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Abstract

This paper deals with agricultural dynamics in late-Imperial Russia. Based upon a comprehensive micro-level data set on annual yields between 1883 and 1913, we provide insight into regional differences of agricultural growth and the development prospects of Russian agriculture before WWI. Making use of the fact that—unique in Europe—contemporary Russian statistics distinguished between "privately owned" and mostly communally governed "peasant" land, we are able to test the implications of different land-tenure systems for agricultural growth. In a broader sense we will challenge the stereotype of the "backward" peasant and the common narrative of Russia as an exception to the pan-European picture of economic development during the era of industrialization.

JEL Codes: N53, O13, Q15

Keywords: Russia, land productivity, peasant communal agriculture, land tenure

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I. Introduction

There is a long tradition of locating Russia outside the experience of Western modernity. Since the idea of historical progress emerged from the Enlightenment, Russian and non-Russian elites have invoked the historical development of Western Europe as a benchmark for evaluating that country's economic performance. The resulting grand narrative depicted Russia as a backward country aspiring to catch up with its more developed opponents or allies, thereby putting it on a unique path of historical development (Hildermeier 1987). In the 20th century, this idea served as a foundation for the macro-historical model of relative backwardness which situated Russia as an economic latecomer compensating for its development delay by enforced state-driven modernization (Gerschenkron 1962). Referring to these intellectual traditions, "backwardness" is even now applied as an analytical category for understanding Russian history (Hildermeier 2013).

A cursory view of late-Imperial Russia does suggest that Russia was different. Regarding the scope and pace of economic transformation, the country was indeed left behind other European powers, as well as the United States and Canada. Russia's economic take-off was both delayed and more gradual. In 1883 the share of agriculture in national income was about 57%. By 1913 this indicator had declined to 51% (Gregory 1994, pp. 27-29). Social structure mirrored the slow pace of economic change. The population census of 1897 reveals that 85.2% of the population inhabiting the European parts of the Russian Empire belonged to the social estate called "peasant." At this time, 74.9% of the European Russian population was occupied in agriculture, forestry, fishing and hunting (Moritsch 1986, p. 249, fig. 3 and 4). By comparison, as early as 1870, only 50% of the population in 15 European countries (including England, Germany, France as well as less-developed countries such as Spain and Italy), worked in the primary sector (Van Zanden 1991, p. 219).

Tsarist Russia's rural economy exhibited several structural and institutional features that were missing in other European settings at the time, thus contributing to the narrative of Russia's "otherness". Continuing until the end of the 1920s, agriculture was characterized by peasant household production, a low degree of mechanization, and rather simple cultivation methods (Melton 1998; Moon 1999; Kerans 2001). The legal framework of the rural order had been established in the emancipation reforms of 1861 when peasants received personal independence. Freedom, it turned out, was not free. The reforms granted peasants a

consolidated homestead and some additional allotments for permanent use, but required them to pay redemption fees. Moreover, the land was vested not to individuals or individual households, but to newly created organs of peasant self-government, the so called "rural societies" (*sel'skie obshestva*), consisting of all peasants who had formerly belonged to one estate. These new rural societies were often congruent with the much older institution of the land commune – institutional arrangements in which peasants organized local affairs, including the distribution and often regular redistribution of land among peasant households. Hence, the emancipation reforms generally codified a century-long custom of communal land tenure in Tsarist Russia. These arrangements facilitated the elite's desire to enforce control and prevent social unrest. The 1861 legislation constrained peasant mobility by prohibiting exit from a commune without approval of the village assembly. The institution of collective tax obligations meant that communes sought to prevent the exit of their members. The new reforms also prohibited commercial transactions of peasant land, thereby precluding the development of a land market (Atkinson 1983; Moon 1999, chap. 6).[1]

Contemporary Russian elites were the first to draw a connection between rural order and their country's bemoaned development delay. At the end of the 19th century, the stereotype of the "backward peasant" entered public discourse. The peasantry was accused of ignorantly clinging to traditional farming techniques and to a collectivist spirit of mind that impeded modernization of agriculture and the economy as a whole (Kotsonis 1999). Adherents of socialist ideology shared this assumption. The stereotype of peasant backwardness was crucial for Bolshevik self-understanding. Lenin harbored special disgust for the "...idiocy of rural life" (Conquest, 1986: 20). Maxim Gorki, the political and literary hero of socialist thought, was particularly contemptuous of the "…animal-like individualism of the peasantry" and the "…deadweight illiterate village life which stifles the town" (Conquest, 1986: 20).

The emergence of the "peasant question" at the eve of the 19th century was accompanied by far-reaching debate on the prospects of agrarian reform. Central here were discussions of the economic role of the land commune. While conservative politicians adhered to the paternalistic idea of the commune as protection for a helpless and awkward peasantry against unrestricted capitalist dynamics, a growing number of officials and intellectuals launched a

[1] First studies on 19th century Northwest Germany clearly prove that even in highly productive leading agrarian regions the full privatization of land in the course of agrarian reforms had no lasting impact on the land market. Moreover, the lack of an active land market did not prevent highly dynamic agricultural growth (Fertig 2007, Kopsidis, Hockmann 2010). It looks like that in large parts of Central Europe - even in most developed areas - no active land markets did emerge in the course of liberal agrarian reforms. Thus, the Russian experience was no exception.

public campaign against the land commune which, in their view, was the reason for the country's backwardness. They insisted that communal land tenure blocked economic initiative and tied peasants to irrational and inefficient agricultural methods. They embraced the agrarian reforms launched in 1906 by prime-minister Petr A. Stolypin as an important step towards a "normalization" of Russian development. Eliminating the land commune and consolidating privatized allotments would induce market-based agricultural growth and accelerate economic development on a national scale (Yaney 1982; Pallot 1999; Litzinger 2007).

Underlying the political promotion of land privatization was the familiar assumption that individual ownership of land, and the emergence of an unrestricted land market, are major and necessary conditions of agricultural development. On the micro-level, land ownership is supposed to positively stimulate private initiative, while on a macro-level it is regarded as important condition of economic growth: The land market would lead to an equilibrium in which individual parcels of land would be cultivated by the most efficient producer. This unambiguous faith in the market would turn out to play a profound role in the post-Soviet agrarian reforms of the 1990s. Russian politicians and historians returned to Stolypin's reforms as a model for resolving the post-Soviet agrarian crisis (for examples see Litzinger 2007, p. 10).

Recent research from the fields of development economics and agricultural history has cast empirical doubt on the unquestioned superiority of private ownership as compared to other property regimes (Atwood, 1990; Braselle, et al., 2002; Lund, 2000; Migot-Adholla, et al., 1993; Ouedraogo, et al., 1996; Place and Hazell, 1992; Sjaastad and Bromley, 1997, 2000). Evidence comes from developing countries where the absence of formalized individual property cannot satisfactorily explain low levels of productivity and investments. Moreover, in many cases, attempts to formalize property relations by issuing individual land titles did not show expected results. Titles can even serve to *decrease* tenure security (Bromley 2008a). Doubts about alleged positive effects of privatization are thus part of a more general skepticism about implementation of institutions "from above" (Easterly 2008). While questions of land tenure are usually discussed within a dichotomous framework of "traditional" versus "modern," associating communal tenure with "backward" and individual private tenure with "modern" economic relations (Deininger and Feder 2009), there is no unambiguous connection between tenure regimes and certain levels of "backwardness", "progressiveness" or "development". Research on property relations in some of the

economically most productive and technologically most advanced parts of the world provide evidence that communal tenure of natural resources can be compatible with their productive and sustainable management regardless of development level (Bromley, 1992; Schlager and Ostrom 1992).

Scholars in rural history also question the idea of a direct link between tenure regimes and the stages and dynamics of the economy. Research on 18th century Ireland, Northern France, and England has shown that yields were not significantly higher on enclosed (private) land as compared with open (common) fields (Allen and Ó Gráda 1988). There is also no direct correlation between agricultural productivity growth and the existence of private tenure. Indeed, even in England, the epitome of capitalist agriculture, there was neither a "medieval stagnation" on peasant open fields, nor an upsurge of yields after the privatization of land (Allen 1992). Empirical works on the history of England and Germany support the idea that common fields per se cannot be regarded as obstacles to rural development (Kopsidis 2006, Pfister, Kopsidis 2013). In many cases, the implementation of advanced technologies or agricultural methods on communal lands did not lag behind those on privately owned lands. These findings are supported by recent developments in China where de-collectivization, and the introduction of the Household-Responsibility-System with communal land tenure and regular land reallocations, has triggered agricultural growth beginning in the late 1970s. While there is evidence that the lack of long-term tenure security negatively effects sustainable investments (Brandt, et al., 2002), there is also evidence that communal land tenure does not constrain farmers to adjust to new market opportunities (de Brauw, et al., 2008).

Since peasant agriculture in late-Imperial Russia was largely organized within a communal tenure system, these findings have important implications for quantitative research on late-Imperial Russian agriculture. The results suggest a need for research to determine whether peasants – because of institutional and legal constraints, or because of alleged "traditional state of mind"– were resistant to change and technical progress. Do data support the hypothesis that communal land tenure was an obstacle of agrarian change, or that progress on common fields lagged behind that on individually owned lands? Addressing this question promises valuable insights into Russia's agrarian history, as well as the opportunity to "resituate" Russia on a pan-European map of agrarian development in the 19th and 20th centuries.

II. Late-Imperial Russian Harvest Statistics and its Explanatory Range

A. State of the Art

Thanks to wide-ranging research, late-Imperial rural Russia is not *terra incognita* for historians. Quantitative studies are rooted in 19th century debates between Russian populists and Marxists – the former arguing that the future of the country lay in the institutions of a proto-socialist peasantry, and the latter expecting a revolutionary transformation carried by the growing proletariat. Quantitative research on the prerevolutionary rural economy was dominated by a narrative of crisis as expressed in Lenin's "The Development of Capitalism in Russia" (1899). Here, the future leader of the Bolshevik revolution urged the ongoing dissolution of the peasantry as a social class and situated this in a framework of revolutionary progress (Kingston-Mann 1981). Lenin's intellectual legacy served to legitimate Bolshevik power as subsequent Soviet authors created a picture of impoverishment and emerging class struggle in the late-Imperial village. This narrative served to justify revolutionary destruction of the *ancien régime* as the logical and inevitable result of deepening systemic crisis (Mironov 2012, pp. 36-38). The durable narrative of agrarian crisis served as a fundamental argument within the teleology of socialist revolution. It was also deployed by Western scholars who, like their Soviet counterparts, were interested in the alleged "deeper" reasons for the Bolshevik revolution. Influenced by arguments of late-Imperial Russian intellectuals, they supported the idea of a Russian *sonderweg* (special-way, or exceptionalism). Focusing on rural poverty and the allegedly increasing exploitation of the peasantry by the Imperial government, these writers interpreted the revolution as a consequence of the political system of the Tsarist autocracy which hindered economic development "from below" (Gerschenkron 1962; Simms 1977).

Since the late 1970s, scholars have cast increasing doubt on the idea of agrarian crisis, instead paying attention to regional differences, increasing yields, and the rising role of agricultural commodity production in the last decades of the Tsarist Empire (Simms 1977; Wilbur 1983; Gregory 1980; Gatrell 1986; Löwe 1987). After the collapse of the Soviet Union, this "optimistic" view has been widely embraced by Russian and international scholars. Increasing levels of peasant consumption, steadily declining mortality, as well as significantly enhanced trade of agricultural products on national and international markets, combine to serve as strong arguments against the assumption of generally deteriorating living standards and deepening rural crisis in late-Imperial Russia (Hoch 1994; Mironov 2012, pp. 545-562; Davydov 2003, 2010). Recent calculations of TFP-growth in Russian agriculture between

1861 and 1911 indicate a constant growth of agricultural output in the period between the emancipation of serfdom (1861) and the outbreak of WWI, with a significant contribution of TFP-growth to output growth during the 1870s – and again beginning in the 1890s (Leonard 2011, p. 241 et passim; Appendix I).

Research has also been done on the political, institutional and cultural environment within which pre-revolutionary agriculture existed. Apart from the top-down analysis of the stepwise integration of rural regions into the hierarchies of state administration and state intervention into agricultural affairs (Yaney 1982), there is growing interest in how peasants used institutions which were created by the central state for their private purposes, and for regulation of local affairs (Gaudin 2007; Schedewie 2006). Scholars have also studied the discovery of the peasantry as an object of discourse and public debate by late-Imperial political and intellectual elites. This research confirms the idea of peasant backwardness arising as a product of debates about the fate of Russia as a national state seeking to situate itself in relation to a discursively constructed West (Frierson 1993; Kotsonis 1999; Kingston-Mann 1999). A recent study has thrown light on the intensifying dialogue between the late Empire's elites and the peasantry. It seems that peasants were not silent objects of elitist discourses but were actively engaged in public negotiations over the modernization of the rural economy (Gerasimov 2009). Moreover, peasants used newly evolving communication platforms, as well as personal ties with intellectuals or experts, to articulate their own interests to a broader public (Herzberg 2013).

While the narrative of a late-Imperial agricultural crisis, and the stereotypical image of the peasantry as an irrational and ignorant mass reluctant to any kind of progress and scientific advice, have now been seriously challenged, there is still a lack of systematic information on the quantitative and regional dynamics of peasant agriculture in late-Tsarist Russia. Our research will, therefore, combine insights from recent development economics, quantitative agrarian history on Western Europe, and cultural historical research on land in Imperial rural Russia. Drawing on comprehensive data of annual yields collected by the Statistical Committee of the Tsarist Ministry of Interior, we analyze the dynamics of land productivity in Russia between 1883 and 1913.

B. Our Approach

Systematic and regular yield surveys started in 1883. Between 1883 and 1887, harvest statistics covered the fifty provinces (*guberniia*) of European Russia. These data were later expanded with records from the ten Polish provinces (since 1888) and the Caucasian region,

Central Asia and Siberia (between 1892 and 1907). Since 1908, yield statistics covered the whole Empire, except Finland. Records on yields focused on the main grain cultures as well as potatoes and hay, while yields of fruits and vegetables were largely missing. Our analysis is based on annual yields in the fifty provinces of European Russia between 1883 and 1913. We selected a sample of eight cultures, containing six major grains wheat (winter, spring), rye (winter, spring), oats and barley, as well as potatoes and flax. As an extension to our analysis, parts of our study rely on a sample of the eight cultures already mentioned and five additional cultures, including hemp, corn, millet, peas, and buckwheat.[2]

Our sample reflects major vectors and development trends of late-Imperial agriculture. While wheat, rye and barley were food cultures, which accounted for a high share of human consumption in the countryside, oats was mainly used for animal fodder (Gregory 1980). There were some differences in the meaning of domestic and foreign markets for the particular grain cultures. In the post-emancipation period, Russian wheat cultivation (especially spring wheat) was steadily increasing, with wheat being increasingly traded on domestic and foreign markets. By the end of the 19th century wheat was the most important export commodity of the Russian Empire. On the world market, Russia was the second largest exporter after the USA. At the same time, demand on domestic markets consistently increased as wheat began to replace rye as a major component of grain consumption. Rye had been the most dominant grain culture for centuries. At the beginning of the 20th century, Russia was the world's leader in rye production, although the share of sown area for rye cultivation in overall sown area had noticeably decreased. Rye marketing underwent significant changes, too. The share of rye exports in overall rye trading was in decline. Moreover, there was a tendency towards decreasing rye trade on domestic markets as well. Oats was the third major grain culture in Russian agriculture. In the decade before WWI, the share of oats exports in general oats marketing was in decline, suggesting a sustained growth in domestic demand. Barley was a food and fodder crop as well as an important export commodity, and Russia was the world's leading barley producer at the beginning of the 20th century. In contrast to wheat, rye, and oats — for which domestic markets became more important in the late-Imperial period — the share of barley exports in overall barley trade increased up until the start of WWI (Davydov 2010, chap. 3).

[2] Between 1883 and 1893 statistics measured yields in *chetvert* (measure of volume*)*, from 1894 in *pud* (measure of weight. 1 Pud = 16,38 kg.) per *desiatina* (measure of area1 Desiatina = 1,09 ha). To receive comparable data on yields, we converted yields of the earlier period in *pud* per *desiatina*, making use of annual conversion tables included into harvest statistics.

The labor-intense cultures of potatoes, hemp and flax are indicators of changing consumption patterns, and of Russia's changing position in world markets. Potatoes became an important part of the Russian diet in the second half of the 19th century (Moon 1999, p. 288 et passim; Mironov 2010, p. 454), with potato cultivation growing especially in the Western parts of the Russian Empire, and in the densely populated regions of St. Petersburg and Moscow. Flax was widely used in industrial manufacturing. Until the rise of the cotton industry flax had been a major resource for textile production in Russia and abroad. When the American Civil War (1861-1865) interrupted European raw-cotton imports from North America, Russia gained a monopoly-like position on international flax-fiber markets (Pavlovsky: 1967, pp. 289-292).

The reliability of harvest statistics has been a matter of debate since Imperial times. Contemporaries questioned whether yields reported in the statistics could be used for calculating total agricultural output. It was well known that agricultural producers, and local administrators, had strong incentives to report lower yields in order to avoid taxation. Doing so might also attract governmental support (Davydov 2010, pp. 67-76). Soviet economists concluded that pre-revolutionary agricultural output was actually much higher than indicated in official records. Recently, scholars of Russian economic history (Gregory, Mironov) have followed their example (Davydov 2011/12). While there can be little doubt that official harvest statistics do not express actual yields, at least one researcher argues that homogeneity and constant methodology enables researchers to consider such data a reliable source on the dynamics of agricultural yields over time (Kuznecov 2011/12). This view has been justified by analysis of additional statistics which indirectly allow statements about development trends and regional variations of agricultural yields (Koval'chenko 2004, pp. 44-46).

Late-Imperial harvest statistics rely on standard juridical categories of the system of social estates. Although the estate-system was constantly eroding, it kept on providing the main categories for describing society until the end of the Tsarist government. Taking the classification system from the land census of 1877/78,[3] harvest data indicates two types of land: "privately owned land" (*vladel'cheskie*) and "peasant land" (*krest'ianskie / nadel'nye*). These categories refer to the emancipation legislation of 1861. By definition "peasant lands" are those allotments transferred to the new regimes of peasant self-governance. The category of "privately owned" land encompasses all other allotments which remained unaffected by the emancipation reforms (Löwe 1987, pp. 96-97; Koval'chenko 2004, p. 41).

[3] Statistika pozemel'noi sobstvennosti, Saint Petersburg 1880.

The distinction of "peasant" and "private" lands evokes a picture of stability which gradually lost its clarity over time. Between 1861 and 1913, rural Russia was in considerable flux. Despite legal constraints on migration, a slow but accelerating process of industrialization and urbanization encouraged geographical mobility among rural residents (Burds 1998). This process undermined specific social hierarchies ascribed by the central state. At the same time, land-tenure relations gradually underwent far-reaching changes. In the final decades of the 19th century, many members of the landed gentry lost interest in agriculture. Between 1877 and 1905, the amount of land owned by the gentry declined to 58.8% of gentry land in 1861. By the 1917 revolution it had fallen to 45.8%. Members of the peasantry were the dominant purchasers of the gentry's land (Gatrell 1986, chapt. 4.2; Löwe 1987, p. 95 et passim). This development is of crucial importance when it comes time to interpret harvest statistics. While at the beginning of the period (1861) the two categories of land reflected social and economic relations between the peasantry and the noble classes, this connection had become less pronounced shortly after the turn of the 20th century. By that time an increasing number of peasants were farming "peasant" as well as "private" land. Thus, the clear correlation between a certain category of land and the cultivators' juridical affiliation to certain social estate dissipated over time. While some attempts were made to adapt statistics to these changing social realities, official publications of the Central Statistical Committee up until WWI continued to distinguish between "peasant" and "privately owned" land. This meant that so-called "peasant lands" were restricted to those holdings that had been transferred to peasant communities in 1861 (Koval'chenko 2004, p. 41).

This distinction between "peasant" and "private" land has been regarded as the major flaw of late-Imperial harvest statistics – primarily because it fails to clearly relate a certain type of agricultural land to a certain social class. Fortunately for our purposes, this categorization is an important advantage. Referring to the legislation of 1861 which defined "peasant lands" as those lands given to peasant communes, statistical differentiation between "private" and "peasant" land helps to operationalize different systems of land tenure. The category of "peasant land" resembles what is called "open fields" in early modern agrarian societies, and what scholars of recent Chinese agriculture include under the category of "responsibility land" (Brandt, et al., 2002, p. 73): allotments given to households for temporary use by local communes which retain the power to reallocate land among households. Additionally, communes could force households to contribute to local affairs, and to meeting communal obligations to outsiders. Although there were plenty of ways in which Russian peasant communes managed local affairs and governed their resources, the categories of pre-

revolutionary harvest statistics allows for a comparison of communal land tenure in comparison with all other tenure systems in Russian agriculture. Late-Imperial harvest statistics can thus be regarded as a source for answering the key question: whether the absence of land titles and persisting legal restrictions of land transactions, affected peasant yields.

Scholars of agricultural history regard crop yields as the most reliable statistical source to analyze dynamics of agricultural growth prior to the First World War. Time series of crop yields have been used as a key indicator to identify periods of development, decline or stagnation (exemplarily for Great Britain are Turner, et al., 2001; Allen 1992, pp. 130-149, pp. 191-210; Allen 1999, pp. 222-227; and Campbell and Overton 1993). Cross-country comparisons seeking to distinguish leading and lagging European regions in farming generally rely on yields and the growth rates of yields (van Zanden 1999). In that tradition, we here analyze the impact of different agrarian institutions – systems of land tenure (*Bodenverfassung*) – on the dynamics of (European) Russian agriculture between 1883 and 1913. Our research has the dual purpose of: (1) analyzing the spatial dimension of land productivity; and (2) evaluating the yield implications of differing land-tenure systems.

1) *Geography of land productivity*: We first identify productive and less productive agricultural regions. Even if provincial data on yields existed since 1883, continuous reliable data on sown area was only available since 1892. Thus, regional yields and comprehensive yield indicators based on several or all crops could only be calculated for the period 1892-1913. Since yields were highly volatile (Moon 1999, pp. 135-137), we calculate average yields of two five-year periods (1892-1896 and 1909-1913). Exponential trends served to estimate annual growth rates of yields and sown area 1892-1913. We then rank 13 regions and 50 provinces according to their performances of yields. This allows for a synchronic comparison of land productivity in the different parts of European Russia. It also enables us to account for intraregional dynamics over time. Moreover, we study whether there were shifts in the geography of land productivity between 1892 and 1913.

2) *Comparison of "common fields" and "private" lands*: At a second step we use the statistical distinction between "private" and "peasant" lands for evaluating the economic adaptability of communal land tenure. At first we calculate the share of "peasant" land in each region and compare yields on "peasant" lands with yields on "private lands" for both time intervals. Are there significant differences between yields

on the two types of land? In which regions are differences especially pronounced? We then analyze the dynamics of yields on the two different categories of land over time. Did peasant lands develop at the same pace as private land?

III. Agricultural Growth on Peasant and Private Land: Data on Yields

A. The Extent of Common Fields and Private Land

For all 13 crops under consideration except winter wheat, the share of common fields in the cultivated area was significantly higher than that of privately owned plots throughout the entire period (Table 1, figure 1). Still, on the eve of the First World War, more than two thirds of the land used for the cultivation of the 8 cultures in our core sample belonged to the land fund which had been given to peasant communes in 1861. Between 1892 and 1913 there was a slight shift in the relation between the two categories of land, with the area of privately owned land increasing much faster than the area of peasant (common) land (table 2 and 3). This trend can partly be explained as result of growing land lease and purchase by peasants who gradually expanded farming beyond land the peasantry had been allotted during the 1861 reform. It also reflects the Stolypin reforms intended to create a commercial land market by breaking up agricultural communes after 1906.

However, there were significant regional differences in the extent of peasant land. The share of common fields in Ukraine (Novorossiia, Malorossiia, and the Southwest Region) whose final integration into the Tsarist Empire had taken place only at the end of the 18th century never exceeded 65%. On the other hand, this share approached 80-95% in the heartland of the Empire (Central Industrial Region, Priozernyi, Urals, Far North).[4] Refining the picture by looking at the 50 provinces instead of 13 large economic regions confirms the general result (Figures A.1.a, A.1.b). In 1892/96 the share of peasant communal land ranged between 47% in Kherson and 99% in Viatka (map 1). This is in line with findings on the existence of a relatively active land market in the southern regions at the turn of the century (Leonard 2011, p. 47).

There was also a high level of spatial differentiation regarding the regional endowment of arable land. More than 55% of all arable land was located in Novorossiia, the Central Agricultural Region, the region of the Middle Volga, and the Ural Mountains. In the majority of cases, a region's share of peasant communal or private land was roughly equal to its share

[4] The thirteen macro-regions of European Russia are taken from the contemporary statistics. They never served as administrative units but were developed in order to describe economic regions.

of all arable land. The Central Industrial Region around Moscow and the Urals, the most industrialized and economically advanced areas of the oldest parts of Russia, were an exception. In these two cases, the regional shares of peasant land clearly exceeded the regions' share of all cultivated land. Moreover, in both regions the share of common land in all arable land was more than three times higher than the share of privately owned land (Table 4).

Our calculations reveal that on a regional level, sown areas under communal and private tenure developed unevenly. Because of the industrial districts, there was no general trend towards a more dynamic increase of privately owned land. Indeed, in 23 out of 50 provinces, the area of peasant communal land either grew faster or decreased slower than privately owned land between 1892-1913 (table 3, table 5, figure A.1.d). These provinces formed a somewhat compact belt stretching through the Northern half of European Russia from Poltava to Vologda, thus encompassing the entire Central Industrial Region, as well as Priozernyi (Northwest Russia around St Petersburg). In 1892/96, in six out of thirteen regions, the share of peasant land in all of European Russia's peasant land was higher than the regional share of private land in all of European Russia's private land (table 4). In contrast to the industrial areas in the Center and the Urals, regional shares of private land clearly outstripped peasant land in the South (Novorossiia, Malorossiia, and Southwest Region), and to a limited extent in the Central Agricultural Region. Hence, late-Imperial Russian agriculture showed a pronounced spatial differentiation. Private farming was dominant in the highly fertile Southern black-earth-region which is perfectly suited for grain farming and thus quite specialized in agriculture. Less fertile, densely populated but economically more diversified and advanced industrial regions formed the backbone of peasant communal farming. This picture contradicts the modernization paradigm which predicts the disappearance of "backward" communal farming during industrialization in favor of "capitalist agriculture" based on full private property rights especially in "modern" urban-industrial regions (Bloch 1930, Weber 1952).

Cropping patterns on privately owned and communal land were very similar. Over the period 1892-1913, wheat and rye, the major bread grains, covered around 55% of the cultivated area. An additional 30% of the fields were sown with oats and barley mainly used for animal feed. Around 13% of the area was planted with other feed and food crops – potatoes, corn, millet, buckwheat, and peas (tables 6 and 7). There was no clear labor division along lines of the tenure system, although peasant communal farming dominated in the cultivation of labor-

intensive industrial plants such as hemp and flax, which covered 2.5 – 3% of the arable land. Ranking regional growth rates of sown areas shows very similar development trends on open fields and private land, albeit annual growth rates of sown area for spring wheat, barley and oats were twice as high on privately owned land. It is worth noting that dynamic expansion of sown areas for cash crops, most importantly spring wheat, was not concentrated on private land. The same is true for strongly expanding non-tradable cultures like potatoes, with sown areas growing at an annual rate of 1.91% on common land, and 2.3% on private land over the entire period. Only some minor crops (millet, peas and flax) showed opposite trends for the two different categories of land (table 7). These results imply that economic and social conditions were influencing agriculture in a similar fashion, regardless of the tenure regime.

It is important to note that changes in sown areas varied on a regional level. Sown area increases of more than 1% p.a can be observed only in the Southern belt stretching from Bessarabia to Perm (Figure A.1c). This area, which encompassed the entire regions of Novorossiia and the Lower Volga,[5] is perfectly suited for grain farming. In contrast, arable land decreased in Central and Northwest Russia where a comparative advantage lies in grassland farming. These figures reflect signs of early spatial specialization in certain realms depending on natural circumstances of the different regions. Also at work here is the growing importance of domestic market integration—while the Central and Northwestern regions concentrated on green-land farming, the Southwest, South and Southeast of European Russia specialized in grain farming. (Löwe 1987, pp. 57-94; Metzer 1974).

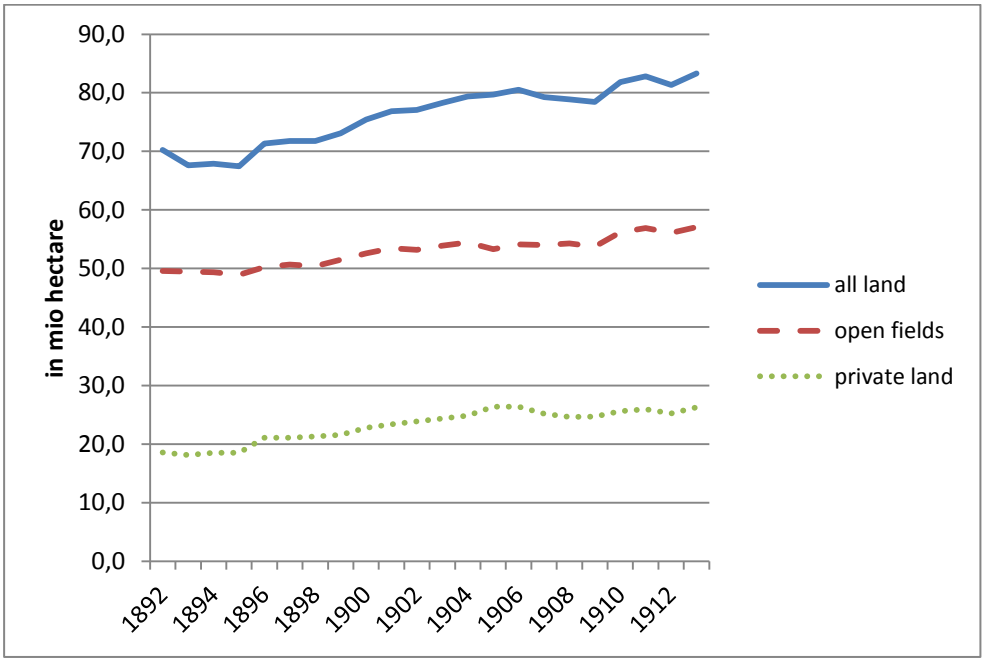
[5] Referring to the time of colonization and opening up for arable farming, Löwe (1987, p. 59) labeled these two regions "Second Colonization Zone". Until the end of the 18th century, they formed the Russian farming frontier. The third zone comprised Northern Caucasus, Western Siberia and parts of the Central Asian Steppe which is beyond the scope of this study. The First Zone colonized in the 17th and early 18th centuries covered the Central Agricultural Region, Middle Volga and parts of Malorossiia. The old nucleus of the empire was formed by the Central Industrial Region, the Northwest (mainly Priozernyi) and the Far North.

Table 1: Sown area per year in European Russia (hectare), 1892-1913

	all land			share of open fields (%)		
	1892/98	1899/06	1907/13	1892/98	1899/06	1907/13
Winter wheat	3,042,124	3,424,629	3,521,682	42.4	36.3	41.1
Spring wheat	10,648,658	14,228,690	16,310,602	69.4	64.2	63.1
Winter rye	25,074,109	26,291,924	25,904,774	75.7	73.7	74.4
Spring rye	295,297	237,941	201,788	77.7	75.9	76.9
Barley	6,621,495	7,626,766	9,105,888	71.4	68.2	66.1
Oats	13,960,214	15,251,459	15,200,093	70.8	68.7	69.5
Potatoes	2,409,647	2,880,505	3,239,326	74.9	73.8	74.1
Corn	879,193	1,101,500	1,256,360	60.0	57.5	56.1
Millet	2,623,199	2,676,710	2,691,040	75.8	73.3	70.0
Buckwheat	2,443,937	2,199,037	2,044,498	74.0	74.7	75.8
Peas	950,804	903,688	827,819	70.8	68.3	64.0
Flax	1,528,555	1,467,203	1,312,677	69.8	73.7	79.3
Hemp	699,400	722,555	633,133	89.4	89.7	90.1
All crops	71,176,632	79,012,606	82,249,679	71.4	68.8	68.6

Sources: own calculation, for data sources see Appendix.

Figure 1: Open fields and private land in European Russia 1892-1913 (all 13 crops)



Sources: own calculation, for data sources see Appendix

Table 2: Regional shares of open fields in sown area, 1892-1913 (hectare, eight crops*)

	sown area in hectare 1892/96			share of open fields (%)	
	all land	open fields	private land	1892/96	1909/13
Novorossiia	12,623,221	8,087,836	4,535,384	64	57
Southwest Region	4,369,029	2,601,493	1,767,536	60	61
Malorossiia	4,671,715	2,861,339	1,810,377	61	68
Central Agricultural Region	9,255,052	6,247,202	3,007,848	68	67
Middle Volga	6,707,723	4,926,348	1,781,374	73	66
Lower Volga	4,159,338	3,283,261	876,077	79	68
Central Industrial Region	4,371,482	3,859,219	512,263	88	90
Belorus	3,701,102	2,640,245	1,060,856	71	70
Priozernyi	1,832,752	1,506,882	325,867	82	86
Lithuania	2,684,675	1,792,704	891,972	67	69
Baltic Region	1,331,711	819,683	512,026	62	72
Urals	6,261,059	5,800,537	460,522	93	86
Far North	706,258	645,972	60,287	91	94
European Russia	62,675,117	45,072,721	17,602,391	72	69

Sources: own calculation, for data sources see Appendix.
Notes: *winter rye, spring rye, winter wheat, spring wheat, barley, oats, potatoes, flax.

Table 3: Regional growth of sown area p. a. for different categories of land, 1892-1913 (%, eight crops*)

	all land	open fields	private land
Novorossiia	1.9	1.2	2.9
Southwest Region	0.6	0.7	0.4
Malorossiia	0.8	1.4	-0.1
Central Agricultural Region	0.3	0.2	0.6
Middle Volga	1.2	0.5	2.9
Lower Volga	3.5	2.6	6.1
Central Industrial Region	-0.3	-0.1	-1.5
Belorus	0.7	0.6	0.9
Priozernyi	0.0	0.3	-1.6
Lithuania	0.4	0.6	0.0
Baltic Region	-0.3	0.6	-2.0
Urals	1.1	0.6	5.2
Far North	0.4	0.5	-1.7
European Russia	1.1	0.8	1.8

Sources: own calculation, for data sources see Appendix.

Notes: *winter rye, spring rye, winter wheat, spring wheat, barley, oats, potatoes, flax.

Table 4: Share of regions in arable land (%), 1892/96 and 1909/13 (eight crops*)

	1892/96			1909/13		
	all land	open fields	private land	all land	open fields	private land
Novorossiia	20	18	26	23	19	31
Southwest Region	7	6	10	6	6	8
Malorossiia	7	6	10	7	7	7
Central Agricultural Region	15	14	17	13	13	14
Middle Volga	11	11	10	11	10	12
Lower Volga	7	7	5	10	10	10
Central Industrial Region	**7**	**9**	3	**6**	**7**	2
Belorussia	6	6	6	6	6	5
Priozernyi	3	3	2	2	3	1
Lithuania	4	4	5	4	4	4
Baltic Region	2	2	3	2	2	2
Urals	**10**	**13**	3	**10**	**12**	4
Far North	1	1	0	1	1	0
European Russia	100	100	100	100	100	100

Sources: own calculation, for data sources see Appendix.

Notes: *winter rye, spring rye, winter wheat, spring wheat, barley, oats, potatoes, flax.

Table 5: Ranking list (all land) of annual growth rates of sown area for different land categories for all 50 provinces 1892-1913 (%)*

	all land	open fields	private land		all land	open fields	private land
Astrakhan'	3,35	2,78	7,76	Vologda	0,41	0,57	-1,75
Orenburg	3,30	2,27	7,15	Smolensk	0,39	0,34	0,66
Samara	3,25	2,34	5,43	Estland	0,38	-0,01	0,52
Don	2,68	1,93	4,61	Olonets	0,20	0,22	-1,07
Ufa	2,52	1,40	5,38	Vitebsk	0,19	0,47	-0,54
Bessarabia	2,34	1,40	3,85	Kurland	0,18	0,09	0,32
Saratov	1,65	0,09	4,24	Vilno	0,16	0,38	-0,33
Ekaterinoslav	1,60	0,97	2,55	Pskov	0,13	0,51	-1,38
Perm'	1,54	1,17	5,77	Tula	0,07	0,26	-0,32
Kherson	1,18	0,71	1,57	Viatka	0,03	-0,05	2,42
Tauride	1,07	-0,02	2,93	Archangel	0,00	0,17	-2,02
Penza	0,94	0,40	1,91	Orel	-0,03	0,24	-0,75
Khar'kov	0,89	0,79	1,12	Novgorod	-0,08	0,13	-1,70
Mogilev	0,83	0,24	2,13	Riazan'	-0,09	-0,06	-0,14
Kovno	0,72	0,66	0,91	Kostroma	-0,09	-0,12	-0,20
Voronezh	0,72	0,04	3,06	Vladimir	-0,13	-0,08	-0,95
Poltava	0,71	1,53	-0,37	Grodno	-0,16	0,43	-0,75
Kazan'	0,70	0,40	2,65	Chernigov	-0,18	0,95	-2,79
Simbirsk	0,66	0,19	1,42	Kaluga	-0,21	-0,01	-1,89
Podoliia	0,59	0,50	0,70	Kursk	-0,31	-0,18	-0,89
Tambov	0,57	0,11	1,48	Tver'	-0,37	-0,12	-3,01
Minsk	0,57	0,54	0,66	Livland	-0,44	1,17	-4,10
Volyniá	0,50	0,60	0,37	Moscow	-0,66	-0,62	-1,59
Nizhnii Novgorod	0,46	0,29	1,15	St.Petersburg	-0,69	-0,38	-2,21
Kiev	0,41	0,27	0,65	Yaroslavl'	-0,71	-0,63	-1,97

Sources: own calculation, for data sources see Appendix.

Notes: * provinces with higher growth rates on open fields are underlined. The sown area comprises all thirteen crops.

Table 6: Share of crops in sown area (%) for European Russia, 1892-1913

	all land			open fields			private land		
	1892/98	1899/06	1907/13	1892/98	1899/06	1907/13	1892/98	1899/06	1907/13
Winter wheat	4.4	4.4	4.4	2.6	2.3	2.6	8.9	9.0	8.2
Spring wheat	15.3	18.4	20.2	14.8	17.1	18.6	16.6	21.0	23.7
Winter rye	36.0	33.9	32.0	38.1	36.3	34.8	31.1	28.6	26.1
Spring rye	0.4	0.3	0.2	0.5	0.3	0.3	0.3	0.2	0.2
Barley	9.5	9.8	11.3	9.5	9.8	10.9	9.7	10.0	12.2
Oats	20.0	19.7	18.8	19.9	19.6	19.0	20.8	19.7	18.3
Potatoes	3.5	3.7	4.0	3.6	4.0	4.3	3.1	3.1	3.3
Corn	1.3	1.4	1.6	1.1	1.2	1.3	1.8	1.9	2.2
Millet	3.8	3.5	3.3	4.0	3.7	3.4	3.2	2.9	3.2
Buckwheat	3.5	2.8	2.5	3.6	3.1	2.8	3.2	2.3	1.9
Peas	1.4	1.2	1.0	1.4	1.2	1.0	1.4	1.2	1.2
Flax	2.2	1.9	1.6	2.1	2.0	1.9	2.3	1.6	1.1
Hemp	1.0	0.9	0.8	1.3	1.2	1.0	0.4	0.3	0.2
All crops	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*

Sources: own calculation, for data sources see Appendix.

Table 7: Annual Growth of Russian sown area 1892-1913 (exponential trends, %)

	all land	open fields	private land
Winter wheat	1.11	0.89	1.27
Spring wheat	2.85	2.21	4.1
Winter rye	0.22	0.01	0.6
Spring rye	-2.4	-2.5	-2.1
Barley	2.15	1.61	3.34
Oats	0.59	0.43	0.98
Potatoes	2.01	1.91	2.3
Corn	2.28	1.82	2.95
Millet	0	-0.6	1.25
Buckwheat	-1.3	-1.2	-1.7
Peas	-0.7	-1.3	0.73
Flax	-0.6	0	-2.4
Hemp	-0.6	-0.6	-1
All crops	*0.99*	*0.71*	*1.79*

Sources: own calculation, for data sources see Appendix.

Map 1: Provinces and macro-regions of European Russia around 1900

Sources: the map bases on a map from Pallot, Shaw (1990).

B. Crop Yields on Common and Private Land: the Regional Dimension

Tsarist agriculture was a regional phenomenon not only regarding cropping patterns but also with respect to strong variations in crop yields on a regional level. At the end of the period under study (1913), crop yields in the Lower Volga Region ranged between a quarter and a third below the national average, while yields were up to 150% of the European Russian average in the Baltic Region and Ukraine (Southwest Region and Malorossiia). Except for barley, yields were clearly above average in the Central Agricultural Region, and to a certain extent in Lithuania. The remaining regions achieved yields slightly below average. However, regarding spring wheat with a sown area growing faster than that of any other crop between 1892 and 1913 (Table 7), these regions (with the exception of the Middle Volga) realized yield increases which were significantly above average. So, there was a clearly pronounced regional differentiation in agricultural productivity. Low-yield agriculture prevailed in the vast steppes of the Volga, while high yields were mainly concentrated in the Southwest and certain Western regions (Table 8, Figure A.2).

In European Russia at the end of the 19th century, yields on common land averaged between 78% and 86% of yields on private land. For five out of eight crops, the gap between yields on peasant and private land increased between 1892/96 and 1909/13.[6] While the deterioration of common land compared to private land was only marginal in the cases of winter wheat, spring wheat, and barley (minus one percentage point), it was substantial for winter rye and oats with peasant production dropping back six (for winter rye) and seven (for oats) percentage points. The picture was ambiguous though. Yields on peasant land relatively improved for potatoes by one percentage point, as well as for spring rye and flax — both by four percentage points (Table A.1).

Variation in yield growth on private land and peasant land also displays a pronounced spatial dimension. A comparison of yield growth (eight crops, 1892/93-1909/13) reveals that for 54 out of 99 regional notations (55%), yields grew faster on private land (table 9a). Nevertheless, there was no general superiority of private farming throughout European Russia. In six out of thirteen regions, yield growth on common peasant land for the majority of crops was higher or equal to yield growth on private lands. This result relates to the following: Middle Volga, Southwest Region, Central Industrial Region, Far North, Priozernyi (Northwest Russia), and

[6] To streamline the analysis, our examination of regional yields is restricted to eight out of thirteen crops which still covered around 85% of the area under crops and include the main grains as well as potatoes and flax (Moritsch 1986, table 25). As will be demonstrated in the following section an analysis which excludes millet, buckwheat, peas, hemp, and corn tends to underestimate the performance of open field farming. However, to reconstruct the broad lines of regional development, the selected eight crops are sufficient.

the Baltic Region. With the exception of the Southwest Region and Middle Volga, regions with superior common land farming were located in the Northern half of European Russia (table 9b).

During the 19th century, and to a certain degree up to the present, two factors are especially important regarding regional specialization processes and yield growth: (1) natural conditions like soil and climate which determine the Ricardian differential rent; and (2) improvements in market access reflected in changes in the von Thünen location rent. While natural conditions determine the agricultural potential of a certain region, the extent to which this potential can be exploited is conditioned by infrastructure – primarily transport costs.

Our results imply that the interplay of both factors in late-Imperial Russia most positively affected yields in Malorossiia and the Southwestern Region. These were very favorable areas for grain farming. Due to favorable precipitation, they had better natural conditions than the two Volga regions.[7] With the railway system expanding in the late 19th century, the agrarian potential of these regions could profitably be exploited. Although not located close to the large ports at the Black Sea (the most important outlets for grain exports), Malorossiia and the Southwest became involved in agricultural trade networks. Railway expansion provided them spatial advantages for supplying the growing domestic urban-industrial agglomerations in European Russia. The same was true for Lithuania (Table 10, 12a, 12b). Moreover, railways offered improved access to seaports for fertile land-locked regions all over Ukraine. Hence, in many parts of interior Russia, transport costs ceased to be the limiting factor for extending farming beyond local needs (Leonard 2011, pp. 195-196). [8]

Regarding the strong impact of infrastructure on regional specialization and agricultural trade, it is worth analyzing the relation between a region's location and its agricultural performance. From the perspective of a von Thünen model with constant fertility and diminishing marginal land productivity, an expanding infrastructure is assumed to cause yield increases in newly integrated "virgin" areas. This would be all the more true if formerly isolated areas were more fertile than regions located next to agricultural outlet markets, as was the case in Russia. Hence, one would expect a convergence of yields of previously isolated regions with traditional leading regions. To test this hypothesis, we used the variation coefficient as a

[7] Except from the Western parts of the Southwest Region, both regions belonged to the black earth zone where soil and climatic conditions for arable farming were the best within Russia, especially in the Southwest Region (Moritsch 1986, p. 138).

[8] It is worth noting, that due to expanding railways, domestic markets became more important for the trade of grain than exports in the late Imperial period (Davydov 2010).

measure of dispersion with a decreasing or negative trend indicating a convergence of yields over time and thus a successful catch-up growth of lagging regions.[9] For nine out of thirteen crops the linear trend of the variation coefficient was negative. Trends were almost identical for yields on peasant land (common) and on private land (table 11). Hence, we have strong grounds to conclude that market integration through railroad expansion not only led to regional specialization but also triggered a convergence of agricultural yields between different regions.

[9] This does not necessarily mean that before market integration absolute yields were lower in southern grain belts compared to Central regions but that southern regions did not exploit their vast agrarian potential to the same degree as denser populated but less fertile central regions.

Table 8: Regional crop yields in Russia, 1909/13 (kg per hectare)

	winter wheat	spring wheat	winter rye	spring rye	barley	oats	potatoes	flax
Novorossiia	857	636	604	596	883	866	4886	581
Southwest Region	1214	757	1087	634	1035	1088	7616	606
Malorossiia	1191	858	924	840	928	1017	8754	612
Central Agricultural Region	1149	733	845	715	716	958	7817	562
Middle Volga	884	601	742	619	798	749	6501	452
Lower Volga	--	538	555	379	550	513	5129	299
Central Industrial Region	967	659	656	548	794	804	6797	377
Belorussia	910	759	726	575	721	764	6887	378
Priozernyi	718	713	705	712	744	746	6675	243
Lithuania	998	768	788	642	812	762	6430	484
Baltic Region	1235	885	1127	802	1019	945	9686	397
Urals	--	784	728	643	812	717	5672	318
Far North	--	723	709	--	854	757	5969	359
European Russia	*996*	*636*	*770*	*580*	*869*	*827*	*7082*	*385*
			European Russia = 100					
Novorossiia	86	100	78	103	102	105	69	151
Southwest Region	122	119	141	109	119	132	108	157
Malorossiia	120	135	120	145	107	123	124	159
Central Agricultural Region	115	115	110	123	82	116	110	146
Middle Volga	89	95	96	107	92	91	92	117
Lower Volga	--	85	72	65	63	62	72	78
Central Industrial Region	97	104	85	95	91	97	96	98
Belorussia	91	119	94	99	83	92	97	98
Priozernyi	72	112	91	123	86	90	94	63
Lithuania	100	121	102	111	93	92	91	126
Baltic Region	124	139	146	138	117	114	137	103
Urals	--	123	95	111	93	87	80	82
Far North	--	114	92	--	98	92	84	93
European Russia	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*

Sources: own calculation, for data sources see Appendix.

Table 9a: Land productivity of eight crops in comparison between open fields and private land, 1892/96-1909/13

	Number of regions*	Private land+*	Open fields+*	No difference*
Winter wheat	10	6	3	1
Spring wheat**	13	6	6	1
Winter rye	13	10	2	1
Spring rye**	12	4	8	0
Barley	12	7	4	1
Oats	13	7	4	2
Potatoes	13	7	5	1
Flax	13	7	5	1
Sum	*99*	*54*	*37*	*8*
Sum = 100%		*55%*	*37%*	*8%*

Sources: own calculation, for data sources see tables A.1a, A.1b.
*Notes:** number of regions: number of regions with cultivation of the crop (maximum = 13), private land+ = number of regions were yields on private land grew faster than on open fields, open fields+ = number of regions were yields on open fields grew faster than on private land, no difference = yield growth equal on private land and open fields. ** = yield growth on open fields was more dynamic or equal to that on private land in the majority of regions. For the eight crops see table 2.

Table 9b: Land productivity on open fields and private land in a regional comparison, 1892-1913

	Number of crops	Private land+	Open fields+	No changes
Novorossiia	8	7	0	1
Southwest Region*	8	2	5	1
Malorossiia	8	5	3	0
Central Agricultural Region	8	6	2	0
Middle Volga	8	4	4	0
Lower Volga	7	5	2	0
Central Industrial Region*	8	3	4	1
Belorussia	8	6	1	1
Priozernyi*	8	2	4	2
Lithuania	8	6	2	0
Baltic Region*	8	2	5	1
Urals	7	5	2	0
Far North*	5	1	3	1

Sources: own calculation, for data sources see tables A.1a, A.1b.
Notes: * = regions were yield growth on open fields for the majority of crops was more dynamic or equal to that on private land. For the eight crops see table 2.

Table 10: Annual growth of regional yields, 1892-1913

	winter wheat	spring wheat	winter rye	spring rye	barley	oats	potatoes	flax
Novorossiia	2.16	0.67	1.01	1.70	0.77	1.61	0.29	2.31
Southwest Region	1.90	0.67	1.72	0.72	2.29	2.45	0.87	1.31
Malorossiia	1.22	1.42	1.67	1.74	1.21	2.05	1.30	0.96
Central Agricultural Region	1.50	1.49	0.62	0.15	0.38	2.47	0.80	1.67
Middle Volga	0.29	-0.21	-0.29	-0.15	0.54	0.88	1.20	1.78
Lower Volga	--	-0.91	-0.57	-2.40	-1.16	-1.94	0.61	0.28
Central Industrial Region	0.56	0.66	-0.51	-0.10	1.71	1.15	0.37	0.82
Belorussia	0.83	0.69	0.77	0.78	1.29	0.34	0.32	0.87
Priozernyi	2.53	0.18	0.83	0.55	1.10	0.45	1.02	2.49
Lithuania	1.22	0.78	1.30	0.97	1.57	1.94	0.77	1.28
Baltic Region	0.70	0.08	0.68	-0.01	0.27	0.90	1.26	1.25
Urals	1.72	0.21	0.03	0.52	0.26	-0.25	-0.24	-0.08
Far North	--	0.66	0.02	0.64	1.10	0.55	0.87	1.27
European Russia	*1.70*	*0.34*	*0.52*	*0.28*	*0.94*	*1.19*	*0.71*	*0.82*

Sources: own calculation, for data sources see Appendix.

Table 11: Linear trend of crop yields' variation coefficient , 1883-1913

	all land	open fields	private Land	N*
Winter Wheat	-0.0032	-0.0025	-0.0034	36
Spring Wheat	-0.0022	-0.0016	-0.0027	48
Winter Rye	0.0003	0.0010	-0.0012	50
Spring Rye	0.0011	0.0023	0.0003	43
Barley	-0.0018	-0.0013	-0.0022	50
Oats	0.0003	0.0001	-0.0005	50
Potatoes	-0.0044	-0.0032	-0.0049	50
Corn	-0.0063	-0.0068	-0.0077	8
Millet	-0.0005	-0.0009	0.0002	33
Buckwheat	0.0012	0.0013	0.0000	44
Peas	-0.0013	-0.0004	-0.0008	49
Flax	-0.0026	-0.0038	-0.0017	49
Hemp	-0.0038	-0.0040	-0.0044	45

Sources: own calculation, for data sources see Appendix.
Notes: * N = number of provinces (maximum = 50).

C. Growth in Yields

As mentioned above, studies on economic history have long adhered to the assumption that Imperial Russia's agriculture was characterized by "inherent backwardness". The retention of peasant communal farming after 1861, and the absence of full private property rights on most of the farm land, was alleged to have blocked dynamic agricultural adjustment and growth.

Thus, "wrong" institutions hampered industrialization and caused deteriorating living standards in the countryside (Gerschenkron 1966). If analysis considers only the trajectory of grain yields this view retains some support. Table 12a presents regional exponential growth trends for average grain yields based on the four main feed and food grains (wheat, rye, barley, and oats) – which in 1916 covered 80.4% of the cultivated area (Moritsch 1986, table 25). Indeed, there is a correlation between land tenure and the development of grain production. Between 1892 and 1913, average grain yield increased annually by 0.54% on common fields and by 0.93% on private land. On average, common fields realized only 58.3% of the annual growth of that on private land. Russia's grain economy had a strong spatial component as well. Yield growth varied strongly between those regions with an annual growth of 1.63% (Southwest Region) – even 1.98% (Malorossiia) – and those with negative growth, as the Volga regions and the Urals (Table 12a).

The geography of the late-Imperial grain economy is worth a closer look regarding different types of land tenure. While the ranking of regions according to yield development was roughly similar for common and private land, a few quite important regions showed large differences between the two tenure systems. This especially relates to the Central Industrial Region and the Central Agricultural Region, where common land realized only 49.9% and 62.4% respectively of grain yield growth on private lands. Significant but much smaller gaps existed in Novorossiia, Malorossia, Belorussia and Lithuania were common land farming achieved between 74% and 79.9% of the grain yield growth achieved on private land. The largest productivity gap between common and private land occurred in the oldest parts of the Empire. Contrary to this, in two of the most dynamic agricultural regions, the Southwest and the Baltic Region, growth rates of grain yields on peasant land outstripped those on private land (Table 12a).

Looking at the 50 provinces instead of the 13 macroeconomic regions tends to confirm this picture. Growth of grain yields was negative in eight provinces, ranged between 0.0% and 0.5% in a further 12 provinces, and reached more than 1.5% in nine provinces. The topography of yield growth accords with earlier results. Grain yields stagnated or decreased in the Eastern half of European Russia, while showing dynamic increases in the Southern and Western regions (Figure A.3a). Grain yield growth on a provincial level also validates results on growth rate differences between the two types of land tenure. As compared with private lands, peasant lands showed much higher rates in the Southern and Western parts of European Russia, while significantly lagging behind in central Russia. The productivity gap between

peasant and private land grew in the majority of provinces. Grain yields grew faster on peasant lands only in the provinces of Astrakhan, Estland, Saratov, Samara, Orenburg, Bessarabia, Kiev, Kurland, Pskov, St. Petersburg, Vologda, and Olonets (Table A.2a).

However, considering an average crop yield based on 13 crops — those which in 1916 accounted for almost 95% of the cultivated area (Moritsch 1986, table 25) — makes alleged "peasant backwardness" nearly disappear. We constructed an average crop yield which, in addition to the six grains, takes into account potatoes, corn, millet, buckwheat, peas, flax, and hemp (table 12b).[10] This extended indicator, which reflects production on 95% instead of 80% of the cultivated land, clearly refines our results. Between 1892 and 1913, common lands realized on average 91.4% of yield growth shown on private lands (not 58.3% as shown by the grain based indicator). This finding has far-reaching implications for a broader picture of late-Imperial Russian agricultural development. The poor performance of communal agriculture in grain farming does not necessarily imply peasant backwardness or general economic inferiority of the land commune. Instead, our findings suggest that peasants in the late-Imperial period consciously redirected resources from traditional grain farming to the cultivation of more profitable crops. Indeed, when looking at European Russia as a whole, it appears that yield growth on communal land exceeded growth on private land for corn, flax, and hemp. Potato yields grew equally regardless of the land tenure system (Tables A.3a, A.3b, A.3c).

Again, these results have a strong spatial component. In the less fertile, climatically disadvantaged and above-average industrialized heartland — with a predominance of common fields — yield growth was significantly higher on communal land. This especially refers to the Central Industrial Region, the Far North, and the Priozernyi Region around St. Petersburg. A highly dynamic growth of crop yields on peasant as compared with private land occurred as well in the Baltic Region (Tables A.3a, A.3b, A.3c). This finding allows us to integrate Russia into the bigger story of agricultural development during the era of industrialization — a period when expanding livestock husbandry, including dairy farming, stabilized peasant farming on small and medium farms all over Western, Northern and Central Europe. Our results indicate that Russia was no exception. Indeed, the four regions had a comparative advantage in intense livestock and green-land farming but were definitely not favorable for large-scale grain cultivation. Since the 1880s, the peasant-dominated livestock

[10] The annual growth rate of this average crop yield corresponds to the sum of the weighted growth yields of every single crop. As weights serve for every year the share of every crop's sown area in the total sown area of all 13 crops. The same is true for the average grain yield with the own difference that the total sown area refers to the six grains only.

sector in the Empire's heartland was booming (Loewe 1987, pp. 294-337).[11] Regarding the strong traditions of peasant communal farming in these regions (with the exception of the Baltic provinces), one can assume that peasant communes substantially contributed to minimize the enormous risks peasants faced when switching to more intensive livestock farming. It is therefore important to keep in mind that in contrast to 18th century England, Russian peasant communes managed to invest considerable sums in very costly large-scale melioration projects (Moon 1999, pp. 222-223). This could explain why the various strongholds of peasant communal farming gave rise to a dynamic market-oriented peasantry.

There was no clear connection between the share of peasant land and yield growth. In the Southwest Region and Malorossiia, the most productive regions in crop farming with yields increasing by more than 2% p.a., shares of common land in all arable land were comparatively low. However, the same was true for the two least productive regions on the Volga — with negative growth or stagnant yields (Table 12b). Drawing on this observation, we offer two conclusions. First, peasant communal farming did not preclude or block dynamic agricultural growth. Second, private farming was not necessarily superior. Looking at the results on the provincial level, there were regions where yields on common land grew faster than on private lands. This occurred in the Lower Volga and the Baltic Region, the Priorzernyi Region, and the regions in the North of an imagined line from Kovno to Kostroma, as well as in most parts of the Southwest Region (Table A.2b). Compared to private (individualized) agriculture, peasant communal farming lagged behind in Novorossiia, the Central Agricultural Region, the Middle Volga, and most parts of Belorussia as well as Lithuania. In general, yields stagnated or decreased in the Southeast of European Russia east of the line Don – Viatka, and increased above average in the West of a line from St. Petersburg to Ekaterinoslav (Figure A.3b).

A closer look at regional yield growth for single crops provides additional support for our results. Table 13 presents a comparison of regional yield growth 1892-1913 on common and private land for all thirteen crops. Our calculation reveals that common land agriculture was clearly inferior only with respect to a limited number of grains in a very few regions. Only winter rye and spring wheat showed common-land growth rates that were less than half as high as growth rates on private land. It is worth noting that these two crops, where private

[11] In analyzing the development of a commercially highly successful market oriented peasant agriculture in the province of Moscow Loewe concluded, "The results of this chapter reduce the perception of a stagnating peasant agriculture and of peasants vegetating at the subsistence minimum, who were unable to improve their way of farming to absurdity" (1987, p. 337, translation by Michael Kopsidis).

farming out-competed peasant farming, showed by far the lowest yield growth of all crops. The only exception was spring rye with a negligibly small sown area. Moreover, apart from the Urals, even for these two crops depressed yield growth on common fields (less than 60% of the yield growth realized on private land) occurred in only two important agricultural regions, Novorossiia, and the Central Agricultural Region (Table A.3a, A.3b, A.3c, table 6).

Our results imply that under certain circumstances, peasant (communal) land tenure was competitive if not superior to private farming. With the exception of winter rye, spring wheat and oats, yield growth on common fields reached at least 85% of yield growth on private land. For corn, flax, and hemp, yields grew even faster than on private land. For potatoes growth rates were equal. Indeed, all aforementioned crops with higher yield growth on common land are labor-intensive crops. This means that there is no reason to assume a general inferiority of farming on peasant communal land as compared to private land. On the contrary, it seems very likely that extending our analysis to livestock farming would tilt the balance even more in favor of peasant farming.

Table 12a: Annual growth rates of an average grain yield, 1892-1913* (in per cent, 1.0 = 1%)

	all land	open fields	private land	yields on private land = 100.0**
Novorossiia	1.15	0.88	1.19	74.0
Southwest Region	1.98	2.03	1.95	104.0
Malorossiia	1.63	1.51	1.98	76.3
Central Agricultural Region	1.20	0.98	1.57	62.4
Middle Volga	-0.08	-0.29	0.21	--
Lower Volga	-0.97	-1.31	-0.68	--
Central Industrial Region	0.24	0.24	0.48	49.8
Belorussia	0.71	0.66	0.85	78.3
Priozernyi	0.71	0.74	0.78	94.7
Lithuania	1.48	1.38	1.73	79.6
Baltic Region	0.59	0.96	0.26	364.8
Urals	-0.01	-0.09	0.14	--
Far North	0.45	0.43	0.41	104.7
European Russia	*0.72*	*0.54*	*0.93*	*58.3*

Sources: own calculation, for data sources see Appendix.

Notes: *the average grain yield is calculated by dividing for every year the added up total crop of winter wheat, summer wheat, winter rye, summer rye, barley, and oats by the sown area in total for these six crops (total harvest of six grains / sown area of six grains). ** = yields on open fields / yields on private land.

Table 12b: Annual growth rates of an average crop yield, 1892-1913* (in per cent, 1.0 = 1%)

	all land	open fields	private land	yields on private land = 100.0**
Novorossiia	1.17	0.94	1.26	74.4
Southwest Region	2.10	2.09	2.12	99.0
Malorossiia	2.23	2.10	2.54	82.8
Central Agricultural Region	1.47	1.38	1.64	84.2
Middle Volga	0.56	0.45	0.71	63.6
Lower Volga	-0.68	-0.92	-0.42	--
Central Industrial Region	1.08	1.10	1.02	107.9
Belorussia	1.54	1.37	1.83	74.9
Priozernyi	1.33	1.43	1.01	141.0
Lithuania	2.03	1.81	2.40	75.5
Baltic Region	1.36	1.69	1.16	145.0
Urals	0.13	0.01	0.41	1.8
Far North	0.77	0.74	0.71	103.8
European Russia	*1.06*	*1.00*	*1.09*	*91.4*

Sources: own calculation, for data sources see Appendix.

Notes: *the average crop yield is calculated by dividing for every year the added up total crop of winter wheat, summer wheat, winter rye, summer rye, barley, and oats, potatoes, corn, millet, buckwheat, peas, flax and hemp by the sown area in total off all 13 crops (total harvest of 13 crops / sown area of 13 crops). ** see table 12a.

Table 13: Crop yield growth on open fields as share of yield growth on private land, 1892-1913 (growth of crop yields on private land = 100.0)*

	winter wheat	spring wheat	winter rye	spring rye	barley	oats	potatoes
Novorossiia	92.2	60.4	53.3	60.3	76.8	66.5	43.1
Southwest Region	89.6	308.1	107.1	57.2	111.9	111.9	84.1
Malorossiia	99.8	92.8	73.4	139.0	55.2	79.3	66.9
Central Agricultural Region	66.4	153.9	34.3	minus1	4.5	99.4	89.1
Middle Volga	271.6	minus+	minus1	minus2	minus2	107.8	80.9
Lower Volga	--	minus+	minus+	minus-	minus+	minus+	46.0
Central Industrial Region	23.1	76.9	minus+	minus-	106.7	91.7	173.6
Belorussia	43.3	79.8	73.1	1721.6	99.4	39.2	32.9
Priozernyi	185.5	minus2	89.8	minus2	72.5	132.9	175.5
Lithuania	71.8	165.1	73.2	481.3	76.9	89.1	83.5
Baltic Region	135.9	minus2	367.4	363.4	minus2	252.5	256.0
Urals	99.8	23.1	minus1	632.1	49.4	minus-	minus-
Far North	--	88.5	minus1	--	120.8	120.4	143.2
European Russia	*89.9*	*41.8*	*42.7*	*minus2*	*86.6*	*66.4*	*99.9*

	corn	millet	buckwheat	peas	flax	hemp
Novorossiia	94.2	30.1	93.9	84.8	104.0	82.9
Southwest Region	176.2	109.8	104.4	48.4	134.9	202.4
Malorossiia	150.6	71.9	84.3	minus2	67.4	101.3
Central Agricultural Region	--	46.0	90.1	minus2	116.6	105.5
Middle Volga	--	89.6	112.9	170.7	94.5	117.4
Lower Volga	--	80.5	127.0	minus2	1557.4	101.7
Central Industrial Region	--	minus+	103.4	138.5	95.8	minus1
Belorussia	--	159.3	124.1	153.5	42.1	42.0
Priozernyi	--	--	100.5	92.3	103.9	minus2
Lithuania	--	50.5	113.4	minus2	66.8	minus+
Baltic Region	--	--	151.1	86.1	77.4	minus2
Urals	--	78.7	49.7	32.4	minus1	60.3
Far North	--	--	--	121.9	88.1	122.9
European Russia	*104.6*	*93.3*	*89.4*	*85.8*	*101.9*	*112.0*

Sources: own calculation, for data sources see Appendix (Tables A.3a ,A.3b, A.3c).

Notes: *minus1 = negative yield growth only on peasant land, minus2 = negative growth only on private land, minus+ = negative yield growth on both types of land but stronger on peasant land, minus- =negative yield growth on both types of land but stronger on private land.

IV. Conclusions

Agricultural development in the late-Tsarist Empire contradicts the traditional idea of a Russian *sonderweg* rooted in long-lasting peculiarities of that country's rural institutions — but especially the peasant commune. We have shown that on average, crop yields on common peasant land developed and evolved similarly to those on private land during the years 1892-1913. Slightly more than 90% of the observed yield growth on private land was realized on communal peasant lands. Our results suggest that peasant agriculture continued to develop dynamically during the Late-Tsarist period and that communal farming was most assuredly not an obstacle to adjustment and growth (Gatrell 1994, pp. 37-54). This evidence corresponds to findings about yield growth on common fields and enclosures in early modern England. Moreover, our results are consistent with a pan-European picture of agricultural change during the era of early industrialization. Due to demand patterns of urban population, 19th century industrialization was a golden age of labor-intensive family farming which, in many European regions, outcompeted more extensive large-scale capitalist farming based on wage labor.

Our findings make a further case for the recent paradigm shift in modern development economics and economic history. Instead of considering the peasant economy an obstacle to economic growth, peasants are now regarded as potential agents of market-oriented, dynamic agricultural development. The late-Imperial Russian case is of interest especially from the perspective of recent debates on the necessary conditions of effectively working commons (Ostrom 1990; Bromley 1992, 2008a). There was a wide range of organizational patterns in which Russian peasant communes regulated their affairs. This was partly due to various forms of serfdom (until 1861), and partly due to regional conditions of the rural economy. In the less fertile Central and Northwest Russia, with a long tradition in proto-industrial and industrial manufacturing, peasants (mainly state tenants) largely had to deliver pecuniary obligations (*obrok*), while the peasants on noble estates in the highly fertile black-soil-regions mainly paid labor dues (*barshina*). Mixed forms of obligations were also common (Cerman 2012, pp. 17-18, pp. 82-83, p. 123; Leonard 2011, pp. 36-37). It can be assumed that peasant communes, bearing primarily pecuniary obligations, possessed greater flexibility in managing their resources, and in meeting their financial obligations. Having a relatively long period of adaptation to a more commercial and diversified economic environment even before 1861, the flexibility of common fields provided peasant farmers with the opportunity to quickly react to the rising urban demand for livestock and dairy products in the late 19th century. In this

respect, farmers in non-black-soil provinces differed little from farmers in other European countries during industrialization. Regarding the black-soil provinces, it can be inferred that a more direct intervention of the noble gentry into communal affairs, and the persistence of clearly defined tenurial obligations obstructed adaptation and the ensuing development of effectively managed peasant commons. These circumstances likely affected peasant communities even after the abolition of serfdom.

While the relation between certain traditions of serfdom and peasant adaptability to market developments after the reform of 1861 requires further research, our results allow tentative but seemingly robust insights regarding development perspectives of communal agriculture in late-Imperial Russia. Among development economists there is a growing consensus about "community" and "market" being potentially compatible with each other. Moreover, it is conceivable that their successful combination (integration) allows for solutions in accordance with sound economic principles. Both principles are considered to be complementary — especially in early stages of economic development in the presence of weak or dysfunctional institutions (Bromley, 2006; Bromley and Anderson, 2012). In many developing societies, effective working and flexible village communities even happened to be the only working framework to lower costs of market transactions and to take risks of larger investments into agriculture (Bromley, 2008b). Thus, communal management of resources can contribute to the establishment of functional markets (Aoki and Hayami 2001; Hayami 1998a, 1998b). The implications of our findings are in line with this argument. Our approach transcends the neoclassical view that Russian peasants circumvented inefficient rules inherent to all kinds of communal farming, and grudgingly adapted the "inferior institution" of the peasant commune to their needs (Gregory 1994, pp. 49-52; North 1990). However, bypassing inefficient rules normally goes along with high transaction costs which on their part negatively affect growth. In showing high and/or above-average yield growth on peasant land, our findings suggest that the standard apologias for textbook models are suspect. In some Russian regions, peasant communes represented effective and adaptive institutional arrangements that offered peasants a comparative advantage compared to other institutional settings available at the time.

To bolster the explanatory range of our findings, future research should include livestock farming, which in Russia (as elsewhere in 19th-century Europe) was a peasant domain. Between 1890 and 1913, prices of livestock and dairy products increased much more rapidly than grain prices, thereby leading peasants to switch from grain cultivation to intensive animal farming. Especially in regions close to urban markets, expanding demand by the urban-

industrial classes for high value-added livestock and dairy products stabilized commercially active peasant communities (Gatrell 1986, p. 135; Koval'chenko 2004, p. 284; Löwe 1987, pp. 70-82). Hence, we suggest that further research will shift results even more in favor of communal farming. Although this hypothesis must still to be tested, we have grounds to state that the dynamics of peasant farming in late-Imperial Russia were not much different from those in Western, Northern and Central Europe where peasant farming out-competed large estate farming on the basis of high and rising domestic demand. This also holds important implication for the evaluation of agricultural policy in the late Imperial period. Knowing that institutional change played a minor role even in Prussia, whose famous agrarian reforms served as a role model for late-Imperial Russian reformers (Kopsidis, Wolf 2012), one could suggest that the form of land tenure has been much less important for yield growth and agricultural (and general economic) development in Russia than is widely assumed.

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Appendix

Data Sources

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Tables

Table A.1a: Share of yields on open land in yields on private land (= 100%, in per cent)

	Winter wheat			Spring wheat		
	1892/96	1909/13	Diffe-rence*	1892/96	1909/13	Diffe-rence*
Novorossiia	72	70	-3	78	75	-2
Southwest Region	89	89	0	74	84	10
Malorossiia	84	86	2	77	79	1
Central Agricultural Region	87	73	-14	71	78	6
Middle Volga	89	96	7	78	76	-2
Lower Volga	-	-	-	87	78	-10
Central Industrial Region	91	85	-6	87	83	-4
Belorussia	91	78	-13	100	97	-3
Priozernyi	75	71	-4	92	98	6
Lithuania	90	82	-7	83	90	6
Baltic Region	88	92	3	81	80	0
Urals	-	-	-	102	91	-11
Far North	-	-	-	84	85	1
European Russia	81	80	-1	80	78	-1
Range	*72-91*	*70-96*		*71-102*	*75-98*	
	Winter rye			Spring rye		
	1892/96	1909/13	Diffe-rence*	1892/96	1909/13	Diffe-rence*
Novorossiia	71	64	-7	67	56	-11
Southwest Region	95	98	3	76	74	-2
Malorossiia	87	80	-7	72	73	1
Central Agricultural Region	82	75	-7	80	81	1
Middle Volga	83	77	-6	74	89	15
Lower Volga	79	75	-3	85	82	-3
Central Industrial Region	85	83	-2	63	78	14
Belorussia	85	82	-3	76	95	19
Priozernyi	81	81	0	83	105	23
Lithuania	90	84	-6	74	91	16
Baltic Region	76	89	13	86	79	-7
Urals	87	75	-12	81	83	2
Far North	93	91	-2	-	-	-
European Russia	85	79	-6	82	86	4
Range	*71-95*	*64-98*		*63-86*	*56-105*	

Sources: own calculation, for data sources see Appendix.

Notes: *Numbers are rounded off and up.

Table A.1b: Share of yields on open land in yields on private land (= 100%, in per cent)

	Barley			Oats		
	1892/96	1909/13	Difference*	1892/96	1909/13	Difference*
Novorossiia	82	80	-2	82	75	-7
Southwest Region	90	93	3	86	88	3
Malorossiia	86	76	-10	88	81	-7
Central Agricultural Region	82	69	-13	79	76	-3
Middle Volga	96	99	3	78	79	1
Lower Volga	95	84	-11	83	78	-5
Central Industrial Region	88	91	3	87	87	0
Belorussia	87	87	0	96	90	-5
Priozernyi	95	89	-6	86	87	0
Lithuania	91	86	-6	93	88	-4
Baltic Region	80	91	11	75	89	13
Urals	96	91	-4	86	81	-5
Far North	-	-	-	91	95	3
European Russia	82	81	-1	85	78	-7
Range	*80-96*	*69-99*		*75-96*	*75-95*	

	Potatoes			Flax		
	1892/96	1909/13	Difference*	1892/96	1909/13	Difference*
Novorossiia	104	100	-3	77	77	0
Southwest Region	92	91	-1	84	97	12
Malorossiia	88	82	-6	86	85	-1
Central Agricultural Region	88	86	-1	71	70	-1
Middle Volga	90	87	-3	77	75	-3
Lower Volga	93	94	1	78	86	8
Central Industrial Region	90	92	2	96	97	1
Belorussia	85	82	-3	118	102	-16
Priozernyi	84	93	9	101	104	3
Lithuania	85	84	-2	102	96	-6
Baltic Region	84	100	16	96	90	-5
Urals	98	103	6	79	71	-8
Far North	104	104	0	90	95	5
European Russia	86	87	1	78	82	4
Range	*84-104*	*82-104*		*71-118*	*70-104*	

Sources: own calculation, for data sources see Appendix.
Notes: *Numbers are rounded up and off.

Table A.2a: Growth of grain yields on open fields as share of grain yield growth on private land (=1.00), 1892-1913 (ranking list)*

	share**		share**
Astrakhan'	4.86	Khar'kov	0.86
Estland	4.56	Kherson	0.85
Saratov	2.72	Poltava	0.84
Samara	1.84	Kovno	0.84
Orenburg	1.53	Ekaterinoslav	0.79
Bessarabia	1.37	Voronezh	0.76
Kiev	1.30	Riazan'	0.71
Kurland	1.28	Vilno	0.71
Pskov	1.24	Tula	0.70
St. Petersburg	1.12	Moscow	0.69
Vologda	1.05	Orel	0.63
Olonets	1.04	Kursk	0.62
Volyniá	1.00	Tauride	0.62
Vladimir	0.99	Smolensk	0.59
Minsk	0.98	Chernigov	0.58
Vitebsk	0.93	Kaluga	0.45
Don	0.93	Perm'	0.41
Grodno	0.91	Kostroma	0.36
Archangel	0.91	Nizhnii Novgorod	0.27
Mogilev	0.90	Tambov	0.14
Podoliá	0.89	Kazan'	0.06
Novgorod	0.88	Penza	0.00

Sources: own calculation, for data sources see Appendix.
Notes: * the average grain yield is calculated by dividing for every year the added up total crop of winter wheat, summer wheat, winter rye, summer rye, barley, and oats by the sown area in total for these six crops (total harvest of six grains / sown area of six grains). **(share = annual growth rate on open fields / annual growth rate on private land). Due to the fact that in Tver, Simbirsk, Viatka, Yaroslavl, and Ufa growth of yields on open fields was negative and in Livland on private land these six provinces could not be considered.

Table A.2b: Growth of crop yields on open fields as share of crop yield growth on private land (=1.00), 1892-1913 (ranking list)*

	share**		share**
Astrakhan'	4.62	Kursk	0.93
St. Petersburg	3.85	Vladimir	0.89
Estland	2.68	Grodno	0.88
Saratov	2.25	Minsk	0.85
Kurland	2.06	Voronezh	0.85
Orenburg	1.71	Mogilev	0.80
Samara	1.64	Don	0.79
Livland	1.48	Yaroslavl'	0.76
Tver'	1.44	Nizhnii Novgorod	0.76
Vitebsk	1.34	Poltava	0.75
Bessarabia	1.31	Archangel	0.75
Pskov	1.31	Podoliá	0.74
Kaluga	1.26	Chernigov	0.72
Volyniá	1.15	Ekaterinoslav	0.71
Kiev	1.12	Orel	0.68
Novgorod	1.10	Smolensk	0.66
Moscow	1.07	Penza	0.66
Olonets	1.06	Tambov	0.65
Vologda	1.06	Riazan'	0.62
Kovno	1.05	Tauride	0.55
Tula	1.00	Simbirsk	0.53
Kostroma	1.00	Vilno	0.48
Kherson	0.95	Kazan'	0.43
Khar'kov	0.95	Ufa	0.09

Sources: own calculation, for data sources see Appendix.
Notes: * the average crop yield is calculated by dividing for every year the added up total crop of winter wheat, summer wheat, winter rye, summer rye, barley, and oats, potatoes, corn, millet, buckwheat, peas, flax and hemp by the sown area in total off all 13 crops (total harvest of 13 crops / sown area of 13 crops). **(share = annual growth rate on open fields / annual growth rate on private land). Due to the fact that in Perm the growth of yields on private land and in Viatka on open fields was negative these two provinces could not be considered.

Table A.3a: Annual crop yield growth on all land, 1892-1913 (1.0 = 1%)*

	winter wheat	spring wheat	winter rye	spring rye	barley	oats	potatoes
Novorossiia	2.16	0.67	1.01	1.70	0.77	1.61	0.29
Southwest Region	1.90	0.67	1.72	0.72	2.29	2.45	0.87
Malorossiia	1.22	1.42	1.67	1.74	1.21	2.05	1.30
Central Agricultural Region	1.50	1.49	0.62	0.15	0.38	2.47	0.80
Middle Volga	0.29	-0.21	-0.29	-0.15	0.54	0.88	1.20
Lower Volga	--	-0.91	-0.57	-2.40	-1.16	-1.94	0.61
Central Industrial Region	0.56	0.66	-0.51	-0.10	1.71	1.15	0.37
Belorussia	0.83	0.69	0.77	0.78	1.29	0.34	0.32
Priozernyi	2.53	0.18	0.83	0.55	1.10	0.45	1.02
Lithuania	1.22	0.78	1.30	0.97	1.57	1.94	0.77
Baltic Region	0.70	0.08	0.68	-0.01	0.27	0.90	1.26
Urals	1.72	0.21	0.03	0.52	0.26	-0.25	-0.24
Far North	--	0.66	0.02	0.64	1.10	0.55	0.87
European Russia	*1.70*	*0.34*	*0.52*	*0.28*	*0.94*	*1.19*	*0.71*

	corn	millet	buckwheat	peas	flax	hemp
Novorossiia	2.19	0.42	3.95	0.84	2.31	2.92
Southwest Region	1.81	2.65	3.88	1.14	1.31	1.89
Malorossiia	0.90	1.59	2.88	0.17	0.96	1.77
Central Agricultural Region	--	0.85	2.06	-0.12	1.67	2.58
Middle Volga	--	0.70	2.27	0.61	1.78	3.40
Lower Volga	--	0.52	4.29	0.38	0.28	1.78
Central Industrial Region	--	-1.38	0.91	0.89	0.82	0.03
Belorussia	--	0.69	1.88	0.73	0.87	0.26
Priozernyi	--	--	0.88	1.16	2.49	0.34
Lithuania	--	0.82	2.42	0.17	1.28	-0.61
Baltic Region	--	--	1.34	1.31	1.25	0.70
Urals	--	1.32	1.39	1.45	-0.08	0.83
Far North	--	--	--	1.23	1.27	0.82
European Russia	*2.01*	*1.11*	*2.55*	*0.94*	*0.82*	*1.98*

Sources: own calculation, for data sources see Appendix.

Table A.3b: Crop yield growth on open fields, 1892-1913 (1.0 = 1%)*

	winter wheat	spring wheat	winter rye	spring rye	barley	oats	potatoes
Novorossiia	2.04	0.44	0.52	1.16	0.62	1.15	0.22
Southwest Region	1.80	1.29	1.76	0.78	2.35	2.60	0.79
Malorossiia	1.46	1.45	1.55	2.48	0.97	1.90	1.13
Central Agricultural Region	1.14	1.57	0.37	-0.05	0.05	2.48	0.76
Middle Volga	1.32	-0.57	-0.57	0.12	0.71	0.83	1.07
Lower Volga	--	-1.33	-0.82	-2.25	-1.34	-2.21	0.49
Central Industrial Region	0.26	0.59	-0.51	0.40	1.77	1.14	0.41
Belorussia	0.53	0.58	0.71	1.17	1.31	0.22	0.17
Priozernyi	3.58	0.29	0.88	0.72	0.95	0.50	1.14
Lithuania	1.03	0.87	1.21	1.61	1.50	1.83	0.71
Baltic Region	0.76	0.33	1.11	0.45	0.60	1.33	1.70
Urals	1.73	0.12	-0.09	0.51	0.26	-0.33	-0.14
Far North	--	0.67	-0.10	0.62	1.24	0.55	0.90
European Russia	1.62	0.15	0.37	0.38	0.84	1.00	0.68

	corn	millet	buckwheat	peas	flax	hemp
Novorossiia	2.08	0.19	3.94	0.88	2.20	2.79
Southwest Region	2.21	2.73	3.89	0.75	1.58	2.09
Malorossiia	1.35	1.44	2.79	0.63	0.96	1.81
Central Agricultural Region	--	0.56	2.01	0.08	1.97	2.58
Middle Volga	--	0.54	2.37	0.65	1.78	3.41
Lower Volga	--	0.31	4.39	0.70	0.54	1.76
Central Industrial Region	--	-1.52	0.95	1.01	0.82	-0.01
Belorussia	--	0.69	2.03	0.69	0.65	0.22
Priozernyi	--	--	0.89	1.14	2.52	0.36
Lithuania	--	0.75	2.48	0.16	1.16	-0.64
Baltic Region	--	--	1.43	1.24	1.29	0.93
Urals	--	1.15	1.15	0.81	-0.15	0.73
Far North	--	--	--	1.31	1.28	0.81
European Russia	2.02	1.02	2.49	0.81	0.95	1.99

Sources: own calculation, for data sources see Appendix.

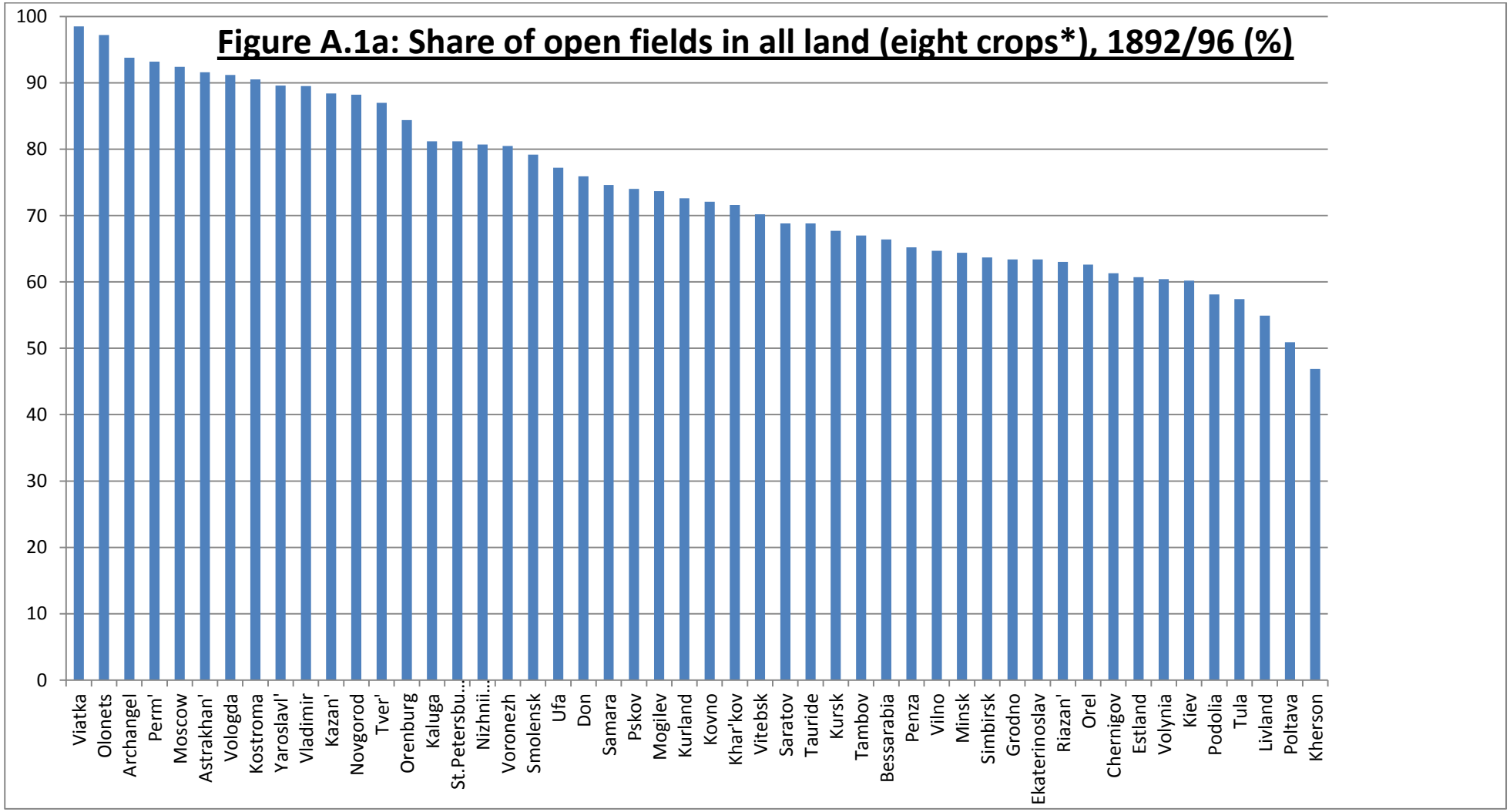
Table A.3c: Crop yield growth on private lands, 1892-1913 (1.0 = 1%)*

	winter wheat	spring wheat	winter rye	spring rye	barley	oats	potatoes
Novorossiia	2.21	0.72	0.98	1.92	0.81	1.73	0.52
Southwest Region	2.01	0.42	1.64	1.36	2.10	2.33	0.94
Malorossiia	1.46	1.56	2.11	1.78	1.75	2.39	1.69
Central Agricultural Region	1.71	1.02	1.08	0.37	1.05	2.49	0.85
Middle Volga	0.48	-0.43	0.38	-0.77	-0.18	0.77	1.32
Lower Volga	--	-0.48	-0.35	-2.33	-0.99	-1.79	1.07
Central Industrial Region	1.14	0.77	-0.23	-1.29	1.66	1.24	0.23
Belorussia	1.22	0.73	0.96	0.07	1.32	0.55	0.52
Priozernyi	1.93	-0.25	0.98	-0.42	1.31	0.38	0.65
Lithuania	1.44	0.53	1.65	0.33	1.96	2.05	0.85
Baltic Region	0.56	-0.07	0.30	0.12	-0.04	0.53	0.66
Urals	1.74	0.50	0.64	0.08	0.52	-0.35	-0.59
Far North	--	0.76	0.16	--	1.03	0.46	0.63
European Russia	*1.80*	*0.36*	*0.87*	*-0.12*	*0.97*	*1.50*	*0.68*

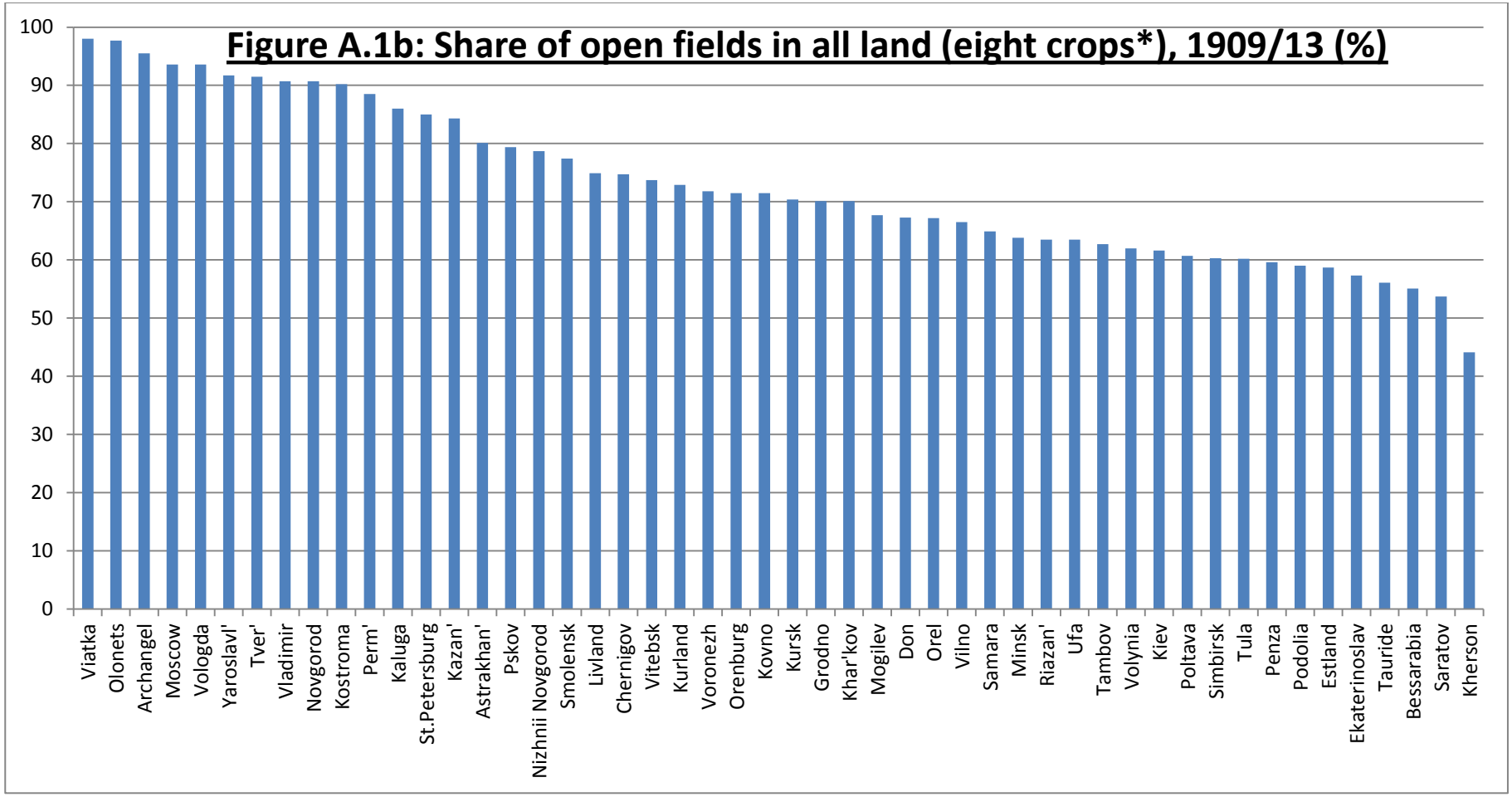
	corn	millet	buckwheat	peas	flax	hemp
Novorossiia	2.21	0.63	4.20	1.04	2.11	3.36
Southwest Region	1.26	2.48	3.73	1.55	1.17	1.03
Malorossiia	0.89	2.01	3.31	-0.42	1.42	1.78
Central Agricultural Region	--	1.22	2.23	-0.05	1.69	2.44
Middle Volga	--	0.61	2.10	0.38	1.88	2.91
Lower Volga	--	0.38	3.46	-0.63	0.03	1.73
Central Industrial Region	--	-0.80	0.92	0.73	0.86	0.34
Belorussia	--	0.44	1.63	0.45	1.55	0.53
Priozernyi	--	--	0.89	1.24	2.42	-0.61
Lithuania	--	1.48	2.19	-0.01	1.74	-0.40
Baltic Region	--	--	0.95	1.45	1.67	-1.01
Urals	--	1.47	2.32	2.52	1.01	1.22
Far North	--	--	--	1.08	1.45	0.66
European Russia	*1.93*	*1.09*	*2.79*	*0.94*	*0.93*	*1.78*

Sources: own calculation, for data sources see Appendix.

Figures

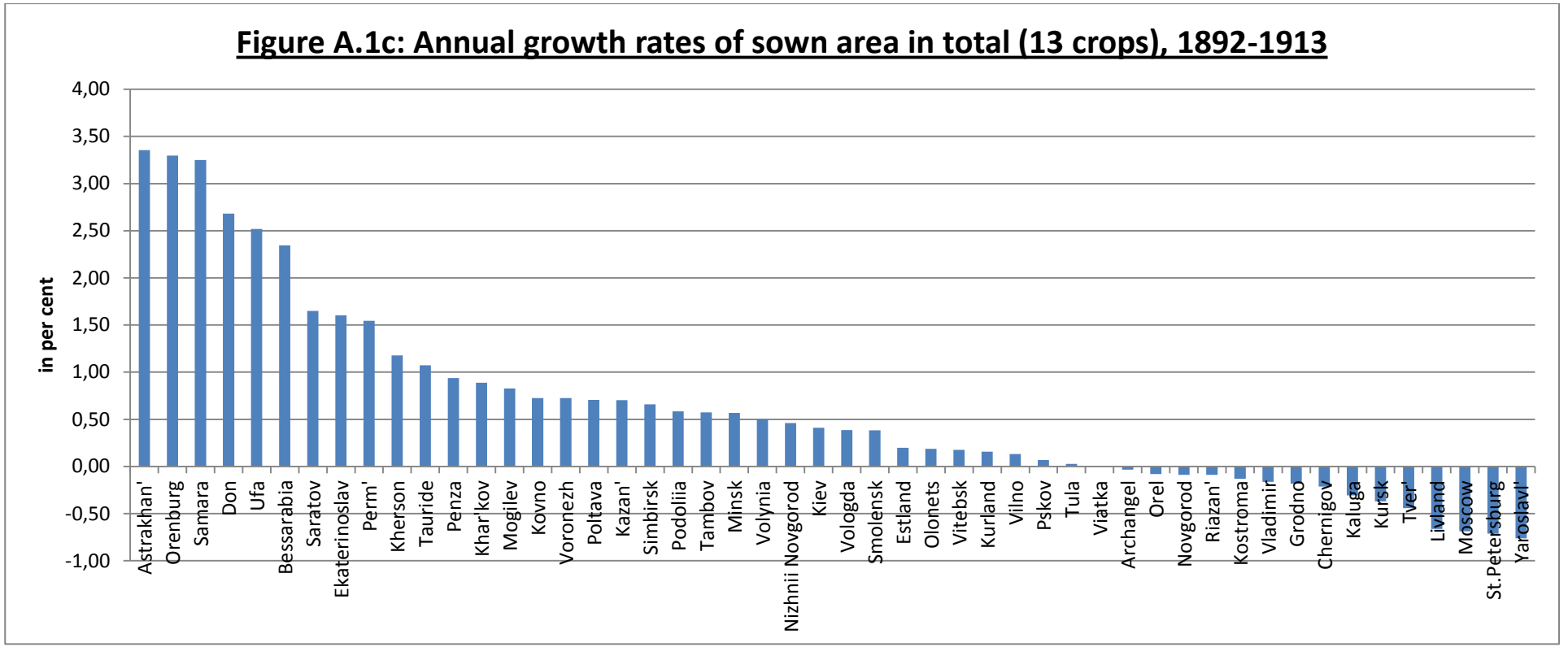


Sources: own calculation, for data sources see Appendix. *Notes*: *winter wheat, spring wheat, winter rye, spring rye, barley, oats, potatoes, flax.



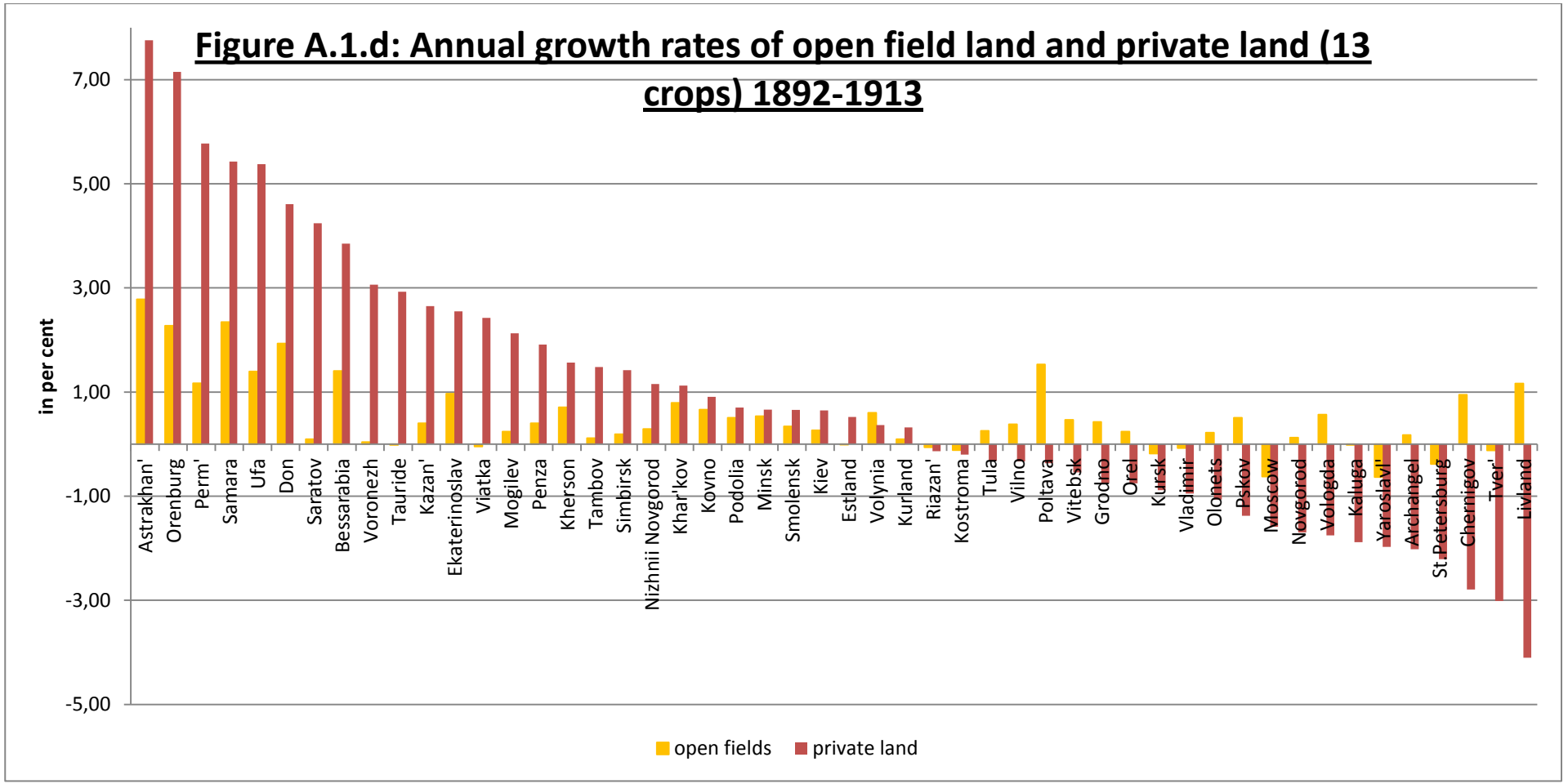
Sources: own calculation, for data sources see Appendix.

Notes: *see figure A.1a.



Sources: own calculation, for data sources see Appendix.

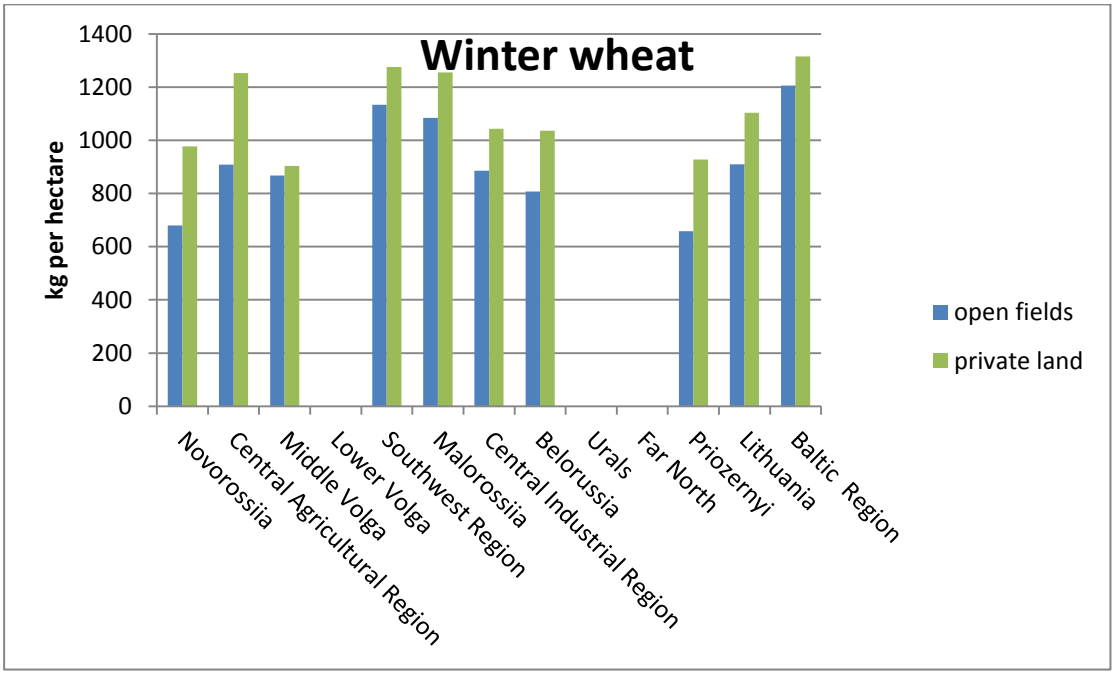
Notes: *winter wheat, spring wheat, winter rye, spring rye, barley, oats, potatoes, corn, millet, buckwheat, peas, flax, and hemp.

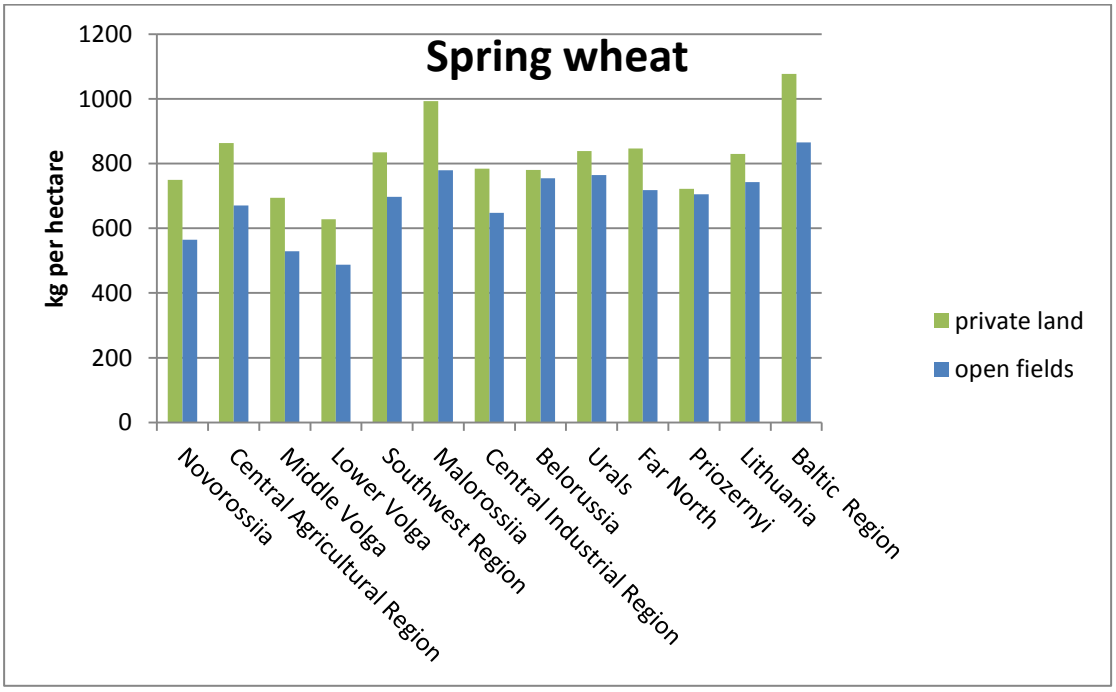


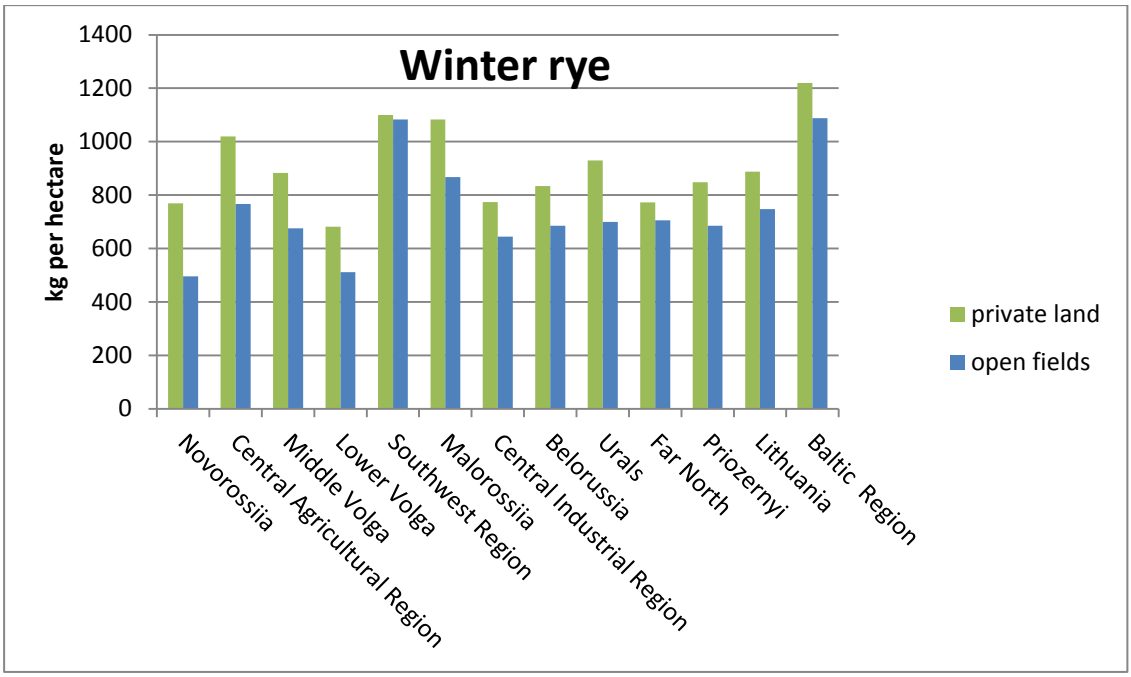
Sources: own calculation, for data sources see Appendix.

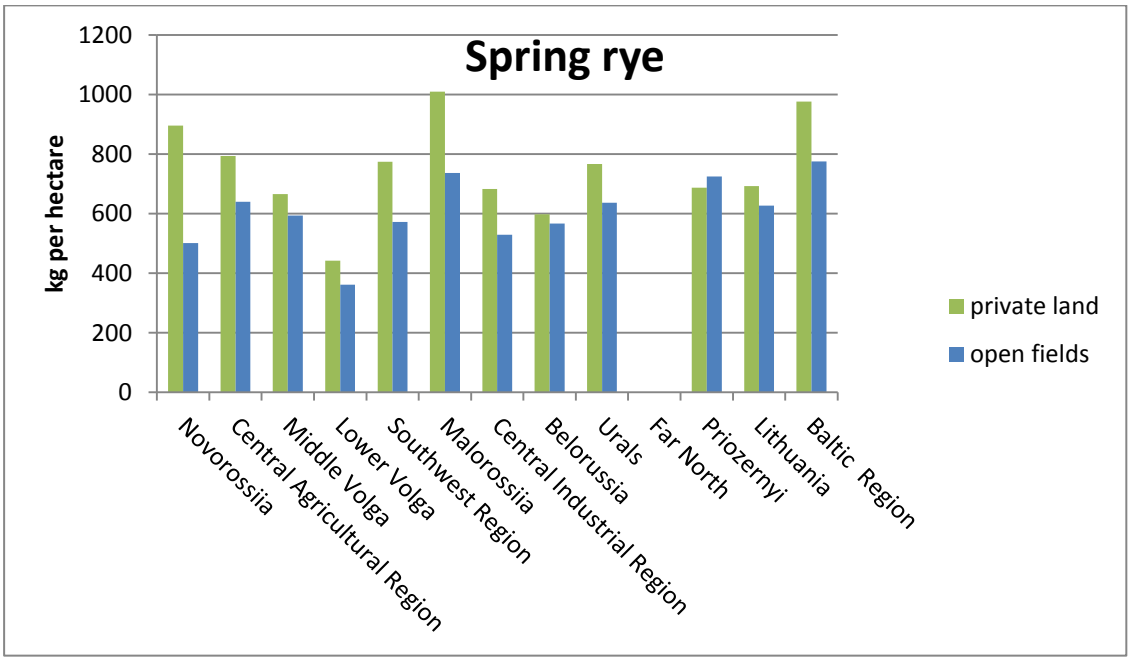
Notes: *winter wheat, spring wheat, winter rye, spring rye, barley, oats, potatoes, corn, millet, buckwheat, peas, flax, and hemp.

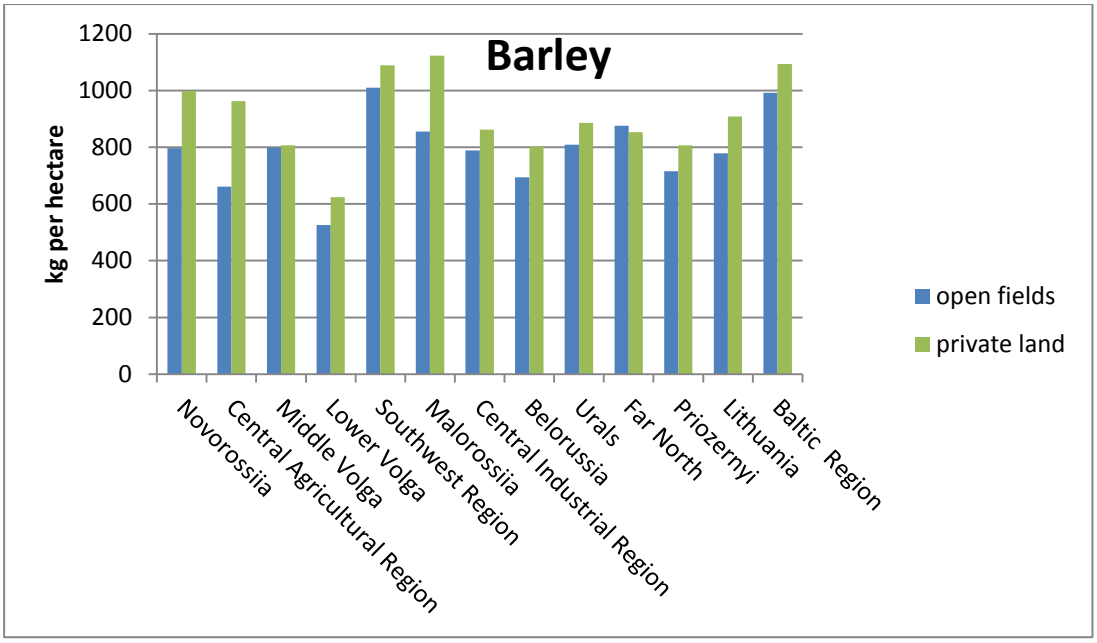
Figure A.2: Average regional yields on open fields and private land for 1909/13

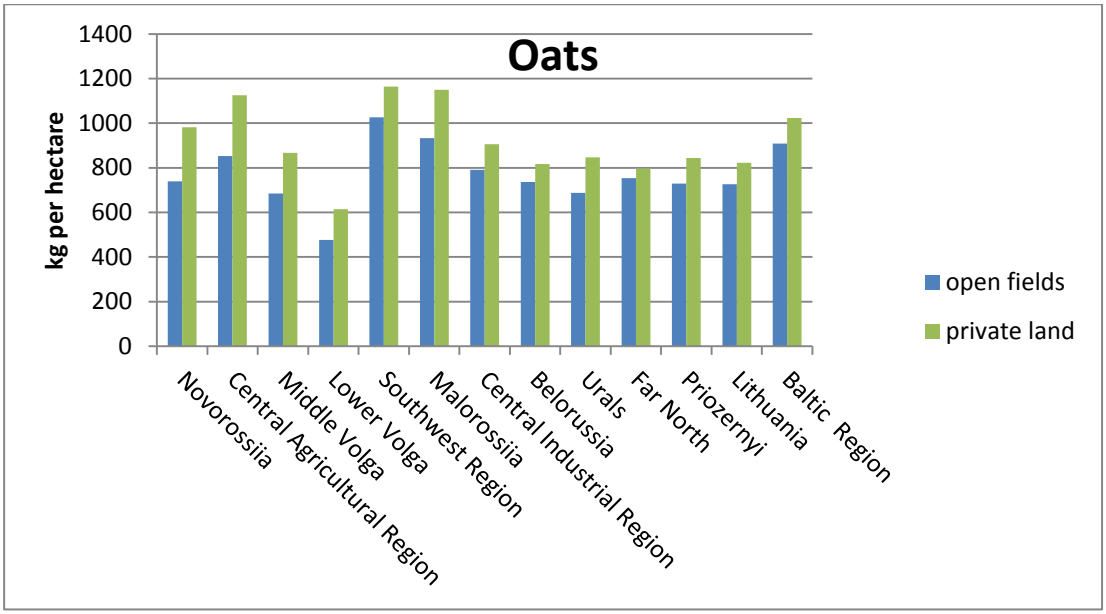


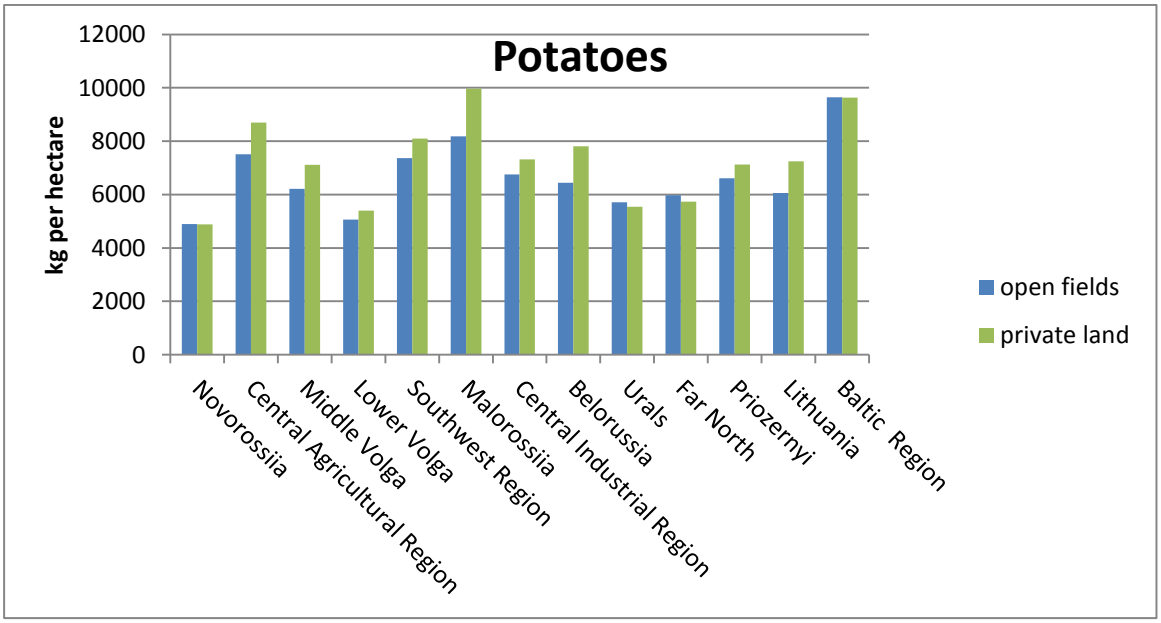


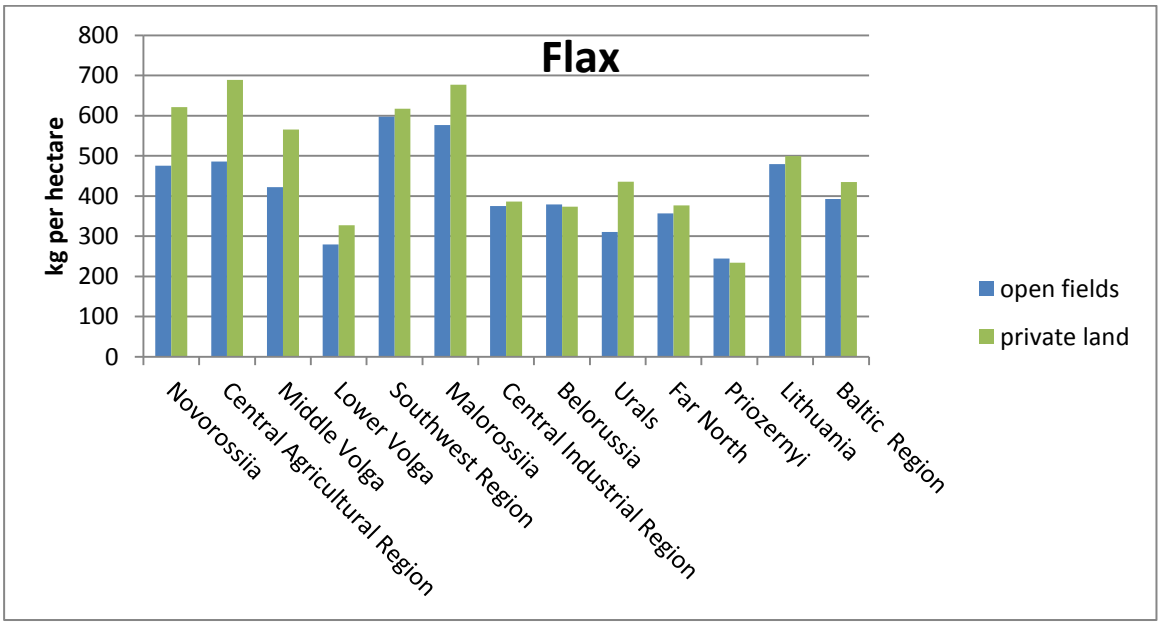

Winter rye
kg per hectare
1400
1200
1000
800
600
400
200
0
Novorossiia
Central Agricultural Region
Middle Volga
Lower Volga
Southwest Region
Malorossiia
Central Industrial Region
Belorussia
Urals
Far North
Priozernyi
Lithuania
Baltic Region
private land
open fields


Spring rye
kg per hectare
1200
1000
800
600
400
200
0
Novorossiia
Central Agricultural Region
Middle Volga
Lower Volga
Southwest Region
Malorossiia
Central Industrial Region
Belorussia
Urals
Far North
Priozernyi
Lithuania
Baltic Region
private land
open fields

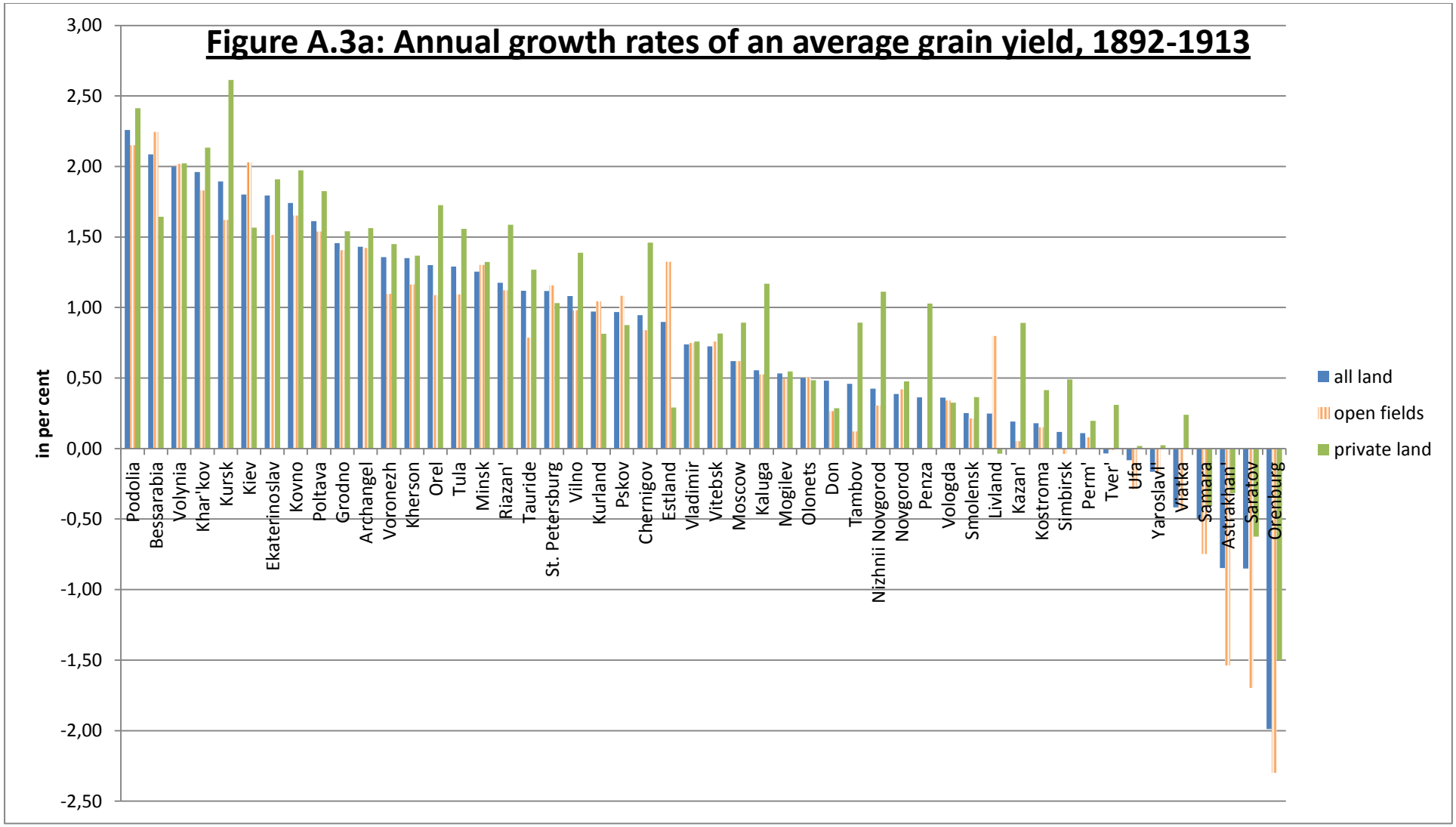

Barley
kg per hectare
1200
1000
800
600
400
200
0
Novorossiia
Central Agricultural Region
Middle Volga
Lower Volga
Southwest Region
Malorossiia
Central Industrial Region
Belorussia
Urals
Far North
Priozernyi
Lithuania
Baltic Region
open fields
private land


Oats
kg per hectare
1400
1200
1000
800
600
400
200
0
Novorossiia
Central Agricultural Region
Middle Volga
Lower Volga
Southwest Region
Malorossiia
Central Industrial Region
Belorussia
Urals
Far North
Priozernyi
Lithuania
Baltic Region
open fields
private land



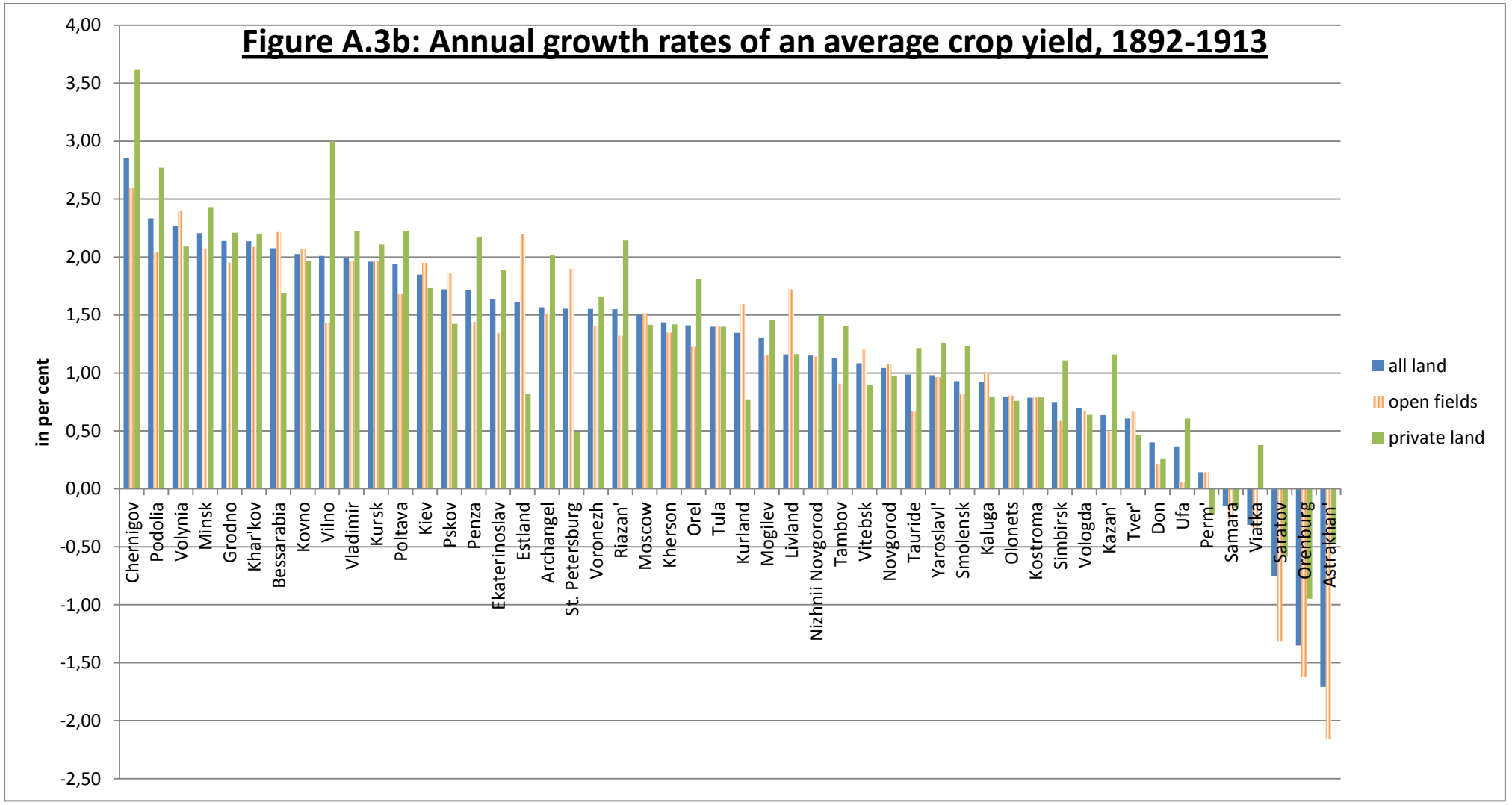


Sources: own calculation, for data sources see Appendix.



Sources: own calculation, for data sources see Appendix.

Notes: see table 12a.



Sources: own calculation, for data sources see Appendix.

Notes: see table 12b.

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