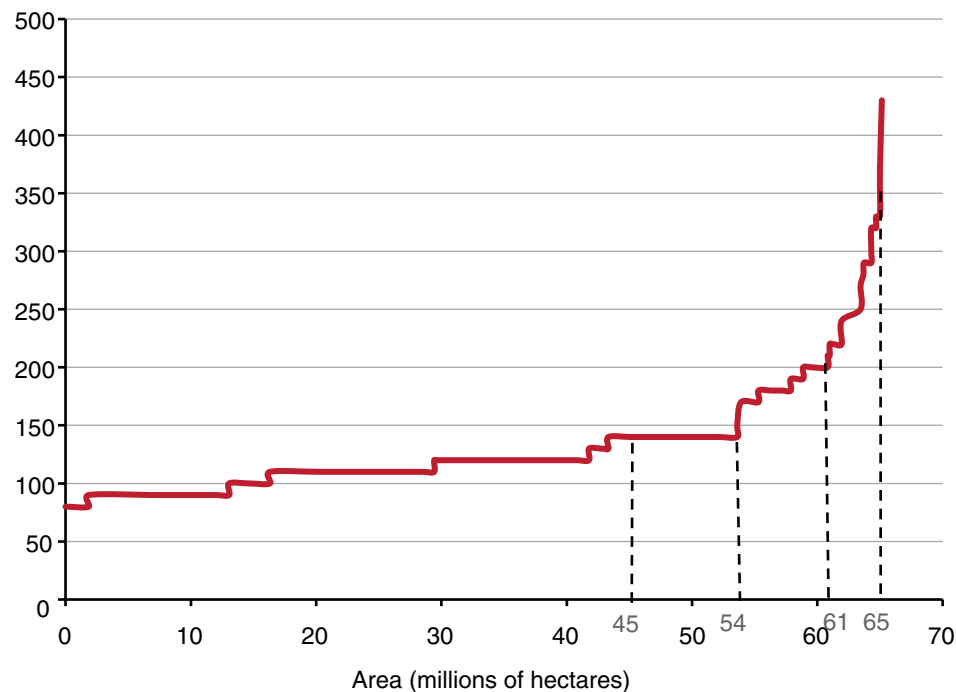
Our analysis requires not absolute grain production costs within regions, but rather relative costs between regions. The sebestoimost' values of Soviet grain production between regions can therefore serve as proxies for these relative productions costs for 2011-14.

We construct a curve that gives the relationship between (1) the sebestoimost' of producing grain in 1990 (henceforth abbreviated to *cost*) and (2) grain area (fig. 12). On the vertical axis, we put the cost of grain production by region. We order the regions from lowest cost to highest cost. The plot gives each region's area at its average cost. As a result, any point on the curve identifies the cumulative (sum of) area from all the regions that produced at an average cost less than or equal to the production cost associated with that point. For example, in the late Soviet period, 61 million hectares of area produced a ton of grain at an average cost less than or equal to 200 rubles (see fig. 12). The grain area numbers are average annual values over 1986-90 (Russian Ministry of Agriculture and Food, 1994), though the grain production costs in figure 12 are for 1990 alone,¹¹ the only year with grain production cost data available by region.

Figure 12

Russian grain production costs would rise sharply if all abandoned land returned to cultivation

Production cost (sebestoimost') in rubles per ton in 1990



Source: Russian Ministry of Agriculture and Food.

¹¹ In this analysis, we use 1986-90 as our base “late Soviet” period rather than 1987-91 as used in figures 6-11. This is because we could find data that give regional grain production only for the entire period of 1986-90 (that is, single average annual numbers for each region covering the entire period), not data that give production cost for each region for each year within the period.

In the late Soviet period, the bulk of Russian grain was grown in regions with fairly low cost (see fig. 12). Of the 65 million hectares of total grain area during 1986-90 (average annual), 54 million (83 percent) were located in regions with a per-ton average cost of 140 rubles or less. This low-cost area produced 89 percent of Russia's grain during that 5-year period. In regions with per-ton costs above 140 rubles (beyond the 54 million-hectare mark), producers had substantially higher output costs. This effect was especially pronounced in regions with per-ton costs of over 200 rubles (the 61 million hectare mark). The rise in grain area from 54 million to 65 million hectares increased the average production cost in the highest cost region from 140 rubles to over 400 rubles.

Although the absolute costs of grain production almost certainly changed from the late Soviet period to 2011-14, it is unlikely that *relative grain production costs* between regions have altered substantially. The main cause of the differences in regional production costs is disparities in soil quality and climatic conditions for production, such as temperature and precipitation, with most of the high-cost regions being in the northern and eastern (Siberia) parts of the country, and the low-cost regions in the south and west.¹² The study by Ioffe et al. (2012) of land abandonment in Kostroma and Samara oblasts demonstrates these points well.

The natural conditions affecting grain production across regions probably changed little between the beginning and end periods of our analysis. Although, as discussed earlier, progressive new operators may have increased farm productivity and reduced production costs (per unit of output) since 2000, such farm-level improvements probably have not substantially altered regions' and districts' relative advantages and disadvantages for grain production (what economists call *comparative advantage*). In fact, it could be argued that the unit-cost-reducing investments and improvements in grain production would be more likely to occur in those regions with the best natural conditions, such as the South and Central, than in the northern and eastern parts of the country. FAO (2009) supports this argument, as it praises the advances in the grain sector in the South since 2000.

During 2011-14, average annual Russian grain area was 45 million hectares.¹³ In the rest of the article, we define *low-cost regions* as those that had an average cost of production in 1990 of less than or equal to 140 rubles—which is associated with 43-54 million hectares of grain area during 1986-90 (average annual) (see fig. 12). We define *high-cost regions* as those that had an average cost of production in 1990 greater than 140 rubles. Grain area has so declined since the late Soviet period that all “current” (2011-14) area could fit within the country's low-cost regions.

However, the data show that grain production has not ceased entirely in the high-cost regions, nor has all the decrease in Russian grain area and production since the Soviet period occurred in just those high-cost regions. The high-cost (less productive) grain area during 1986-90 totaled 11.5 million hectares. Of this amount, 7.5 million hectares went out of grain production by 2011-14, while 4.0 million hectares (35 percent) remained in production. Of the 53.6 million hectares of

¹² Unlike for industry, Soviet agricultural planners followed a policy of regional self-sufficiency rather than specialization, whereby regions were mandated to produce a wide array of products that met the bulk of their consumption needs. Cost minimization and comparative advantage were not among the main drivers of regional agricultural production. The agricultural policy of regional self-sufficiency and non-specialization helps to explain why Russian grain production (and overall agricultural output) fell so heavily in the 1990's, once central planning could no longer dictate production in high cost regions (Gregory and Stuart, 1987).

¹³ In this analysis, we use 2011-14 as the most recent (“current”) period rather than 2011-15 as used in figure 6-11. This is because the Russian source on grain area and production by region provides numbers up to only 2014.

low-cost grain area during 1986-90, 39.1 million hectares remained in grain production by 2011-14, while 13.5 million (25 percent) went out of production (Russian Federal Service of State Statistics (a)). But why did as much as 4 million hectares of grain area continue in high-cost regions, while area in low-cost regions fell by as much as a quarter?

One likely reason is heterogeneity of the quality of land within regions. High-cost regions probably had some lower cost output, and low cost regions probably had some high cost output. More specifically, in regions with 1990 average cost (AC) greater than 140 rubles, some output had marginal cost (MC) less than 140 rubles, while in regions with AC less than 140 rubles, some output had MC greater than 140 rubles. Consequently, as total grain area fell prior to 2011-14, it would still have been economically rational for the low-cost area within the high-cost regions to remain in production, such that the high-cost regions continued to produce some grain. Likewise, it would have been rational for some high-cost output in the low-cost regions to be terminated (as the high-cost area went out of production).

Another likely explanation is that high-cost regions tended to be net grain importers and low-cost regions net exporters. Consequently, producers in high-cost regions were protected to some degree against competing imports (from lower cost regions) by the transport and transaction costs of importing from the low-cost regions. These costs would allow the importing regions to produce at higher cost than low-cost regions.

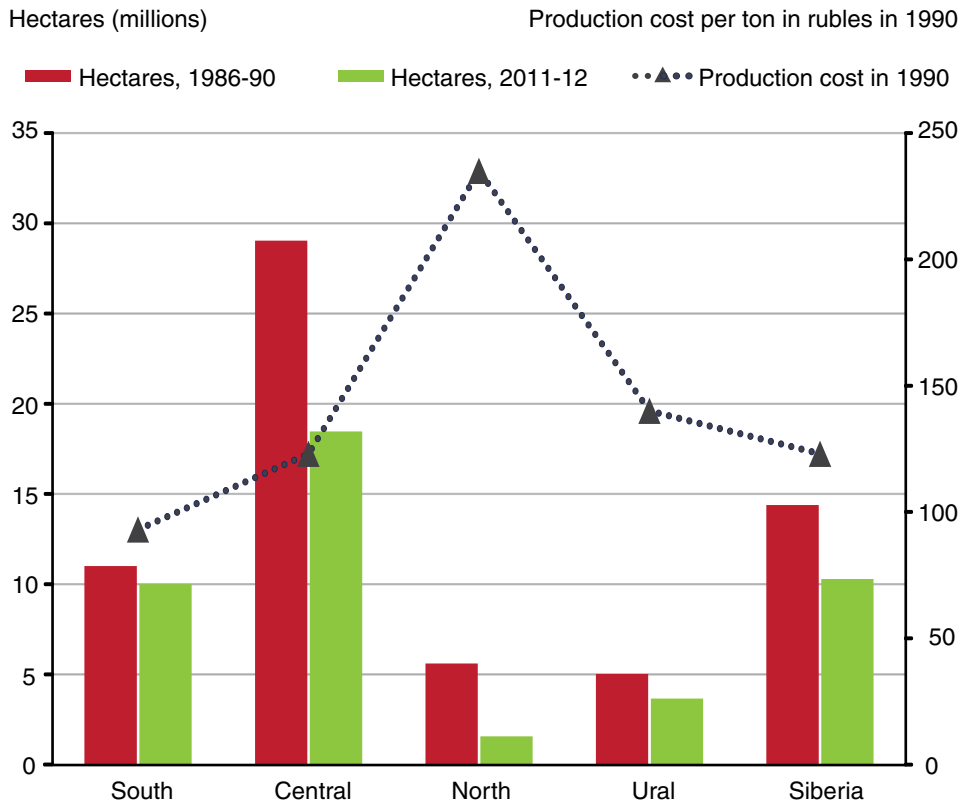
Another reason that low-cost regions lost grain area is that land was switched to other crops, specifically oilseeds (EBRD and FAO, 2008). Oilseeds are the only crop group for which Russian area has increased since the Soviet period. Average annual oilseeds area during 2011-14 was 10.7 million hectares, almost triple the 3.7 million during 1986-90 (Russian Federal Service of State Statistics (b)).

As discussed earlier, oilseed production requires fairly rich soil and favorable climatic conditions. This point is demonstrated by the fact that, in 2011-14, 96 percent of Russian sunflowerseed production occurred in the South and Central districts (see again fig. 6; calculated from the Russian Federal Service of State Statistics (a)), the two districts with the best natural conditions for oilseeds. (Sunflowerseed accounted for 71 percent of Russian total oilseeds output during the period.) Given that the Soviet regime expanded crop production to much high-cost marginal land, it is highly likely that virtually all of the increase in Russian oilseeds area since 1990 has come from taking quality area from other crops rather than bringing virgin land into production. It is also quite likely that almost all the growth in oilseeds area came at the expense of grain. No other crop group is nearly as sensitive as oilseeds in terms of the physical conditions (soil and weather) it demands for production.

The percentage decline in grain area from 1986-1990 to 2011-2012 for Russia's five districts clearly shows the differences between high-cost and low-cost regions (fig. 13). In the North, the AC of grain production in 1990 was 235 rubles, and from 1986-1990 to 2011-2012, it lost 72 percent of its grain area. The average 1990 grain production cost in the South, which contains Russia's best grain-producing land, was 93 rubles, and over the equivalent time, grain area within the district dropped by only 9 percent. From 1986-1990 to 2011-2012, area for sunflowerseed alone increased in the South by more than the 1.0 million hectares that Southern grain lost. These numbers show that grain area in the South declined not because costs for some volume of output were too high for production to be sustained, but rather because some land switched from grain to competing oilseeds.

Figure 13

Russia's change in average grain area by district



Note: The triangles give average production cost within each district in 1990.

Source: Russian Ministry of Agriculture and Food (1996); Russian Federal Service of State Statistics, Regions of Russia: Social-economic Indicators (various years).

The move of some area from grain to oilseeds production also helps explain why the Central district experienced such a large drop of 36 percent in grain area from 1986-1990 to 2011-2012. Between these two periods, sunflowerseed area in the Central rose by 3.2 million hectares, and rapeseed area also increased somewhat. If this switch to oilseeds had not occurred, grain area in the Central district would have declined by only about a quarter.

Two conclusions follow from figure 13. First, Russian grain area and output have dropped since the Soviet period in a way consistent with (predictable from) the country's regional production cost structure, whereby after a certain level of area use, production costs escalate sharply.¹⁴ Second, for the lost grain area to return to production, world grain prices would have to rise considerably from 2011-14 to cover production costs in these higher cost regions. USDA (2016), as well as OECD and FAO (2015), project that real (inflation-adjusted) world grain prices (including for wheat, corn, and barley) will decline modestly from 2015 to 2025. If these projections prove to be correct, there will be no output price incentive for Russian grain area to increase.

¹⁴ Prishchepov et al. (2013) supports our analysis that most of Russia's abandoned grain area had high production costs. Examining land abandonment in five Russian oblasts, the article finds that the idled land had low productivity and yields. Given the inverse relationship between input productivity and production cost, one can conclude that the abandoned land had relatively high costs of production. The article also finds that the substantial drop in Russian government subsidies to agriculture during the 1990s contributed to land abandonment. Subsidies could help sustain high cost producers in the new competitive market economy where farm profitability became a key determinant of survival.

Despite the surges in world grain prices, Russian grain area during the period 2006-15 grew just a bit (fig. 9). However, world grain prices during that time were very volatile, rising in 2007-08, falling in 2009-10, climbing again in 2011-12, and then dropping once more in 2013-15. The annual real price for a metric ton of U.S. hard red winter wheat (in 2010 U.S. constant dollars) in the peak price years of 2008 and 2012 was \$317 and \$291, respectively, while the price in 2005, 2010, and 2015 was \$173, \$224, and \$194, respectively (World Bank, 2016). Most of any major increase in Russian grain area would have to be in high-cost regions, and would also require a nontrivial fixed cost to clear the land and make it suitable again for farming. To motivate the idle land's return to cultivation, world grain prices would not only have to rise substantially, *but also remain high for an extended period of time*, to give producers the confidence that expanding production onto such marginal land could be profitable. Russia would also have to invest heavily in improving the physical and commercial infrastructure for storing and transporting the additional grain.

This analysis indicates that there is little economic potential, or likelihood, that Russia will expand grain area in any substantial way or approach the level of the late Soviet period. Returning national grain area to the historical peak level of 80 million hectares (1961-65) would require even significantly higher and sustained prices to motivate the expansion and cover the apparently extreme production costs. The Soviet regime also pushed grain onto marginal land in Kazakhstan, such that "current" Kazakh grain area (average annual 2011-14) is only 66 percent the level of 1986-90. We, therefore, also surmise that the lost Kazakh grain area was characterized by steeply increasing production costs, such that much higher world grain prices would also be necessary to return that abandoned area to production. This view is supported by Kraemer et al. (2015), who argue that the potential to expand cropland in Kazakhstan is "much lower than commonly believed." In summary, the likelihood that Russia and Kazakhstan might substantially increase grain area anytime soon, even if concerns for world food security were to return to the levels shown during the recent price surges, seems slight.

Projections for Grain and Oilseeds Area and Production for Russia and Ukraine

USDA makes annual projections for grain and oilseeds area, yield, and production for the major countries of the world, including Russia and Ukraine. However, the USDA models that generate the projections do not break Kazakhstan out as an individual country; rather, Kazakhstan is grouped with nine other countries of the former Soviet Union (Armenia, Azerbaijan, Belarus, Georgia, Kirghizstan, Moldova, Tajikistan, Turkmenistan, and Uzbekistan). We, therefore, do not provide projections for Kazakhstan.

Also, tables 1 and 2 do not present the specific USDA projections for Russian and Ukrainian grain and oilseeds area, but rather projections *based on* the USDA numbers. We use values for KRU crop area mainly from KRU sources, rather than from USDA PS&D. The KRU sources give planted area, while PS&D gives harvested area. Presenting the USDA baseline projections based on PS&D numbers would, therefore, create inconsistency between the projections and the historical values presented throughout the report.

We use the following procedure to generate what we call “baseline consistent projections” for Russian and Ukrainian grain and oilseed area. First, using USDA’s Production, Supply and Distribution Online (PS&D) values for 2011-14 and the USDA projections to 2025, we compute the area growth rates from 2011-14 to 2025.¹⁵ Second, we apply those USDA baseline-based growth rates to 2011-14 values acquired from Russian and Ukrainian sources. These calculated numbers give us projections for Russian and Ukrainian grain and oilseed area based on KRU sources for area and crop measurement, but using growth rates computed from the 2016 USDA baseline for Russia and Ukraine. The assumptions behind this approach are that Russian and Ukrainian planted area for grain and oilseeds will increase from 2011-14 to 2025 by the same percentage as harvested area.

The actual USDA projections for the growth in Russian and Ukrainian grain area from 2011-14 to 2025 is a modest 7 and 8 percent, respectively (tables 1 and 2). The USDA projections for the increase in Russian grain area (and, therefore, also the baseline consistent projections that we present in tables 1 and 2) are congruent with figure 12. As indicated by figure 12, Russia appears capable of increasing grain area by a moderate amount from the “current” (2011-14) level of 45 million hectares without increasing production costs substantially, bearing in mind that some of the lower cost grain area has already been lost to oilseeds. The moderate growth in grain area for both Russia and Ukraine reflects that world grain prices are not projected to rise over the projection period. By 2025, Russian corn area is projected to grow by 41 percent, though from a fairly low base, while Ukrainian corn area, after rising from 1996-2000 to 2011-14 by almost 350 percent, is projected to increase by only 4 percent.¹⁶

¹⁵ In tables 1-2 we give planted area and production for certain crops (such as sugar beets and potatoes) for which PS&D does not provide area and production numbers, and Russian and Ukrainian sources provide no data beyond 2014. Therefore for consistency, we use 2011-14 as the most recent (“current”) base period against which we compare the 2025 USDA (baseline-based) projections, rather than the period 2011-15.

¹⁶ Table 1 shows that average annual Russian total grain area in 2011-14 was 45 million hectares *of planted area*, with the data obtained from the Russian Federal Service of State Statistics (a). If USDA PS&D data had been used, which give harvested rather than planted area, the figure would be 38.7 million hectares, a drop of 14 percent. The corresponding figures for Russian total oilseeds area in 2011-14 are 10.7 (from Rosstat) and 9.0 (from PS&D) million hectares. The actual USDA projections for total grain and oilseeds area in 2025 (based on harvested rather than planted area) are correspondingly lower than those shown in the table, at 41.5 and 11.4 million hectares.

Table 1

Area and production projections for Russian grain and oilseeds

	Planted area			Production		
	2011-14	2025 projection	% Change	2011-14	2025 projection	% Change
	<i>Hectares (millions)</i>			<i>Metric tons (millions)</i>		
Total planted area	77.4	na	na	na	na	na
Total grain	45.0	48.3	7	90.7	103.1	14
Wheat	27.5	30.1	9	51.4	61.0	19
Corn	2.2	3.1	41	9.5	15.1	58
Total oilseeds	10.7	13.5	26	13.1	18.0	38
Sunflowerseed	7.1	8.6	21	9.3	12.5	34
Soybeans	1.6	2.6	65	2.0	3.4	73
Other crops						
Sugar beets	1.1	na	na	41.4	na	na
Potatoes	2.2	na	na	31.0	na	na
Vegetables	0.7	na	na	14.9	na	na
Fodder and pasture grasses	17.5	na	na	48.0	na	na

Note: Fodder includes corn for silage, grass for hay, and alfalfa. The figures for the columns 2011-14 give average annual values over the period. na = not available.

Source: USDA, ERS analysis based on data from Russian Federal Service of State Statistics and *USDA Agricultural Projections to 2025 (2016)*.

Table 2

Area and production projections for Ukrainian grain and oilseeds

	Planted area			Production		
	2011-14	2025 projection	% Change	2011-14	2025 projection	% Change
	<i>Hectares (millions)</i>			<i>Metric tons (millions)</i>		
Total planted area	27.8	na	na	na	na	na
Total grain	15.5	16.8	8	57.5	68.6	19
Wheat	6.3	8.1	28	21.1	25.9	23
Corn	4.4	4.6	4	25.8	33.3	29
Total oilseeds	7.3	8.7	18	14.3	19.1	34
Sunflowerseed	5.1	5.5	8	9.6	11.7	23
Soybeans	1.2	1.9	58	2.8	4.9	73
Other crops						
Sugar beets	0.4	na	na	15.9	na	na
Potatoes	1.4	na	na	23.3	na	na
Vegetables	0.5	na	na	9.8	na	na
Fodder and pasture grasses	2.3	na	na	28.2	na	na

Note: Fodder includes corn for silage, grass for hay, and alfalfa. The figures for the columns 2011-14 give average annual values over the period. na = not available.

Source: USDA, ERS analysis based on data from Ukrainian State Statistics Service and *USDA Agricultural Projections to 2025 (2016)*.

The actual USDA projections for the growth in Russian and Ukrainian grain output from 2011-14 to 2025 are 14 and 19 percent, respectively (tables 1 and 2). The higher growth rates for grain production compared to area reflect the fact that grain production will increase because of growth in both area and yields. The anticipated growth in Russian and Ukrainian grain production will in turn increase the surpluses for export.

Area for Russian and Ukrainian oilseeds is projected to expand from 2011-14 to 2025 by 26 and 18 percent, respectively. The rise reflects continued growth in world demand for protein-rich animal feed. Russian and Ukrainian oilseed output is projected to increase from 2011-14 to 2025 by a substantial 38 and 34 percent, respectively, reflecting strong expected growth in both oilseed area and yield.

Conclusion

During the 1990s, total planted area, as well as area for grain within that total, fell substantially in Russia and Kazakhstan, while the declines in Ukraine were less pronounced. Since 2000, total planted area and grain area have risen somewhat for both Ukraine and Kazakhstan, though the levels have not changed much for Russia. “Current” total planted and grain area in Russia and Kazakhstan are both still significantly below the levels of the late Soviet period, while in Ukraine planted area is down, though grain area is slightly up, compared with last years of the Soviet era. The main reason for the area decline was the severe contraction of the KRU livestock sectors, which substantially reduced demand for animal feed.

However, since 2000, area for oilseeds (sunflowerseed and soybeans being dominant) and corn has increased significantly in Ukraine, and to a lesser extent in Russia. This area growth reflects the revival of these countries’ livestock sector, as well as positive supply-side developments whereby producers have acquired the technology, education, and agronomic skills to expand and manage the production of these profitable though relatively challenging crops (compared with wheat and most other grains).

Some observers in both the KRU countries and the West have floated the argument that Russia and Kazakhstan could return their idled grain area to production. Any resulting nontrivial rise in grain production and exports would affect world agricultural markets, U.S. grain producers and exporters, and possibly world food security. Higher KRU grain exports would reduce the prices received by U.S. grain producers and also increase the competition faced by U.S. grain exports in foreign markets, especially in Africa, the Middle East, and China. However, this report finds that, given the regional cost structure of Russian grain production, the increased grain area and output would have to be in relatively high-cost regions. Unless world grain prices were to rise considerably to cover the high production costs, such expansion appears to be unprofitable and thereby not economically feasible. This judgment also applies to grain area and production in Kazakhstan, where just as in Russia, area was pushed during the Soviet period onto marginal land with high cultivation costs.

Area in the KRU region should continue to grow, though less so for grain than for oilseeds. USDA projects that relative to 2011-14, grain area in Russia and Ukraine will increase to 2025 by 7-8 percent to 48 and 17 million hectares, respectively, while oilseed area will expand in the two countries by 26 percent and 18 percent, respectively. However, the recent strong growth in Ukrainian corn area will not continue. USDA projects Ukrainian corn area will increase from 2011-14 to 2025 by only 4 percent.

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