

# The Economic Effects of the Abolition of Serfdom: Evidence from the Russian Empire

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## Abstract

We document a very large increase in agricultural productivity, peasants' living standards, and industrial development in late 19<sup>th</sup> century Imperial Russia as a result of the abolition of serfdom in 1861. A counterfactual exercise shows that if serfs were freed in 1820, by 1913 Russia would have been more than one-and-a-half times richer, compared to what it actually was. We construct a novel province-level panel dataset of development outcomes, and conduct a difference-in-differences analysis of the effects of the abolition of serfdom, relying on cross-sectional variation in the shares of serfs and the timing of the different stages of reform, controlling for unobserved variation across provinces and over time, as well as province-specific development trends. We disentangle the two stages of the abolition of serfdom: the emancipation of serfs and the subsequent land reform. We show that, in contrast to the large positive effect of emancipation, land reform negatively affected agricultural productivity. We provide evidence that a shift to more marketable crops from traditional non-marketable crops is the main mechanism behind the positive effect of emancipation, and the increase in the power of re-partition peasant communes is the main mechanism behind the negative effect of land reform.

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## 1. Introduction

Serfdom, an institution of forced agricultural labor, was widespread in Europe in the Middle Ages. By the early modern period, it disappeared from most parts of Western Europe, while persisting in most parts of Eastern Europe and, in particular, in the Russian Empire, until the mid-19th century. Economists disagree about the role serfdom played in economic development. On the one hand, many scholars, from North and Thomas (1973) to Acemoglu and Robinson (2012), view the relatively early replacement of serfdom by free contractual labor in Western Europe as one of the reasons for the Great Divergence: Both the level and the growth rate of per capita output were systematically higher in Western Europe, compared to Eastern Europe, between 1500 and 1800 (Ogilvie 2013). This literature suggests that the limited rights of serfs over their labor and human capital distorted incentives and discouraged the efficient allocation of resources. On the other hand, a number of recent historical revisionist studies portray serfdom as a dynamic institution that sustained a considerable rate of economic development (e.g., Cerman 2012; Stanziani 2014a). There is little systematic empirical evidence on the effects of the abolition of serfdom, or on whether it contributed to the Great Divergence in Europe. Acemoglu et al. (2011) find a positive effect of the institutional reforms resulting from the French Revolution on economic growth in territories conquered by France during the Napoleonic wars. But, the abolition of serfdom was just one part of a comprehensive reform package.<sup>1</sup>

This paper sheds light on this debate. We are the first to provide systematic empirical evidence of a very large positive effect of the abolition of serfdom on the most important dimensions of economic development in one of the European superpowers of the 19<sup>th</sup> century, the Russian Empire. The magnitude of the effect can be illustrated with a simple counterfactual exercise: Under a set of reasonable assumptions discussed below, Russia would have been more than one-and-a-half times richer by 1913 had it conducted its major emancipation reform in 1820 –

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<sup>1</sup> The example of American slavery in the 19th century is similarly non-conclusive. According to Fogel and Engerman (1974) and Fogel (1989), slave owners in the US managed to organize production in a way that minimized the negative incentive effects of forced labor on productivity. They argue that large cotton, sugar cane, and tobacco slave farms were at least as productive as farms that relied on free laborers, due to better realization of economies of scale and specialization. Recently, Olmstead and Rhode (2008) challenged this view on Antebellum American agriculture, citing biological innovations as an explanation for the relatively high productivity at slave farms.

as was considered by Alexander I and demanded by the “Decemberist” gentry liberals – instead of 1861..

During serfdom, Russia’s serfs were the property of the gentry, who had full formal usage and transfer rights over them. The gentry fully determined the form and the amount of serfs’ labor and obligations, with the expectation – occasionally enforced by the state – that they provide a minimal living standard. Serfdom in the Russian empire remained profitable for the gentry until the very end of its existence. The abolition of serfdom was triggered by the exogenous shock of Russia’s defeat in the Crimean war (1853-1856). The abolition reform had two distinct dimensions: the emancipation itself, which instantaneously granted personal freedom to serfs, and the subsequent land reform, which defined the communal land property rights of the emancipated peasants. The emancipation of serfs occurred in 1861 throughout the empire with the exception of Baltic provinces, where personal freedom had already been granted to peasants between 1816 and 1819. The emancipation transformed serfs into free agricultural entrepreneurs. Their obligations to landlords were first fixed and then completely abolished by the land reform that transferred land rights to peasant communes. The land reform was implemented gradually between 1862 and 1882, with varying rates in different estates.

We estimate the effects of the abolition of serfdom on agricultural productivity, industrial development, and peasant nutrition and mortality. To measure the effect of the emancipation of serfs, we estimate how the provincial development trends diverged post-emancipation depending on pre-emancipation prevalence of serfdom—the share of serfs as compared to formally free rural residents—which varied geographically across Russian provinces. To estimate the effect of the land reform, we use cross-province and over-time variation in the rate with which the land reform was implemented. To address potential endogeneity concerns and mismeasurement in the geographic distribution of serfdom, we rely on exogenous variation in serfdom driven by the nationalization of church lands by Catherine the Great. To address the potential endogeneity of the timing of the land reform, we use the differential incentives of landlords in collateralized versus non-collateralized estates. To conduct our analysis, we assembled a new province-level panel data set, which is the

best source of statistics on the development of Russia in the end of the 18th and throughout the 19th centuries. Our empirical strategy is difference-in-differences, with controls for province and time fixed effects and province-specific trends. As different provinces of Imperial Russia had different development trajectories due to Russia's vast size and, thus, different climatic and soil conditions, controlling for differential trends is essential for identification.

Serfs constituted only 43% of all rural residents in European Russia in 1858. The formally free rural population consisted of state peasants and free agricultural laborers. (We describe legal status of each group in the historical background section.) The composition of the rural population varied greatly across provinces. In 1858, the share of serfs in unemancipated provinces ranged from 0.1% in Arkhangelsk province to 83% in Mogilev province. In our sample, the median province had 50% of its rural population being serfs and the mean province had 45%.<sup>2</sup>

Our main results are as follows: First, our examination of the effect of the abolition of serfdom on agricultural productivity finds that abolition resulted in a significant increase in the ratio of grain yield to seed (henceforth referred to as "grain yield," our best available measure of agricultural productivity). In an average province, where emancipation took place in 1861, the abolition of serfdom led to a 10.3% increase in grain yield, above the overall province-specific development trend over the 19<sup>th</sup> century. This is a large effect, comparable to 35 years of aggregate development: Grain productivity on average increased by 4.4% per decade in 19th century Russia.

Furthermore, we disentangle the effects of the two components of abolition on agricultural productivity: the emancipation per se and the subsequent land reform. We find that the positive effect of abolition is entirely due to emancipation. Obtaining personal freedom by serfs boosted growth in productivity, whereas the land reform significantly slowed it down, leaving the overall effect of abolition positive. The overall effect of abolition on productivity would have been 90% larger if the land reform did not cause the productivity slowdown. We show that the roots of the inefficiency of land reform lie in the re-partition peasant commune, which severely undermined

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<sup>2</sup> The data on the composition of the rural population by province in 1858 come from Bushen (1863). Our results are not affected by whether we also account for a relatively small group of royal peasants, whose legal status was in between of state peasants and serfs.

peasant incentives to invest in land. Our findings support Gerschenkron's (1965) conjecture that the commune was an inefficient institution.

Second, we show that the abolition of serfdom substantially increased the living standards of former serfs. The emancipation had a very large effect on child nutrition: As a result of abolition, the height of draftees from private estates increased by 1.7 centimeters on average compared to what it was before emancipation.

Third, we find a significant positive effect of abolition of serfdom on the industrial development of Russia's provinces. In an average province, industrial output increased by 2.7 times and industrial employment increased by 3.6 times as a result of abolition. This is a very large effect, especially given Gerschenkron's (1965) conjecture about the negative effect of the communal system of land titles on the post-emancipation mobility of peasants to urban areas. This implies that the effect would have been even greater if the land titles were individual rather than communal.

Finally, we test for several alternative potential mechanisms behind the effects of abolition on agricultural productivity. We find that the peasants' liberation hastened the transition from traditional methods of growing non-marketable crops, such as winter rye, to modern methods of cultivating more marketable crops, such as summer wheat. This shift is arguably due to a better post-abolition incentive structure.

Our results are robust to a battery of sensitivity tests. We test for and find no evidence of pre-trends, which could potentially bias difference-in-differences estimates. The results are also robust to controlling for a large number of potential confounds as well as alternative data source for the prevalence of serfdom. OLS and IV estimates are similar qualitatively, although IV estimates are often larger in magnitude, which could be explained by the presence of a measurement error.

Our paper contributes to several strands of economic and historical literatures. First, we contribute to the literature on institutions and divergence in historical economic development across the globe (Acemoglu and Johnson 2005, Banerjee and Iyer 2005, Nunn 2009, Acemoglu et al. 2010, Tabellini 2010, Bruhn and Gallego 2012, Michalopoulos and Papaioannou, Ogilvie 2014). Our results support the hypothesis of a positive effect of early disappearance of serfdom on the rise of

Western Europe. Our findings also contribute to the literature on the efficiency of forced labor and its effects on economic development. While Acemoglu et al. (2012), Nunn (2008), Miller (2009), Dell (2010), Nunn and Wantchekon (2011) and Bertocchi and Dimicio (2014) focus on the longer-term effects of forced labor through its effects on institutional development, we address the question of the effects of the abolition of Russia's serfdom on development during the half century following the reform. The evidence presented is consistent with the main channel – the change in the economic incentives of peasants as a result of the emancipation – through which the abolition of serfdom had its positive effects.

Furthermore, our findings resolve the debate on the effects of serfdom and of the 1861 emancipation reform on Russian economic development in the 19<sup>th</sup> century. Similar to the discussion on the effect on serfdom on European development, there are two views on Russian serfdom. On the one hand, Gerschenkron (1962, 1965) argued that serfdom substantially slowed down Russian economic growth. Koval'chenko (1967) shared this view and argued that serfdom was even unprofitable for nobility during its last several decades. In contrast, Moon (1996), Mironov (2010), Dennison (2006, 2011) and Stanziani (2014a and 2014b) argue that landlords guaranteed and enforced social order, accumulated resources to launch new projects when access to credit was limited, provided minimum food consumption to peasants during famines, and adopted new technologies. Domar and Machina (1984) provided case studies suggesting that serfdom remained profitable for the gentry until its very end. The arguments in this debate prior to our paper were based primarily on sporadic anecdotal evidence.

We also contribute to a recent literature on the economic history of the Russian Empire that uses systematic data analysis. The most important contributions to date are Nafziger (2013) and Buggle and Nafziger (2015), who study the long-term effects of serfdom using cross-sectional variation in shares of serfs before the emancipation at the district (*uezd*, the-second-tier-administrative-division) level. Nafziger (2013) documents a significant cross-sectional correlation between the variation in the prevalence of serfdom and the long-term land inequality. Buggle and Nafziger (2015) find a negative effect of serfdom on modern wellbeing. They argue that persistence

in development was driven by a negative effect of serfdom on agglomeration and local spillovers that perpetuated themselves over time. We use panel data and explore the effect of abolition during the 19<sup>th</sup> century, i.e., about fifty years following the reform. We find that provinces with larger prevalence of serfdom shifted their development trajectories to faster paths after the abolition of serfdom. Combining the results of our paper with the findings of Bugge and Nafziger (2015) suggest that serfdom had negative effect on development and that the emancipation reversed a substantial part of this influence.<sup>3</sup> Our findings on industrial development relate to those of Nafziger (2012), suggesting that former serfs increased off-farm activities after emancipation.

Finkel et al. (2015) estimate the effect of emancipation of Russia's serfs on peasants' rebellions and found a significant increase in protest activity by peasants after their liberation. Our finding of a sharp increase of serfs' wellbeing as a result of emancipation are consistent with the conjecture of Finkel et al. (2015) that peasant riots were a result of a mismatch between expectations and the realization of reform, rather than a deterioration in peasants' wellbeing. Castañeda Dower et al. (2015) find a negative link between the peasants' unrest induced by the abolition of serfdom and subsequent political liberalization, initiated by the government.

Our finding on the negative effect of the peasant commune corroborates the evidence presented by Chernina et. al. (2014) and Castañeda Dower and Markevich (2013), who show that rural-urban migration and agricultural productivity increased when the Stolypin reform of 1906 granted peasants the right to exit the commune.

The paper proceeds as follows: In Section 2, we provide the historical background; Section 3 presents our hypotheses; in Section 4, we describe the data; Section 5 presents the empirical strategy; Section 6 reports the results. In Section 7, we present evidence to differentiate between the potential mechanisms. In Section 8, we describe a number of robustness checks. Section 9 concludes.

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<sup>3</sup> Bugge and Nafziger (2015) were the first to use an exogenous variation prevalence of serfdom coming from the nationalization of the monasterial lands a century before the emancipation of serfs. We also rely on the historical distribution of monasterial lands for our instrumental variable strategy, but our identification assumptions are substantially weaker due to a panel nature of the data we use, which allow controlling for province fixed effects and province-specific trends in contrast to the cross-sectional data used in Bugge and Nafziger (2015).

## 2. Historical background

### 2.1. *Serfdom in Russia: an overview*

Serfdom was one of the key institutions in Russian history. It existed in its most severe form between 1649 and 1861 (i.e., 212 years). Originally, Russian peasants were free and could migrate across estates. The government began to limit the right of migration in the late 16th century. The 1649 Code of Law (*Sobornoye Ulozhenie*) proclaimed that peasants were the property of their estates and made migration out of the estates a criminal offence. Peasants became attached to the land and had to obey the orders of their landlords.<sup>4</sup> Serfs had to carry out duties and obligations in various forms for their landlords. The landlords had (almost) full discretion over the amount and the form of these obligations. The minimal constraints on these obligations came from local customs and the state's requirement to provide minimum living standards to the peasants.<sup>5</sup> Without landlord's special permission, serfs could not leave the estate even temporarily (for example, to work in a city). The landlords also had the right to sell, to buy, or to lease their serfs.<sup>6</sup> Serfs did not have property rights over the means of production. In particular, the landlords had full property rights over the land, which serfs cultivated.

Traditionally, there were two alternative organizational types of serfdom: *corvee* [*barshchina*], in which serfs paid their duties to the landlord in labor working at the landlord's farm, and *quitrent* [*obrok*], in which peasant households were allocated land plots, which they cultivated individually, and paid duties to the landlord in cash or in kind from the proceeds of this cultivation. The landlords had full discretion over the organizational structure of the estate, the type and

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<sup>4</sup> Even retroactively, the peasants, who fled from their estates before 1649, were ordered to return.

<sup>5</sup> In extreme cases of starvation and torture of serfs by landlords, the state could (and sometimes did) take private estates into external management. For example, in 1849 the government operated 180 private estates because of torture and another 88—less than one-quarter of a percent of all estates—because of wastefulness (*Statisticheskie ...* 1852).

<sup>6</sup> In the second half of 18th century, when Russian serfdom reached its apogee under the reign of Catherine II, the nobility held the right to sell serfs without families like slaves. Before and after this period serfs could be bought or sold only as a part of the estate, i.e., with their families and the land they were attached to.

magnitude of labor duties, the amount of quitrent, as well as the size of plots provided to peasants; furthermore, any of these terms could be revised at any time.<sup>7</sup>

Serfdom was associated with severe incentive problems. Under both corvee and quitrent, the peasants' effort and its proceeds were largely unobservable to the landlord as monitoring was costly. In addition, the lack of credible commitment on the part of the landlord not to revise the size of quitrent or labor obligations in the future reduced peasant effort due to the ratchet effect. Anecdotal evidence suggests that some landlords were able to commit to a fixed amount of quitrent, maximizing the stream of payments over a longer-term horizon; however, this was not a common practice (Dennison 2011). In addition to the incentive problems of serfdom, which caused lower peasant effort in production, serfdom was associated with adverse incentives for peasants to invest in their own human capital or in land (both of which belonged to the landlord). Restricted peasant mobility also implied lower industrial development, as labor could not move to the more productive industrial sector from agriculture.

## *2.2. Geographical variation in serfdom in the mid-19<sup>th</sup> century*

Our data cover the provinces of the European part of the Russian Empire, excluding Poland and Finland, which was the home of the eighty percent of the total population of the empire. The map is presented on Figure 1. The empire was predominantly agricultural in the 19th century: In the middle of the century, more than ninety percent of the population lived in rural areas (Bushen 1863). Less than half of all peasants were privately owned serfs. In 1858 in the European part of the empire, there were 22,546,732 serfs out of 52,392,030 rural residents (43.03%). The rest of Russian peasantry was divided into three groups according to their legal status. The dominant group was the state peasants (40.4% of rural population). The two smaller groups were free agricultural workers (12.6%) and royal peasants (4%).<sup>8</sup> State peasants lived on the state land and cultivated land plots allocated to them by the state in exchange for a tax in a form of fixed quitrent. Free agricultural

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<sup>7</sup> Corvee was the dominant type of serfdom: Three-quarters of all serfs worked under the corvee and mixed corvee-quitrent systems. Only about one-quarter worked solely under the quitrent system (Skrebetskii, 1862-1866).

<sup>8</sup> Figures on the rural population and its composition come from the tax censuses of the rural estates. This source gives the best available proxies for the rural population in Russia in the 19th century. These proxies are not perfect, however. The state registered the legal status of people in tax census rather than their actual locations. In practice, some members of rural estates could live in cities for a long period of time. The first population census took place in Russia in 1897.

workers were either landless or had community land titles. The smallest group was comprised of royal peasants, who formally belonged to the royal family, but were managed by a special ministry, which made them *de facto* similar to state peasants under fixed taxation. We describe the legal status of each of these three groups in more detail in the online appendix.

The composition of the rural population and, in particular, the share of serfs, substantially varied across provinces (Nafziger 2013). Figure 2 presents the spatial distribution of serfs across the European provinces of the Russian Empire in 1858. This figure demonstrates that serfs were more prevalent in the “old” regions of the empire closer to Moscow, whereas state peasants were more numerous in the outskirts of the empire. Figure A1 in the online appendix confirms a strong negative correlation between the share of serfs and the proximity to Moscow (we account for this correlation in our empirical strategy). The reason for this spatial pattern was that the introduction of serfdom in Russia was closely connected to the construction of the army. In the 16<sup>th</sup> and 17<sup>th</sup> centuries, being short of cash, the government gave out state lands with peasants to gentry in return for their military service. The government transferred lands to gentry more often in regions close to Moscow for two reasons: (1) gentry had to be mobilized to the capital quickly in case of war; (2) the government had more authority nearby the capital to enforce serfdom (Semevskij 1881, p. 29-30).<sup>9</sup> Gentry often also captured state lands (with state peasants on them), eventually legalizing their titles. Using 1684-1686 household tax census data, Vodarskij (1988) estimates that the land captured by gentry composed 36 percent of all privately owned estates. This share was higher in the “black earth” region where soil was more fertile; the state was too weak to enforce state ownership of these lands. Tsars only managed to keep the very best lands in their own personal ownership as royal estates with “royal peasants” (Indova 1964).

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<sup>9</sup> Over time, due to a short supply of remaining state lands in the old regions and the colonization of new territories, the state transferred more distant lands with peasants to gentry as well. The government continued this practice of transfers during the whole of the 18th century (even after the 1704 military reform, which introduced a regular army instead of an estate-based one). In particular, Catherine II (1762-1796) transferred 800,000 state peasants to private owners; Pavel I (1796-1801) transferred another 400,000 (Semevskij 1881, 1901, 1906). Only Alexander I, who assumed the throne in 1801, ordered a stop to the practice of transfers of state lands. Alexander I and his successor, Nicolas I, however, exchanged state peasants in some provinces for a similar number of royal peasants in the other to distribute royal peasants more compactly (Nifontov 1974 P. 100; Crisp 1976).

In 1764, the land that belonged to the Orthodox Church, which prior to this moment was a major owner of land in Russia, was confiscated by the state and transferred to state ownership. Importantly, these nationalized landholdings rarely were transferred to gentry, unlike other state lands, in order to avoid a conflict between the crown and the church (Semevsky 1906). (In the empirical analysis, we use the distribution of Orthodox Christian monasteries across Russia as an exogenous source of variation in the shares of serfs versus state peasants.) Figure A2 in the online appendix presents the spatial distribution of state peasants.

Free agricultural workers were concentrated in specific regions of Russia, as shown on Figure A3 in the online appendix. In particular, Cossacks in the Don region were free because, in the 17<sup>th</sup> century, the government needed them to protect the country against nomadic invaders from the south. The state also granted free status to local non-Russians in the low Volga region after the conquest of this region in order to avoid rebellion of the new imperial subjects. Similarly, the peasants of Bessarabia (*tzaryane*) were granted a special status as a (relatively) free rural population after the conquest of this province in 1811.<sup>10</sup> Serfs of the three Baltic provinces were emancipated (and became free landless agricultural workers) between 1816-1819. In addition, over the course of the 18<sup>th</sup> and the first half of the 19<sup>th</sup> century the government invited colonists from Europe to settle in the virgin land of the empire in the south and the east.

Overall, the distribution of serfs, state peasants, and free agricultural workers across provinces was relatively stable by 1801. It persisted until the Peasant Reform of 1861, which emancipated the serfs.

### *2.3. The abolition of serfdom: the emancipation and land reform*

Discussions of a potential emancipation reform within the Russian began in the early 19<sup>th</sup> century. However, there were no real steps toward enacting such reform before Russia's defeat in the Crimean War (1853-1856). This defeat against a coalition of countries, which included Great Britain and France, demonstrated to the government that Russia had fallen behind other European countries and that liberalization reforms were overdue (see the online appendix for details).

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<sup>10</sup> "*Tsaryane*" were formally free. They could move between landlords' estates; they cultivated land in return for an obligation to the landlord (Antsupov 1978).

As mentioned above, the abolition of serfdom in Russia consisted of two conceptually distinct reforms: the emancipation and the land reform. The 1861 manifesto both granted personal freedom to former serfs, and outlined the rules of the subsequent land reform.

***The emancipation.*** According to the 1861 law, serfs were granted freedom instantaneously and free of charge. The law concerned all the European provinces of the Russian Empire (with the exception of the three Baltic provinces, where emancipation occurred forty years earlier). Peasants' obligations to landlords were instantaneously fixed. Landlords lost the right to change the level of peasant obligations, to sell, buy, lease, punish, or imprison peasants. Former serfs were also granted a set of civil rights, including the right to marry without anybody's permission, to buy, sell, and lease property, to sign contracts, trade, launch businesses, and to represent themselves in court (Complete ... 1861). As a result of the emancipation, peasants became full owners of their labor and human capital.

***The land reform.*** Emancipated serfs were obligated by law to buy out the land from the landlords. Peasants (as a commune) and their landlords had to negotiate the precise terms of this buyout, namely, the amount of land that peasants had to buy, the price, and the exact timing of the transaction. As a result of these negotiations, the land reform was gradual. It proceeded in two stages. The first stage regulated the peasant-landlord relationship in the form of a *regulatory charter* during the transition period, i.e., before the *buyout contract* was signed. The second stage marked the actual start of the buyout operation, the terms of which were regulated by a buyout contract between the landlord, the peasant commune, and the state.

The law prescribed the first stage to be completed in two years. By 1863, the peasants' obligations to landlords were fixed as quitrent, the level of which could not be changed. This quitrent was the lease payment for the use of land plots by peasants. About 50% of the regulatory charters were signed as a result of a mutual agreement. If mutual agreement was not reached by 1863, local officials determined the terms of a fallback regulatory charter. In estates where landlords did not change the level of quitrent during serfdom, i.e., were able to commit to an

implicit long-term contract with peasants, agreements were usually easier to reach as they just formalized the previously implicit contract.

The second stage involved the actual transfer of property rights on land from landlords to peasant communes in exchange for an immediate payment of land value fixed by the buyout contract. 80% of the land value was financed by the state and was formalized as a loan from the state to peasants, who had to pay it back in the form of fixed quitrent over the next 50 years. The timing of the start of this buyout operation ranged from 1862 to 1882 and varied greatly between eastern and western provinces and across estates within eastern provinces. In western provinces, the state demanded an immediate signature of the buyout contracts in 1863 as a political measure following the Polish rebellion against the empire. In eastern provinces, initially, the timing of negotiation over the terms of buyout contracts was not regulated. As a result, in many cases the negotiations were delayed. For 15% of former serfs, the negotiations lasted until 1881, when a law prescribed an obligatory start of the buyout operation everywhere during the upcoming year. One important determinant of the incentives of landlords to prolong the transition period was their indebtedness. If the land was used as collateral in a debt contract between the landlord and a state financial institution, the start of the buyout operation meant that the state wrote the debt off, leaving the landlord without money, land, or peasant quitrent, which they continued to get during the transition period. Importantly, as a rule, quitrent was higher than the interest rate on the state's loans to landlords. In contrast, landlords without debt to the state got the full value of the land sold to the peasants at the start of buyout operation. We describe the details of the land reform in the online appendix.

***The role of the peasant commune.*** The buyout operations transferred land titles from landlords to peasant communes. Individual peasant households did not get individual property rights. The communes that got land titles as a result of the land reform were of two types: re-partition and hereditary. Periodic redistribution of land between peasant households was the key feature of the re-partition communes. It was the dominant form of land use in most parts of the empire. In hereditary communes, widespread only in Lithonia, Byelorussia and the West-Bank

Ukraine, peasant households had perpetual usage rights on their own plots and there was no redistribution of land among households within the commune. The land title was communal in both cases. Communal ownership had several important costs: First, re-partition communes limited peasants' incentives to invest in land after the emancipation. Second, communes regulated production decisions of individual households, which constrained the adaptation of new technologies. In particular, communes took all major decisions on land allocation and use: what to grow, when to plant the seeds, etc.<sup>11</sup> Finally, communes restricted mobility, as peasants had to ask permission from the commune to migrate. The fact that the commune became the landowner *de jure* and *de facto* strengthened the institution of the commune, whose power was previously counterbalanced by the landlord's authority.<sup>12</sup> Gerschenkron (1965 pp. 744-5) argued that the commune and "*the institutional framework, within which the peasants were placed [after the abolition of serfdom], militated directly against any improvements in this [economic efficiency] respect.*"

### 3. Hypotheses

Our aim is to estimate the effect of the abolition of serfdom on agricultural productivity, peasants' wellbeing, and industrial development. *A priori*, these effects are ambiguous. On the one hand, as we discussed in the previous section, serfdom created adverse incentives for serfs. They were not owners of their own labor or human capital, nor did they have ownership rights for land they cultivated. Due to severe asymmetries of information between the principals, the owners of all these resources, namely, the gentry, and the agents, i.e., the serfs, one could expect severe distortions in production and investment decisions as well as peasant effort. The extent to which the gentry could solve these problems either by intense monitoring or by committing to a long-term contract, should

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<sup>11</sup> All major decisions were made through direct democracy at the general commune assembly (*schod*), where each peasant household had one vote. The assembly also elected a local village executive, who made day-to-day decisions on minor issues (Bartlett 1990).

<sup>12</sup> The landlord continued to counterbalance the power of the commune during the transition period. In particular, during the first eight years post-emancipation the landlord had a legal right to reallocate communal and landlord plots within the estate without peasants' consent. The landlord kept some administrative power over former serfs until 1870. It was only the buyout operation that made the commune a full owner of the peasant land, thus completely removing the landlord from bargaining process.

determine how inefficient serfdom was. Some of these incentive problems are expected to have been alleviated with the emancipation, as it changed the status of serfs from being an agent to being a principal, owning their own human capital and labor.

Serfdom might also have had efficiency advantages compared to post-emancipation production because of economies of scale, access to new technologies and to finance, which most probably were better realized in the large estates of the nobility compared to the small-scale entrepreneurial agricultural production by emancipated peasants, who had to solve coordination problem in order to enjoy the benefits of the economies of scale. In theory, the use of coercion in forced labor relations may also increase effort, compared to free labor, because of its effect on the reservation utility of agents (Acemoglu and Wolitzki 2010). In practice, the extent to which the gentry were able to solve incentive problems through commitment, monitoring, and coercion, and to which the economies of scale and access to new technologies boosted the productivity of agricultural production under serfdom, is unclear.

The expected effect of the land reform is also ambiguous. On the one hand, the land reform might have improved productivity by increasing peasants' incentives to invest in land that they owned. On the other hand, the land reform strengthened the inefficient institution of the commune, which substantially restricted both the usage and transfer of land rights. It is possible that communal ownership of land was less efficient than landlords' ownership, because, for instance, the gentry were more flexible in adopting new technologies than the traditional peasant commune.

It is also *a priori* not clear whether one should expect nutrition, and therefore, peasants' (draftees') height and mortality, to be affected by the emancipation. The reason for this is that serfs were a valuable input into production for nobility and, therefore, rational landlords should have made sure that their serfs were well fed, as nutrition directly affected peasant productivity. However, the asymmetry of information may have led to malnutrition of serfs in equilibrium, as gentry were concerned that peasants were hiding the proceeds of their production, which could lead to an excessively high level of peasant obligations. In addition, peasants may have had lower

incentives to feed children (i.e., invest in their human capital) under serfdom, as peasants' children belonged to the gentry.

Personal freedom given to serfs should increase mobility from rural to urban areas, where productivity, and therefore wages, were higher. Thus, one should expect a positive effect on the development of industry. However, migration to cities was limited by the communal land titles and mutual responsibility for taxes within the commune (Gerschenkron 1965).

#### **4. Data**

We combine various published and archival sources to construct a unique province-level panel dataset on development of fifty European provinces of the Russian Empire in the 19<sup>th</sup> century. The appendix lists all of our sources in detail. Data on grain yield – one of our main outcome variables – come from the annual governor reports for the years before 1883, and the official imperial statistics of the central statistical committee for the later period. The methodologies of the data collection were different before and after 1883, but it was the same within each of these periods irrespective of prevalence of serfdom in a province.<sup>13</sup> Historians agree that the quality of the late imperial statistics and governor reports is rather high (Koval'chenko 1979; Nifontov 1974 pp. 35-46).<sup>14</sup> Similarly, the data on other main outcome variables, e.g., draftees height, deaths and births per 1000 inhabitants, the size of population in a province, and industrial output and employment, come from either the governor reports or various other official statistical sources. Table A1 in the online appendix lists the exact sources for each variable.

We have different numbers of snapshots over time for different outcomes. The largest number of over-time observations is for grain yield: 41 snapshots. The smallest is for industrial employment: only 3 snapshots. Table A1 in the online appendix lists the years for which we have

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<sup>13</sup> Governor reports provide only aggregated figures on all cereals without distinction of particular crops. We aggregate data on rye, oat, wheat, barley, and bluckwheat for the post-1883 period to construct comparable measures. In Section 8 below, we verify that the change in the methodology of collection of grain data that occurred in 1883 does not drive our results for grain productivity. In particular, we restrict the sample to data from governor reports only, i.e., to before 1883, and find that the results are robust.

<sup>14</sup> According to Nifontov (1974), the official procedure for data collection was very deliberate. It required a lot of cross checking by various local authorities. In addition, the central government carefully monitored implementation of the data collection, as the data were used for potential tax redemption. Nifontov (1974) verified that the time-series of grain yields from the alternative sources, such as reports of the Ministry of State Property, are highly correlated with those based on the governors' reports.

data for each variable. Some of the snapshots are the averages over a decade. By construction, these data are less volatile than the annual data. Occasionally, data for some provinces are missing in the historical sources; thus, the resulting panel is unbalanced. To date, our data is the best source of statistics on the development of Imperial Russia in the 19<sup>th</sup> century.

Data on the composition of rural provincial populations by status (*soslovie*), namely, the shares of serfs, state peasants, free agricultural laborers, and royal peasants, before the 1861 reform is a cross-section; the data come from the 1858 police data (Bushen 1863).<sup>15</sup> To measure the land reform implementation, we constructed a proxy for the share of serfs who started buyout operation in the total rural population, which varies both across provinces and over time. In order to construct this variable, we use the redemption payments statistics, which report the sums that peasants were supposed to pay each year in redemption by province, available for all provinces and all years up to (and including) 1877, and the 1877 cross-section on the number of peasants who had initiated the buyout operation by that time (Vilson 1878). Assuming constant land payments per peasant across estates and over time within each province, from these two variables, we construct the share of serfs who started buyout operations each year in each province up to 1877. Then, we extrapolate these numbers to the years 1878-1881 using a linear projection from 1871-1877. Finally, as land reform was forced to be completed in 1882 by law, we set the share of serfs who started buyout operations in the total rural population to be equal to the total share of former serfs in 1882. Similarly, for the five most western provinces, Kiev, Mogilev, Podolsk, Vitebsk, and Volhyn, we set the proxy for the land reform implementation to be equal to the share of former serfs starting in 1863, as the

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<sup>15</sup> We define the number of serfs in a province as the sum of two categories of peasants from Bushen (1863): *temporary obliged peasants former serf-sevants*. We define the number of state peasants in a province as the sum of *state peasants* and *military dwellers* (Bushen 1863). To get the shares, we consider the following groups reported by Bushen (1863) as making up the rural population: *royal peasants; state peasants; military dwellers; soldiers in reserve; former soldiers; cantonists; citizens from irregular military regiments, i.e., cossacks, colonists, peasants under supervision of various ministries; foreigners in rural areas; non-Russians in rural areas*. Taken together, the latter eight groups comprise the free rural population in our classification. We verified that our results are robust to using 1857 tax census data (Kabuzan 1971) as a source of data for the composition of the peasantry by type instead of the data from Bushen (1863). 1858 and 1857 figures are highly correlated (the coefficient of correlation for shares of serfs is 0.99). There is no consensus in the historical literature on which source is superior (Kabuzan 1971). In our baseline analysis, we rely on the 1858 police data simply because they have more observations. Kabuzan (1971) provides data for only 33 of the 46 provinces reported in Bushen (1863). Kabuzan (1971) reports figures for the territory of the remaining 13 provinces but use 1805 province borders, which makes them incompatible with the rest of our data.

government made buyouts obligatory at that time in these provinces in response to the Polish rebellion.

In Table 1, we report descriptive statistics. Panel A of Table 1 summarizes data on the prevalence of serfdom across provinces. Panel B presents summary statistics for the distribution of serfs by type of obligations, estates' characteristics, and the measure of land reform. As shown in the table, there were about one hundred forty serfs per estate on average.

As reported in the Panel B of Table 1, in an average province, only forty three percent of former serfs signed regulatory charters by the end of the two-year period prescribed by the emancipation law. We use the share of serfs who did sign the regulatory charter by province as a proxy for the prevalence of implicit contracts between peasants and landlord under serfdom. Peasants were more likely to refuse to sign a draft of the regulatory charter suggested by their landlord if they believed that their *de facto* pre-emancipation rights were violated by the landlord (Zajchkovskij 1968). Between 1862 and 1882, shares of former serfs who launched the land reform gradually increased from zero to all former serfs in all provinces. The average land allotment of peasant household was about fifteen *desyatinas*, i.e., five-and-a-half acres in 1877. In an average province, as a result of land reform, peasants lost access to 6.5 percent of the land they previously cultivated.

We summarize the development outcomes in panel C of Table 1. There were about one million citizens in a province in an average year in the 19<sup>th</sup> century. Population grew rapidly; there were almost forty-seven births per thousand of population in a year and thirty-five deaths. The average province was highly agricultural; there were only thirty-one thousand industrial workers in a province, producing about eighteen million rubles worth of output.<sup>16</sup> Grain was the main output of the empire. There are no panel data on the area under crops before 1877 or on other non-labor and labor inputs that would cover both pre- and post-emancipation periods. This is why we measure

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<sup>16</sup> Reliable data on urbanization do not exist for this period, and therefore, we focus on industrial employment and production only. The Russian statistics on urban population followed the legal definition of a city and counted as urban only those residents who belonged to urban estates (*soslovies*) and only settlements that had legal city charters. In practice, agrarian occupations dominated in many of the settlements deemed legal "cities" by the Imperial administration (Mironov 2010).

grain productivity as the grain yield to grain seed ratio – a measure widely used as a proxy for productivity in Russian agriculture before the late-19<sup>th</sup> century as well as in medieval European agriculture.<sup>17</sup> Yield to seed ratio for grain was 3.95 in an average province in an average year, increasing from about 3.5 to 4.5 over the century. Potato was a more labor-intensive crop than grain, with a higher yield to seed ratio (about 4.4 on average). Animal husbandry had secondary importance. There was on average one head of cattle per two inhabitants in the empire. The mean height of a draftee was 164.5 centimeters.<sup>18</sup> Tables 1 and A1 also provide summary statistics and sources for all control variables.

## 5. Empirical methodology

We use cross-province variation in the shares of different types of peasantry and over-time variation in the emancipation to estimate the effect of the abolition of serfdom on agricultural productivity, peasants' wellbeing, and industrial development. Our main specification is as follows:

$$Y_{it} = \alpha \text{ShareSerfs}_i \times \text{PostEmancipation}_t + \mathbf{X}_{it}'\gamma + \psi_i + \zeta_t + \tau\delta_i + \varepsilon_{it}, \quad (1)$$

Subscripts  $i$  and  $t$  index provinces and time periods. Time periods are either years or decades, depending on data availability for a particular outcome. We consider the following outcomes, denoted by  $Y$ : grain yield (harvest/seed ratio), height of draftees in centimeters, mortality (ratio of the number of deaths to provincial population) and fertility (ratio of the number of births to provincial population),  $\log(\text{population})$ ,  $\log(\text{industrial employment})$ , and  $\log(\text{industrial output})$ . *ShareSerfs* denotes the share of privately owned serfs in a province in 1858. *PostEmancipation* denotes a dummy indicating the time after the emancipation of serfs. Our baseline sample excludes Baltic provinces, and therefore, *PostEmancipation* dummy switches on in 1861 in all provinces.<sup>19</sup>

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<sup>17</sup> There are no data on labor inputs in agriculture in the 19th century. Employment in agriculture is known only for the 1897 population census year. In addition, figures on population with rural legal status are known only for tax census years (1795, 1811, 1816, 1851, and 1858). Arable land data are available for 1800, 1858, 1871, and 1877. There are no data on investments into land.

<sup>18</sup> All height data are on soldiers drafted after the 1874 military reform, i.e., collected under the same procedure. Draft occurred at the age of 21, i.e., those who were drafted before 1881 were born during the serfdom period.

<sup>19</sup> To study the robustness of our results to inclusion of Baltic provinces, we use the interaction *ShareSerfs<sub>i</sub>PostEmancipation<sub>it</sub>* as our main variable of interest, where *PostEmancipation<sub>it</sub>* varies both over time and across provinces. *PostEmancipation<sub>it</sub>* switches on in 1819 in three Baltic provinces and in 1861 in all other provinces. *ShareSerfs<sub>i</sub>* for Baltic provinces is equal to the share of former serfs in 1858 according to Bushen (1863). Alternatively,

The interaction between the share of serfs and the post-emancipation dummy is our main variable of interest. The coefficient on this interaction ( $\alpha$ ) is the difference-in-differences estimator of the effect of the abolition of serfdom on the considered outcome. In order to estimate this parameter consistently, we need to control macroeconomic shocks, unobservable characteristics of provinces, as well as provincial trends.  $\psi_i$  and  $\Theta_t$  are the province and year fixed effects. As different provinces are expected to have different development trajectories in a country as vast as Russia, it is crucial to control for province-specific development trajectories. Thus, for the vast majority of the outcomes, i.e., whenever data availability permits, we control for 46 province-specific linear trends ( $t\delta_i$ ). We also include a number of additional controls to the list of covariates ( $\mathbf{X}_{it}$ ). As the share of serfs is correlated with the distance to Moscow, we control for the interaction between log distance to Moscow (minus its sample mean) with post-1861 dummy. We also include the interaction between demeaned land suitability with post-1861 dummy into our baseline specification, to account for potential differences in agricultural productivity.

To ensure robustness of our results, we also report specifications with controls for the two main potentially confounding reforms: the land reform for state peasants in 1866, and the emancipation of royal peasants in 1859. We include interactions of shares of these groups in provincial rural populations with post-1866 and post-1859 dummies, respectively. We follow Bertrand, Duflo, and Mullainathan (2004) and cluster error terms within each province separately before and after the emancipation of 1861.

Specification (1) is the standard difference-in-differences specification with the main identifying assumption being that there are no systematic differences in the trends of the outcomes of interest among provinces with different prevalence of serfdom before the emancipation (conditional on all other covariates, including province-specific trends). This is testable for the outcomes with sufficient number of over-time observations before the reform, namely, grain and

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we replace the main interaction term of interest with two interaction terms: *Share of non-Baltic serfs*<sub>*i*</sub> *Post\_1861*<sub>*t*</sub> and *Share of Baltic serfs*<sub>*i*</sub> *Post\_1820*<sub>*t*</sub> to estimate the effect of the emancipation of serfs separately for Baltic and non-Baltic provinces, where *Post\_1861*<sub>*t*</sub> and *Post\_1820*<sub>*t*</sub> are dummies which switch on in 1861 and 1820, respectively. In either of these augmented specifications, we allow the two main controls – the interactions of post-1861 dummy with log distance to Moscow and land suitability – to have different effects in Baltic and non-Baltic provinces to account for the fact that Baltic provinces are special.

draftees' height. Thus, we augment specification (1) by replacing the interaction between the share of serfs ( $ShareSerfs_i$ ) with post-emancipation dummy by a series of interactions of  $ShareSerfs_i$  with a number of dummies indicating pre-reform and post-reform time periods.

As the differences in the prevalence of serfdom are not random (and may be driven by some unobserved factors), we also use an instrumental variable strategy. It is important to note that only those unobserved factors that change the development trends in 1861 could potentially be driving the results of OLS estimation of equation (1). We cannot think of any such factors. Nonetheless, we take the historical distribution of Orthodox monasteries across provinces before 1764 as a source of exogenous variation in the share of serfs in 1858 because, as described in the historical appendix, monasterial lands nationalized by Catherine II were less likely to be subsequently redistributed to gentry than other state lands and, therefore, peasants who lived on these lands were less likely to be serfs after the nationalization of monasterial property (we provide historical details on the 1764 nationalization in the appendix). A similar instrument is used by Bugge and Nafziger (2015) in a cross-sectional regression to investigate long-term effects of serfdom on modern outcomes.<sup>20</sup> Our identification assumptions are much weaker than those of Bugge and Nafziger (2015) as we use this instrument in a panel setting with province fixed effects and province-specific trends. Figure 3 presents the conditional scatter plot between the number of Orthodox monasteries per 1000 people in 1897 (which is denoted by  $Monasteries_i$ ) and the share of serfs in 1858 conditional on log distance to Moscow and land suitability across provinces. In the panel setting of equation (1), we instrument  $ShareSerfs_i \times PostEmancipation_t$  with  $Monasteries_i \times PostEmancipation_t$ .

In order to disentangle the effect of the two components of the abolition of serfdom, namely, the emancipation, which gave personal freedom to serfs, and the subsequent land reform, which gave them communal land titles, we include in the list of covariates, our dynamic proxy for the

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<sup>20</sup> There is a difference between our instrument and that of Bugge and Nafziger (2015). Bugge and Nafziger (2015) consider only monasteries closed by 1764 (from Zverinskii 1890), whereas we account for both monasteries closed by 1764 and monasteries that were created before 1764, but which continued to operate after 1764. The serfs of these monasteries also became state peasants as a result of the 1764 nationalization (Zverinskii 1897). There were about eight hundred closed monasteries and another thousand monasteries that continued to operate after nationalization. The sum is a better predictor of monasterial serfs in a province as both closed and open monasteries as of 1764 owned land and serfs before the 1764 nationalization.

implementation of the land reform, i.e., a measure of the number of former serfs who started the buyout operation as a share of rural population in a particular year. As the timing of the start of buyouts depended on the negotiations between the landlords and the peasants, it may be endogenous to changes in agricultural productivity. To estimate the causal effect of land reform we instrument the share of serfs who started the buyout operation in a particular year in a particular province with a synthetic variable which predicts the progress of the land reform using the pre-reform indebtedness of estates in a province. In particular, to construct the predicted land reform variable we assume that landlords without debts initiated the land reform in 1862, immediately after the emancipation; whereas, the number of landlords with debts, who launched the land reform, grew linearly between 1862 and 1882. This instrument reflects the fact that the indebted landlords had incentives to postpone buyout operations. Thus, we construct the IV for the land reform as an interpolation between  $(1 - \text{indebtedness})$  and 1 in the interval 1862-1882, 0 before 1862, 1 after 1882. For western provinces the IV switches from zero to 1 in 1863 because of changes in the land reform rules for these provinces as a result of the Polish revolt. To illustrate how well this instrument predicts the progress of the reforms, we take a snapshot in 1872, i.e., halfway through the land reform implementation and plot on Figure 4 the cross-sectional association between the share of serfs who started buyout operations and the predicted land reform progress in 1872. (We present the results of the actual first stage estimations in the next section together with the results of the second stage.) This instrument is likely to be excludable, as indebtedness of gentry was likely to be orthogonal to any market forces because the primary reason to obtain loans was the status consumption for Russian nobles. In addition, loans were issued by non-market state financial institutions. (We provide historical details behind both instrumental variables in the online appendix.)

To analyze the differential effects of the abolition of serfdom for large and small estates of the nobility (to proxy for the economies of scale in production) we add a triple interaction between  $ShareSerfs_i \times PostEmancipation_{it}$  with the size of the estate. In order to analyze differences in the effect of land reform between re-partition and hereditary commune, we add to the list of covariates

an interaction term between the share of serfs who started land buyouts and a dummy for whether re-partition communes were prevalent in the province.<sup>21</sup>

## 6. Main results: The effects of the abolition of serfdom

### 6.1. Productivity of Russian agriculture

Table 2 presents the estimated effect of the abolition of serfdom on the productivity of Russian agriculture. The results yield strong and robust evidence of a large positive effect of the abolition of serfdom on the grain to seed ratio. The first column of the table presents the results of the most basic OLS specification with no additional covariates beyond province and year fixed effects. The coefficient on the interaction term between the share of serfs and post-emancipation dummy, estimating the average effect of the abolition of serfdom, is positive and statistically significant. In column 2 we add controls for the (demeaned) distance to Moscow and crop suitability interacted with post-1861 dummy. In column 3, we instrument our main explanatory variable with the number of monasteries per thousand people interacted with post-emancipation dummy. In columns 4 and 5, we repeat the same OLS and IV exercises adding province-specific trends to the list of covariates. In all specifications we find a positive and statistically significant effect of the abolition of serfdom. The first stages of the 2SLS specifications are presented in Panel B of the Table (just below the second stage results). The instrument is a strong predictor of the interaction of the share of serfs and post-emancipation with F-statistic above 20, irrespective of specification. The magnitude of the effect is stable between the OLS and IV specifications once province-specific trends are controlled for, suggesting that there is no unobserved heterogeneity beyond the province-specific development trends that could bias the OLS estimates.<sup>22</sup> Finally, in column 6, to the OLS specification we add controls for the share of state peasants interacted with the onset of their land reform, i.e., post-1866 dummy and for the share of royal peasants interacted with the onset of their emancipation, i.e., post-

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<sup>21</sup> We use 1905 data to construct the dummy for re-partition communes because of the lack of information for the earlier years. This approach is valid because very few if any communes changed their status. All communes in Grodno, Kovno, Vilno, Minsk, Podolia, and Volyn provinces were hereditary. Baltic provinces had no communes at all (Dubrovsky 1963).

<sup>22</sup> In specifications that omit province-specific trends, IV yields a coefficient of interest almost twice as large as the OLS point estimate.

1859 dummy. Our coefficient of interest remains significant and roughly stable in magnitude. As the monasteries instrument predicts the variation in the prevalence of serfs versus state peasants across provinces, we cannot use IV once we control for the share of state peasants interacted with post-1866 dummy, as it is too highly correlated with the interaction between the share of state peasants and post-1861 emancipation (which is what is explained by our instrument).

The estimated effect is substantial. A one standard deviation increase in the share of serfs in a province before the emancipation (i.e., an increase of the share of serfs in rural population of 24 percentage points) led to an increase in grain yield of 0.21 (or 5.5% from the mean level of 3.79) after emancipation (according to the estimate in column 5). These are large effects, as compared to the aggregate trend in grain productivity, which, on average, increased by 4.4 percent in a decade in the 19<sup>th</sup> century. For an average province, where serfs were 45% of rural population, the abolition of serfdom led to a 10.3% increase in grain productivity, on top of the overall development trend. Importantly, once province-specific trends are accounted for, we find that the coefficient on the distance to Moscow interacted with post-emancipation dummy is negative and significant. Thus, the effects that we describe above are relevant for provinces with the mean log distance to Moscow. The closer the province was to Moscow, the larger the effect of the abolition of serfdom. This is not surprising, as the proximity to Moscow also meant the proximity to the largest markets and to market infrastructure. In Moscow, its effect was about twice as large as in a province with the mean log distance to Moscow. In the most remote provinces of our sample, the effect of the abolition of serfdom was positive, but much smaller than the average.<sup>23</sup>

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<sup>23</sup> In table A2 of the online appendix we present results for the sample including Baltic provinces, where the abolition of serfdom took place in 1820 and on different terms than in the rest of the empire. We use specifications discussed in footnote 18. Our main results hold. The estimated coefficients on the main variable of interest are positive and significant, even though they are slightly smaller in terms of magnitude than in the baseline sample (see Table 2). In columns 3 and 4 of table A2, we allow for the effect of the emancipation of serfs to be different in Baltic provinces than in the rest of the sample. The effect of the emancipation of Baltic serfs is positive but imprecisely estimated and smaller in magnitude than for European Russia. This may be explained by better conditions of serfs and a more efficient production under serfdom in Baltic provinces and also by a possibly worse condition of their freedom. The historical literature (Fedorov 2000) argues that former serfs in the Baltics remained heavily dependent on the landlord even after their emancipation, in particular, because emancipated peasants remained landless in the Baltics. We cannot run IV regressions in the sample including Baltic provinces because we do not have a reasonable instrument for share of serfs in Baltic provinces. In contrast to the rest of the European Russia, there were almost no Orthodox population or Orthodox monasteries in the Baltic region. The 1764 nationalization of property of Orthodox monasteries did not affect Baltic provinces.

We proceed to testing the identifying assumption of the difference-in-differences approach, i.e., we test for diverging pre-trends in agricultural productivity among provinces with high and low prevalence of serfdom. We estimate the coefficients of eleven interaction terms of the share of serfs in 1858 with dummies indicating five-year intervals, including three before the emancipation (leaving 1795-1829 period as a comparison group). In this specification, we include the same controls as in column 6 of Table 2 with one important difference: Instead of 46 province-specific trends, we control for 14 region-specific trends, each of which groups together several provinces that are commonly considered as having similar development trajectories.<sup>24</sup> This change is necessary as the addition of eleven interaction terms into this specification makes the use of 46 province-specific trends too demanding. Figure 5 visually represents the results by plotting the coefficients on these interactions along with their 90% confidence intervals by time periods. Column 1 of Table A3 in the online appendix presents the entire regression output. The results clearly indicate the absence of pre-trends, as there are no significant effects before the emancipation reform. Importantly, a sharp increase in grain productivity occurred immediately after the emancipation. The coefficients are positive and rather large already for the first five-year interval after the emancipation. The grain productivity continued to rise slowly for the next fifteen years after the initial jump in the first five years after the reform. Ten years after the reform the coefficients become statistically significant. The cumulative effect of the reform in the first twenty years is twice as large as in the first five years. Thus, these results provide only a partial support for the claims of historians that the realization of the positive effects of the emancipation was slow because of the slow institutional adjustments and associated transaction costs (Gerschenkron 1965, Nifontov 1974). The data do show larger effects of the abolition of serfdom in twenty years than in the first five years, consistent with the idea that realization of some productivity gains took time. However, the largest single jump in grain productivity occurred right after the emancipation. We also find a decrease in grain productivity in the late 19<sup>th</sup> century compared to the peak attained by 1876-1880. The coefficients on the interactions of the share of serfs with five-year-period dummies

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<sup>24</sup> We provide the precise list of the regions and the provinces they are comprised of in the appendix.

after 1881 are substantially smaller (but remain positive and jointly statistically significant). In the next sub-section, we investigate the channel for this partial setback.<sup>25</sup>

## 6.2. Land reform vs. Emancipation

In columns 1 and 2 of Table 3, we disentangle the effects of the two components of the abolition of serfdom on agricultural productivity: the emancipation per se, which gave personal freedom to former serfs, and the subsequent land reform. As discussed in the methodology section, in addition to the share of serfs interacted with post-emancipation, we include in the list of covariates our measure of the implementation of the land reform, namely, the share of (former) serfs who had started land buyouts in this province up to this year among the provincial rural population. In this augmented specification, the coefficient on the interaction between the share of serfs and the post-emancipation dummy estimates the effect of the emancipation (per se) and the coefficient on the share of serfs who started land buyouts estimates the effect of the land reform. Column 1 presents OLS estimates and column 2 – IV estimates. In the 2SLS estimation, we instrument both the emancipation and land reform measures. The instrument for the share of serfs post emancipation is as above. The instrument for the land reform, as described in the methodology section, is the interpolation between (1-indebtedness) at the beginning of the land reform (in 1862) and one at the end of the land reform (in 1882). Panel B of the table right below the second stage results presents the results of the first stages, which yield that both instruments are strong predictors of their respective endogenous variables (F-statistics for the excluded instruments are reported at

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<sup>25</sup> In table A4 of the online appendix we estimate the effect of abolition on productivity in the production of potatoes. Columns 1 and 2 of Table A4 replicate the specifications of columns 5 and 6 of Table 2, but for potato productivity rather than grain productivity. Similarly, we measure potato productivity as harvest to seed ratio. We do not find a significant effect. In both OLS and IV specifications, the coefficients on the main interaction term of interest are insignificant (and have opposite signs). Potatoes were a relatively new crop representing advanced agricultural technologies in the context of 19<sup>th</sup> century Russia. Historical literature points out that landlords in large estates were the ones who introduced new technological advances in agriculture in Russia (Gerschenkron 1965, Nifontov 1974). To explore this explanation for the non-result for potatoes, we add a triple interaction between *ShareSerfs<sub>i</sub>*, *PostEmancipation<sub>i</sub>*, with large estate dummy (which is equal to one in provinces with the mean size of the estates being larger than one hundred male serfs before 1861). Results presented in column 3 and 4 suggest that there was a differential effect of abolition on potato yields in provinces with large and small estates. The coefficients on the triple interaction are negative and significant in both OLS and IV exercises. (The coefficients on the interaction of shares of serfs with post-emancipation dummy are positive while IV estimate is not statistically different from zero). These results are consistent with the view that potato production was more efficient before the emancipation in large estates, leading to the absence of the effect of abolition. An alternative interpretation, however, is that productivity dropped in large estate after the emancipation. Note that we do not find any differential effect of abolition on grain yield depending on the size of estates (in contrast to potato yield). We do not report these results for conciseness; they are available from the authors upon request.

the bottom of the table). Both in OLS and IV specifications, we find that the effect of the land reform on productivity in agriculture is negative and statistically significant, whereas the effect of the emancipation is positive and significant. The IV point estimates are much larger than the OLS estimates, which points to the *a priori* plausible endogeneity of the implementation of the land reform to agricultural productivity. In IV estimates, the effect of the emancipation per se is much larger compared to the total overall effect of abolition (presented in Table 2). According to the IV estimates, a full implementation of the land reform (from affecting zero to affecting all former serfs) in an average province led to a decrease in grain productivity by 0.59, or 15.4%, whereas the emancipation led to an increase in grain productivity by 1.22 or 32%. Thus, the land reform substantially slowed down the growth in agricultural productivity, which was initially boosted by the emancipation. The net effect of the abolishment of serfdom would have been 94% larger if not for the setback caused by the inefficiency of the land reform.<sup>26</sup>

In columns 3 and 4 of Table 6, we explore the mechanism through which the land reform had a negative effect on agricultural productivity by including the interaction between the land reform proxy and the dummy for re-partition commune, which equals one if re-partition communes were prevalent in the province. We find that the average negative effect of the land reform is primarily due to the negative effect of land reform under the re-partition commune. As above, we run both OLS and IV specifications. IV specification has three endogenous variables: an additional endogenous variable, the interaction between the land reform proxy and the dummy for the re-partition commune, is instrumented by the interaction of the instrument for the land reform interacted with the re-partition commune dummy. As above, all instruments are sufficiently strong to mitigate concern about the weak instrument problem. According to the IV point estimates (column 4), the full implementation of the land reform in the re-partition commune led to a decrease in grain productivity by 0.68 or 19%, which is 2.7 times the magnitude of the effect of the land reform in the hereditary commune (the latter is not statistically significant). In column 5, we verify

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<sup>26</sup> The 94% figure comes from the following calculation:  $1.22 / (1.22 - 0.59) = 1.936$ .

that the OLS estimates of column 3 are robust to controlling for the reforms that affected state and royal peasants.

This result on the negative effect of the land reform is consistent with Gerschenkron's (1965) conjecture that the land reform negatively affected Russian agricultural development through its effect on the empowerment of the peasant re-partition commune. These results are also consistent with recent findings on the positive effect of the Stolypin reform, which allowed peasants to exit the commune (Castañeda Dower and Markevich 2013). Our results suggest that the land reform was the reason for the setback in reform progress after 1882 — the year, when the land reform was completed. As discussed above, this setback is illustrated in Figure 5.

### *6.3. Peasants' wellbeing*

We proceed by estimating the effect of the abolition of serfdom on development outcomes beyond agricultural productivity. Table 4 explores the effect of abolition on peasants' nutrition, focusing on the average height of draftees (using a sample of 21-year-old males) by province and year as an outcome variable.<sup>27</sup> We estimate equation (1) merging the years of the reform with the average height of draftees with a 21-year lag, as nutrition affects height primarily in the childhood years. Thus, we compare the height of all those draftees who were born before the 1861 reform with the height of all those who were born after 1861, and relate this difference to the variation in the prevalence of serfdom. For each of the two samples, the first column presents the baseline OLS specification, the second – IV specification, and the third – OLS with controls for reforms affecting state and royal peasants. (The first stage results are reported in column 1 of Table A5 in the online appendix and F-statistics for the excluded instrument at the bottom of this table.) We find that serfdom had a large significant negative effect on child nutrition. The abolition of serfdom in an average province led to an increase in the height of draftees by 0.77 centimeters (according to the IV specification). This is because both serfs and free peasants had the same chance to be drafted and serfs were 45% of the total in an average province. Given that the draftee's height is an individual characteristic (rather than a characteristic of the economy), we can interpret the results one to one:

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<sup>27</sup> Rural citizens were the main source of draftees for the army (Beskrovnnii 1973).

The abolition of serfdom led to an increase in the height of a (former) serf of 1.7 centimeters on average. This very large effect is most likely driven by a combination of two effects: 1) the boost of productivity as a result of the abolition of serfdom (that we find in Table 2) and 2) the redistribution from landlords to peasants as a result of emancipation, which first fixed and then reduced the peasants' obligations to landlords (which we describe in the background section).

To test for pre-trends and to study the dynamic effects of abolition on nutrition, we allow the effect of the prevalence of serfdom to vary over time, just as we did in the case of grain yield. We interact the share of serfs with dummies for the following time periods: 1855-56, 1857-58, 1859-60, 1861-62, 1863, 1865-66, and 1875 (leaving two cross-sections of 1853 and 1854 as the comparison group).<sup>28</sup> Figure 6 reports the results in a graphic form and column 2 of Table A3 in the appendix reports the regression output. The coefficients on interactions with pre-1861 period dummies are close to zero in magnitude and not statistically significant. Thus, we conclude that there is no pre-trend. In contrast, the coefficients on the interactions with post-1861 period dummies are positive and statistically significant (with the exception of the last 1875 snapshot, where the effect is imprecisely estimated). The positive effect of the emancipation on height was realized immediately after the reform and we observe an increasing diverging trend for the rest of the cohorts.

We further investigate the effects of the abolition of serfdom on peasants' wellbeing in Table 5, by considering average mortality (columns 1-3), average fertility (column 4-6) and log total population in a province (column 7-9) as outcomes.<sup>29</sup> The three consecutive specifications for each outcome are exactly as in Table 4. The results are consistent with the view that the abolition of serfdom had a positive effect on peasants' living standards and population growth. The coefficients on the interaction between the share of serfs and the post-emancipation dummy are negative for mortality and positive for fertility and population. Not all of them are precisely estimated, however: the coefficient of interest is insignificant in IV specification for mortality (column 2) and in OLS

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<sup>28</sup> We do not have data for the years 1865 and 1876.

<sup>29</sup> Disaggregated data on rural and urban mortality and fertility do not exist. Total fertility, mortality and population, nevertheless, are good proxies for rural fertility and mortality and rural population because Russia was predominantly agrarian country during the whole of the 19<sup>th</sup> century with rural population comprising about ninety percent of the total population.

specification with controls for the other reforms (column 9) for population. According to IV specifications, a one standard deviation increase in the share of serfs before the emancipation increased fertility by six births per thousand inhabitants and increased population size by 12% after the emancipation. The abolition of serfdom in an average province with 45 percent of rural population comprised of serfs led to an increase in fertility by eleven births per thousand inhabitants, and as a consequence, a 24% increase in population size. Again, given that fertility is an individual characteristic, we can interpret the estimated coefficients one to one: The abolition of serfdom led to an increase in fertility by twenty five births per thousand among liberated serfs. These estimates should be interpreted with caution, however, as they assume no inter-province mobility, which is a restrictive assumption. The level of mobility was indeed low in the 19<sup>th</sup> century Russia, but it was strictly above zero. In 1897, 7.8 percent of people in an average province of the European part of Russia were born in a province different from the province of residence; there are no data for earlier years.<sup>30</sup>

#### *6.4. Industrial development*

In Table 6, we estimate the effect of the abolition of serfdom on industrial development focusing on two outcomes: industrial output and industrial employment. The table has the same structure as Tables 4 and 5 with one exception: as we have only three snapshots of data for industrial employment, we do not have enough statistical power to include province-specific trends in regressions with this outcome variable; thus, we only control for year and province fixed effects. We find a very large positive, robust, and statistically significant effect of the abolition of serfdom on both outcomes. A one standard deviation increase in the share of serfs before the emancipation increased industrial output by a factor of 2, and industrial employment by a factor of 2.3 after abolition (according to the IV specifications). Note point estimates in the IV specifications are larger than in OLS specifications. In an average province, industrial output increased by a factor of 3.7 and the industrial employment more than quadrupled as a result of abolition (increased by a factor of 4.6). These findings are in line with recent findings on the substantial level of labor

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<sup>30</sup> This figure is estimated from the 1897 census results available online at [http://demoscope.ru/weekly/ssp/rus\\_nem\\_97.php?reg=11](http://demoscope.ru/weekly/ssp/rus_nem_97.php?reg=11) (accessed on May 3, 2015).

migration within provinces from villages into the provincial industrial sector after the emancipation (Borodkin et al. 2008, Burds 1998, Crisp 1976, and Nafziger 2010).

Overall, we find a very large effect of the abolition of serfdom on the economic development and wellbeing of emancipated peasants.

## **7. The mechanisms behind the emancipation effect**

The evidence that we presented above suggests that the mechanism behind the negative effect of the land reform was the inefficiency of the re-partition commune (Gerschenkron's 1965). In this section, we address the question of what is the mechanism behind the strong positive effect of emancipation on the development outcomes.

First, we explore whether the abolition of serfdom had an effect on the use of one of the main agricultural inputs, namely, land. If emancipated peasants had a higher incentive to explore virgin lands than they did as serfs (to accommodate growing European demand for Russian grain), and if the former virgin lands were more productive, the land extension may explain the effect of emancipation on productivity. We have data on arable land for four cross-sections – two before and two after the emancipation. We use the logarithm of arable land as an outcome variable estimating equation (1) dropping province or region-specific trends because of the small number of observations. Results of the OLS and IV estimations are presented in columns 1 and 2 of Table 7. We find that the abolition of serfdom did not affect cultivated area. The coefficients on the interaction of the share of serfs with post-emancipation dummy are positive but not significantly different from zero, irrespective of specification. We do find, however, a positive and significant coefficient on the interaction of land suitability with post-emancipation dummy, which suggests that arable land was increased in the provinces with better agricultural potential after 1861; however, this enlargement was not associated with serfdom.

Due to the lack of data, we cannot formally test whether other inputs (used in the 19<sup>th</sup> century) were affected by the abolition of serfdom. However, the results that we present above, combined with anecdotal evidence from historical sources, strongly suggest that the changes in

other inputs also cannot be the main channel of the effect of emancipation on agricultural productivity. In particular, the positive effect of emancipation on industrial employment makes it unlikely that an increase in labor input in agriculture occurred as a result of emancipation, as labor was moving away from agriculture. Communal tenure in general, and especially the re-partition commune, combined with the negative effect of the land reform on agricultural productivity, makes it unlikely that substantial investments in land took place after the abolition of serfdom. In addition, historians agree that there were no major improvements in agricultural capital, i.e., tools and machines, until the end of the 19<sup>th</sup> century (Nifontov 1974), whereas we find that the bulk of the effect occurred immediately after the emancipation.<sup>31</sup> Our results on height and demographics suggest that important investments into human capital took place as a result of the emancipation. However, we do not expect these investments to be the main mechanisms driving our productivity results, because the realization of returns to investments into human capital requires time, whereas the emancipation translated into gains in agricultural productivity almost immediately.

As we discuss in the online appendix, in the second half of the 19<sup>th</sup> century, Russian agriculture saw a shift from traditional crops (e.g., winter rye) to summer crops (e.g., summer wheat and barley), which were more modern and more productive, provided that their cultivation took place on suitable soil, and they were in higher demand by the world market. This change required adaptation (such as the introduction of new seed varieties, new crop rotation systems and, most importantly, better consideration of local soil types). As is true for most adaptations, one should expect this particular one to be implemented faster when local decision makers have both incentives and local knowledge. As emancipation gave high-powered incentives to former serfs, we test whether the emancipation facilitated these changes in the crop structure. In particular, in columns 3 and 4 of Table 7, we report estimation results of equation (1) with the share of summer crops as the dependent variable. As expected, both the OLS and IV estimates are positive and statistically significant. According to the IV estimation, in an average province, the abolition of serfdom led to

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<sup>31</sup> According to Nifontov (1974), agricultural machines remained largely unknown in the Russian countryside until the 1880s.

an increase in the share of modern summer crops in the total seed mixture by 20 percentage points or by 35 percent of the average share of summer crops in the late 19<sup>th</sup> century.

Agricultural handbooks from the first half of 19<sup>th</sup> century (e.g., Mordvin 1839, Usov 1840, Dmitriev 1844, Ungern-Shterenberg 1848) shed light on the kind of technological improvements that were readily available at that time. Some of these improvements were as sophisticated as new seed varieties and the introduction of multiple-field crop rotation, others as simple as a change in the timing and the order of existing agricultural operations. These handbooks explicitly name the lack of incentives on the part of serfs, and landlords' monitoring problems, as the main explanations for the delays in adoption of new technologies. Mordvin (1839) singled out fifteen reasons for poor harvests, with six of them related to low serfs' effort. We do expect that the peasants' effort improved after emancipation as they started working for themselves rather than for the landlord and became full owners of their labor. As we do not have a direct measure of effort or incentives of peasants before and after the emancipation, we aim at testing the change in incentives as the mechanism behind our productivity results using an indirect proxy for the change in incentives as a result of emancipation. In particular, we investigate how the presence of longer-term implicit contracts that increased serfs' incentives under serfdom affected the increase in agricultural productivity as a result of the abolition of serfdom. If peasant incentives were the main driver of the productivity improvements following emancipation, in estates where serfs faced high-powered incentive schemes designed by landlords, we expect smaller gains in productivity after the emancipation. As described above, we use the share of serfs who signed regulatory charters as a proxy for the presence of implicit contracts (that improved serfs' incentives under serfdom). Columns 5 and 6 of Table 7 present the results of the estimations of the differential effect of abolition on productivity, depending on the share of serfs with long-term implicit contracts. We operationalize this test by adding a triple interaction of share of serfs with the post-emancipation dummy and the share of serfs with signed regulatory charters into our main equation (1). As above, we run both OLS and IV specifications. We instrument this triple interaction with the triple interaction between the number of monasteries per thousand inhabitants, the post-emancipation

dummy, and the share of serfs with signed regulatory charters.<sup>32</sup> As expected, we find that implicit contracts decreased the inefficiency of production under serfdom and left a smaller scope for productivity improvements as a result of the abolition of serfdom. The productivity increase due to the abolition of serfdom was more than twice as large in estates where there were no implicit contracts prior to emancipation as in estates with implicit contracts.

Overall, we find that a shift to more progressive crop varieties and, more generally, an increase in peasants' incentives, were the main mechanisms through which the abolition of serfdom boosted agricultural productivity.

## 8. Additional sensitivity tests

We conducted a multitude of sensitivity tests to verify robustness of our findings controlling for potentially confounding factors, using different data sources, and excluding potentially influential observations from the sample. First, we estimate equation (1) for two outcomes with the longest time component of the panel, grain yield and height, including the following potentially confounding factors in the list of covariates: the length of railway network in a province X year (in log kilometers), historical yearly temperature, the court reform, which started in 1864 and was implemented in different provinces at different rates, and the so-called *zemstvo* reform, which introduced elected local self-government bodies in thirty-four out of forty-six provinces in 1864. To account for these two reforms, we construct a dummy variable, which switches on when the court reform was launched in a particular province, and a variable equal to the size of *zemstvo* expenditures per capita in a particular year and a particular province, which is equal to zero before *zemstvo* was established in 1864. Tables A6 and A7 in the online appendix report results including each of these factors separately and together. Our main coefficients of interest, estimating the effect of the abolition of serfdom, remain positive, statistically significant, and are roughly stable in magnitude in all specifications. None of these potentially confounding factors robustly affect height

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<sup>32</sup> We add the land reform variable to these specifications because regulatory charters were signed as the first stage of land reform. Thus, the results in columns 5 and 6 of Table 7 should be compared to the results presented in columns 1 and 2 of Table 3 rather than to Table 2.

of draftees, whereas the railways are positively associated with grain productivity, and heat waves are negatively associated with it.<sup>33</sup>

As a next step, we verify that the land redistribution between peasants and landlords that occurred as a result of the land reform did not drive the main effects of the abolition of serfdom on agricultural productivity. We measure land cuts as the ratio of land that peasants lost as a result of the reform to the land they cultivated under serfdom. We interact land cuts with the post-emancipation dummy and add this variable as an additional control into the specifications reported in columns 1, 3, and 5 of Table 3, i.e., the main OLS specifications estimating the effect of the land reform. We present the results in Table A8 of the online appendix. The estimated effects of interest, i.e., of the emancipation and the land reform on average and in provinces with re-partition commune, are unaffected by the inclusion of this additional covariate. This suggests that land redistribution was not driving our results on agricultural productivity. The coefficient on the land cuts interacted with post-emancipation dummy is small and not statistically significant.

Further, we examine the robustness of our results to measurement issues in two ways. First, we reproduce our main estimations using 1857 tax census data (Kabuzan 1971), instead of 1858 data from Bushen (1863) on the spatial variation of serfs (the results are presented in Tables A9-A12). Our results are broadly robust to using this alternative measure: The signs of coefficients on the variables of interest data are consistent with the results of the baseline exercise based on 1858 data. The magnitudes of these coefficients are usually somewhat smaller, and in a few cases they lose statistical significance. This is to be expected, as the 1857 data are noisier and represent a much smaller sample size. Nevertheless, the vast majority of results remain statistically significant with 1857 tax census data. Second, in regressions for grain yield, we restrict the sample to years before 1883, when the grain productivity data all come from governor reports. In Table A13 we report the same specifications as in Tables 2, but for the restricted sample. All our results hold, and

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<sup>33</sup> The length of railways in a province is certainly endogenous. Therefore, regressions including this variable only serve one purpose: to show that our results are robust controlling for infrastructure created by industrialization. We do not have a reasonable instrument to explore causal effect of the railway construction on grain productivity. Zemstvo reform seems to be negatively associated with our outcomes in some specifications, but these results are unstable.

the magnitude of coefficients on the main variable of interest remains roughly the same, despite the reduction of the sample size.

Finally, we study whether our results are driven by any influential observations. In particular, we estimate all our regressions excluding from the sample up to the four provinces with the lowest shares of serfs (smaller than five percent), up to four provinces with the highest shares (larger than 75 percent), or the capital provinces of Moscow and Saint Petersburg. Our results remain robust to these restrictions of the sample (the results are available from the authors upon request).

## 9. Conclusions

We find a very large positive effect of the abolition of serfdom on agricultural productivity, peasants' living standards, and industrial development in 19<sup>th</sup> century Russia. The main lesson from this exercise is that serfdom substantially slowed down Russia's economic development both in agriculture and in industry. A simple counterfactual exercise shows that if serfdom were to have been abolished in 1820, rather than 1861, by 1913 Russia would have been about one-and-a-half times richer compared to what it actually was. In 1913, according to Maddison (2007), Russia's GDP per capita was \$1,488 (measured in 1990 US dollars). Our estimates suggest that an abolition of serfdom in 1820 would have resulted in per capita GDP between \$1,935 and \$2,602 (in the online appendix we present the derivation of these figures from our estimates). Thus, by 1913 Russia would have had a level of GDP per capita comparable to Norway (\$2,447) or Finland (\$2,111).<sup>34</sup> The very large effects that we find on nutrition (measured by draftees' height) make the abolition of serfdom in Russia one of the most important humanitarian reforms of all times.

The evidence suggests that such a large effect of the abolition of serfdom on Russia's development occurred because of a sharp change of incentive structure of the 43% of Russia's rural population, which was transformed by the 1861 emancipation from serfs with no rights over their own labor or human capital into small-scale agricultural entrepreneurs. This change led to greater

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<sup>34</sup> Finland was actually a part of the Russian Empire, but had a considerable degree of political and economic autonomy, including an independent monetary policy. We present details of these counterfactual estimations in the online appendix (see Table A14 for the summary).

effort, better use of local conditions, and better use of available agricultural knowledge and technologies, all of which allowed for a shift to more modern marketable crops from traditional non-marketable crops.

The abolition of serfdom would have contributed to even faster development if the land reform transferred ownership rights over land to peasant households rather than the commune, or at least to hereditary rather than re-partition communes. The increase in the power of the re-partition peasant commune (designed by the emancipation reform) was the main mechanism behind the negative effect of the land reform.

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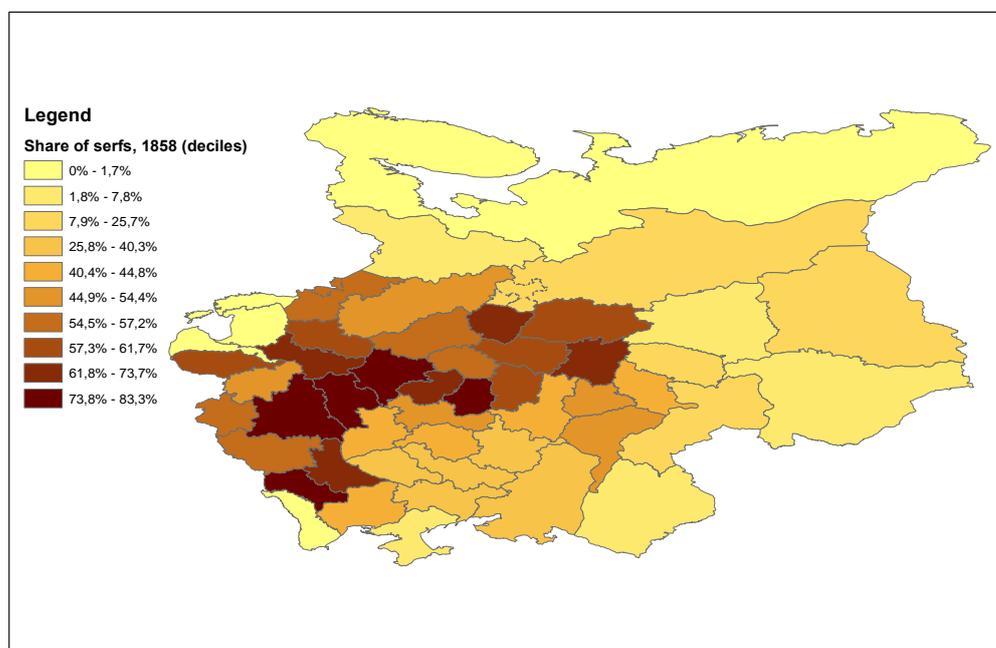
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**Figure 1. European provinces of the Russian Empire**



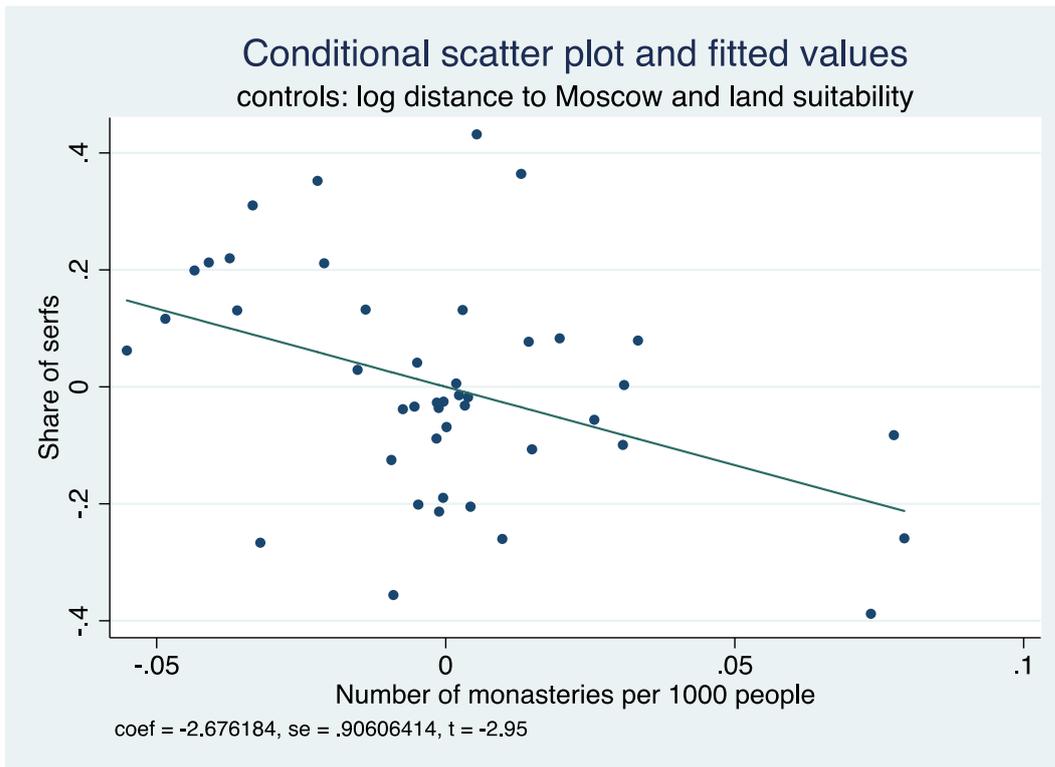
Note: Equirectangular projection used. Serfs in the Baltic provinces, Estlyndiya, Liflyandiya, and Kurlyandiya, were liberated 40 years before the emancipation of serfs in the rest of the empire. We run regressions both with and without Baltic provinces in the sample. The baseline sample excludes them.

**Figure 2. Geography of serfdom: serfs in 1858 as a share of rural population**

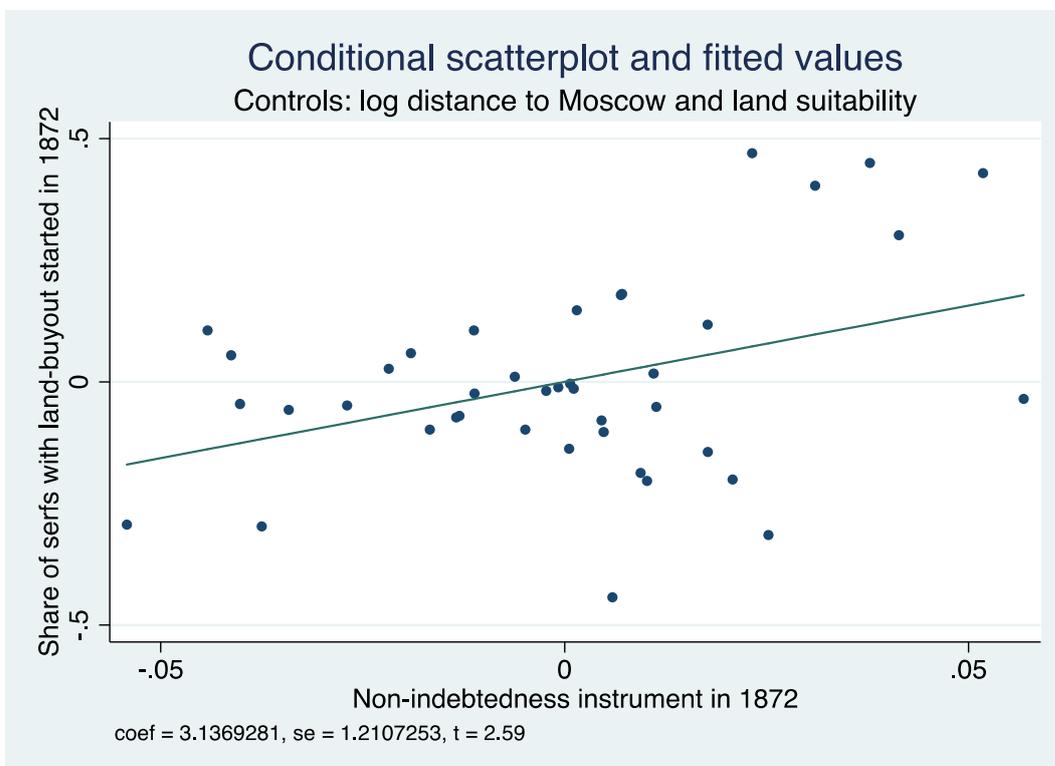


Note: Equirectangular projection used.

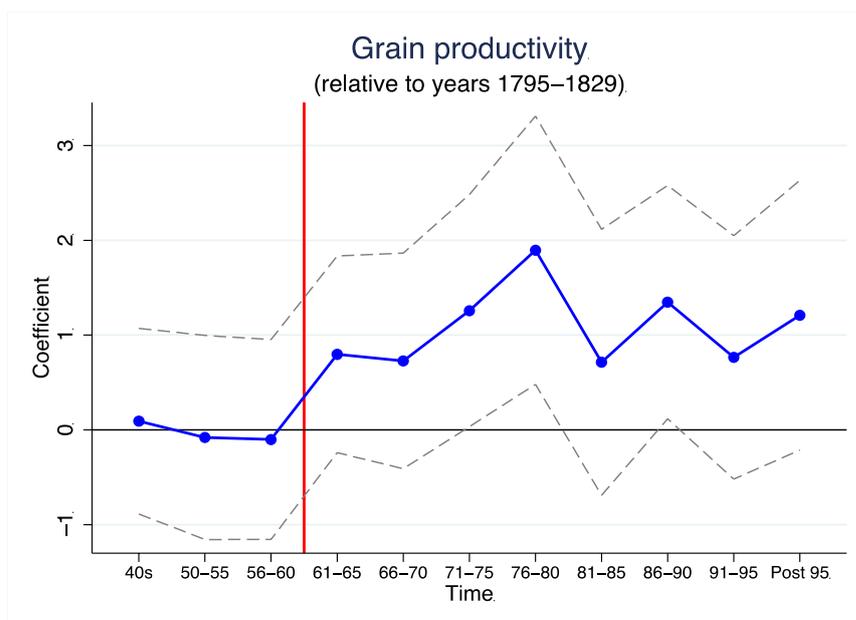
**Figure 3. Monasteries in 1764 and the share of serfs in 1858 across provinces**



**Figure 4. The progress of land reform and the land reform instrument in 1872, i.e., halfway through land reform implementation**

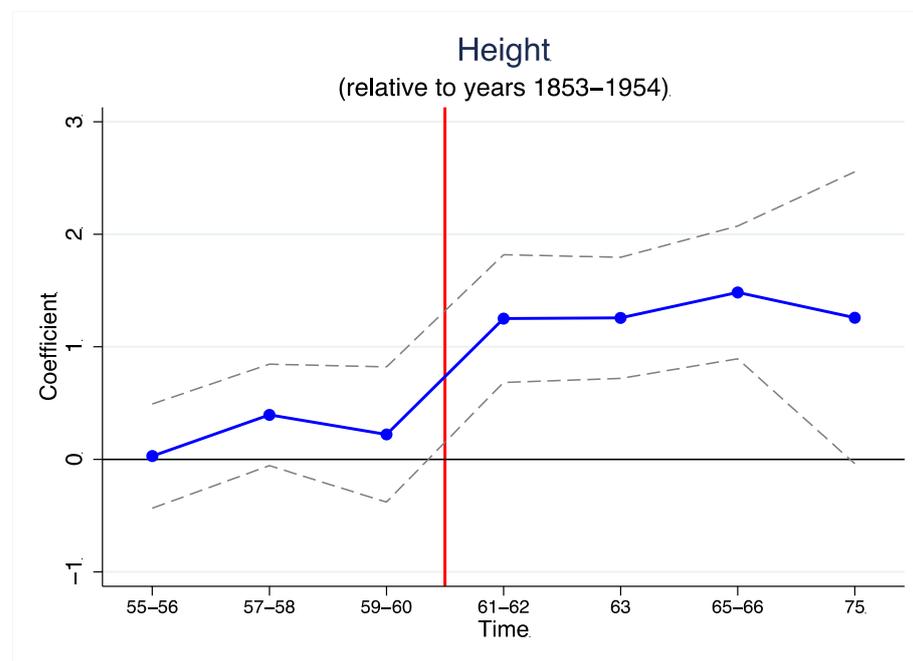


**Figure 5. The time-varying effect of emancipation: grain productivity**



Note: The number of cross-sections within five-year intervals varies because of missing data for 1867-1869 and 1877-1882. The figure presents coefficients (along with their 90% confidence interval) in the regression of grain yield on 5-year interval dummies, province and year fixed effects, region-specific linear trends, and controls for demeaned suitability interacted with post-emancipation dummy, and demeaned distance to Moscow interacted with post-emancipation dummy, the share of state peasants interacted with post-1866 dummy, and the share of royal peasants interacted with post-1959 dummy. Four cross-sections between 1795 and 1829 are held as the comparison group. The vertical red line marks the timing of the emancipation. The table-form representation of the results of this estimation is presented in column 1 of Table A3 in the online appendix.

**Figure 6. The time-varying effect of emancipation: height**



Note: The figure presents coefficients (along with their 90% confidence interval) in the regression of grain yield on 2-year interval dummies, province and year fixed effects, region-specific linear trends, and controls for demeaned suitability interacted with post-emancipation dummy, and demeaned distance to Moscow interacted with post-emancipation dummy, the share of state peasants interacted with post-1866 dummy, and the share of royal peasants interacted with post-1959 dummy. Two cross-sections of 1853 and 1854 are held as the comparison group. The vertical red line marks the timing of the emancipation. The table-form representation of the results of this estimation is presented in column 2 of Table A3 in the online appendix.

Table 1. Summary statistics (without Baltic provinces)

Panel A. Distribution of rural population by status in 1858 (Source: 1858 police data)

	Obs	Mean	Std. Dev.	Min	Max
Share of serfs	46	0.45	0.24	0.001	0.83
Share of state peasants	46	0.39	0.21	0	0.88
Share of royal peasants	46	0.04	0.09	0	0.47
Share of free rural population	46	0.12	0.17	0.04	0.85

Panel B. Distribution of serfs by the measures of land reform

	Obs	Mean	Std. Dev.	Min	Max
Share of rural population with land-buyout started in 1862-1882 (Land reform)	877	0.32	0.24	0	0.83
Share of serfs with signed regulatory charters by 1863	45	0.43	0.2	0.02	0.85
Repatriation commune dummy	46	0.87	0.34	0	1

Panel C. Development outcomes

	Obs	Mean	Std. Dev.	Min	Max
Grain productivity (yield to seed ratio)	1777	3.79	1.27	0.59	12.3
Industrial output (mln current rubles)	296	16.3	36.3	0	334
Industrial workers (thousands)	133	31.98	57.27	0.03	496.1
Population (thousands)	884	1245	843	37.5	4610
Births per thousand	501	0.048	0.008	0.021	0.123
Deaths per thousand	501	0.036	0.008	0.017	0.127
Height of draftees (centimeters)	644	164.33	1.04	161.86	168.15
Summer grain share	376	0.56	0.11	0.36	0.9

Panel D. Monasteries and Gentry Indebtedness

	Obs	Mean	Std. Dev.	Min	Max
1764 monasteries per thousand inhabitants	44	0.3	0.04	0	0.14
Gentry Indebtedness in 1858	43	0.12	0.07	0.003	0.29

Panel E. Geographical variables

	Obs	Mean	Std. Dev.	Min	Max
Distance to Moscow (km)	46	666	323	24	1307
Crop suitability (one to five index)	46	2.17	1.33	1	5

Table 2. The effect of the abolition of serfdom on productivity in agriculture

Panel A: Main results

Dependent var:	(1) Grain yield OLS	(2) Grain yield OLS	(3) Grain yield IV, 2nd stage	(4) Grain yield OLS	(5) Grain yield IV, 2nd stage	(6) Grain yield OLS
Share of serfs X Post-emancipation	0.91*** [0.26]	0.90*** [0.23]	1.51*** [0.42]	0.74** [0.31]	0.87* [0.48]	1.02*** [0.32]
Demeaned log distance to Moscow X Post-emancipation		-0.02 [0.321]	0.85** [0.372]	-0.9* [0.46]	-0.76* [0.45]	-0.81* [0.45]
Demeaned crop suitability X Post-emancipation		-0.08** [0.04]	-0.12*** [0.03]	0.02 [0.05]	0.01 [0.05]	0.01 [0.05]
Share of state peasants X Post-1866	No	No	No	No	No	Yes
Share of royal peasants X Post-1859	No	No	No	No	No	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Province-specific trends	No	No	No	Yes	Yes	Yes
Observations	1,777	1,756	1,695	1,756	1,695	1,756
R-squared	0.47	0.47	0.5	0.51	0.52	0.51

Panel B: First stages of 2SLS regressions

Dependent var:	Share of serfs X Post- emancipation IV, 1st stage	Share of serfs X Post- emancipation IV, 1st stage
Monasteries 1764 per capita X Post-emancipation	-2.77*** [0.59]	-2.66*** [0.55]
Demeaned log distance to Moscow X Post-emancipation	-0.81*** [0.12]	-0.82*** [0.11]
Demeaned crop suitability X Post-emancipation	0.05** [0.02]	0.05*** [0.02]
Year fixed effects	Yes	Yes
Province fixed effects	Yes	Yes
Province-specific trends	No	Yes
Observations	1,695	1,695
F, monasteries instrument	22.07	23.6

Notes: Standard errors are clustered by province separately before and after the 1861 emancipation reform. Post-emancipation is a dummy, which is switched on in 1861.

\*\*\* indicates p-value <0.01, \*\* p-value <0.05, \* p-value <0.1.

Table 3. Disentangling the emancipation of serfs and the implementation of the land reform

Panel A: Main results					
Dependent var:	(1) Grain yield OLS	(2) Grain yield IV, 2nd stage	(3) Grain yield OLS	(4) Grain yield IV, 2nd stage	(5) Grain yield OLS
Share of serfs X Post-emancipation	1.01** [0.42]	2.72*** [0.70]	0.79* [0.43]	2.30*** [0.83]	0.88** [0.44]
Share of serfs with land-buyout started	-0.52* [0.27]	-1.30*** [0.32]	0.08 [0.31]	-0.6 [0.49]	0.16 [0.32]
Share of serfs with land-buyout started X repartition commune			-0.80** [0.37]	-0.92* [0.54]	-0.77** [0.36]
Demeaned log distance to Moscow X Post-emancipation	-0.49 [0.51]	0.63 [0.51]	-0.83 [0.55]	0.13 [0.66]	-0.84 [0.56]
Demeaned crop suitability X Post-emancipation	0.02 [0.05]	0.02 [0.05]	0.001 [0.05]	0.001 [0.05]	-0.01 [0.05]
Share of state peasants X Post-1866	No	No	No	No	Yes
Share of royal peasants X Post-1859	No	No	No	No	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes
Province-specific trends	Yes	Yes	Yes	Yes	Yes
Observations	1,701	1,651	1,701	1,651	1,701
R-squared	0.52	0.53	0.52	0.53	0.52

Panel B: First stages of 2SLS regressions					
Dependent var:	Share of serfs X Post- emancipation IV, 1st stage	Share of serfs with land- buyout started IV, 1st stage	Share of serfs X Post- emancipation IV, 1st stage	Share of serfs with land- buyout started IV, 1st stage	Share of serfs with land- buyout started X repartition commune IV, 1st stage
Monasteries 1764 per capita X Post-emancipation	-2.76*** [0.58]	-2.73*** [0.58]	-2.09*** [0.59]	-1.82*** [0.61]	-2.04*** [0.60]
Interpolation b/w (1-indebtedness) and 1 in the interval 1862-1882	0.004 [0.164]	2.65*** [0.25]	0.01 [0.16]	2.66*** [0.23]	1.999*** [0.222]
Interpolation b/w (1-indebtedness) and 1 in the interval 1862-1882 X repartition commune			-0.2*** [0.06]	-0.27*** [0.06]	0.37*** [0.05]
Demeaned log distance to Moscow X Post-emancipation	-0.79*** [0.11]	-0.58*** [0.11]	-0.8*** [0.10]	-0.6*** [0.11]	-0.6*** [0.10]
Demeaned crop suitability X Post-emancipation	0.06*** [0.02]	0.04** [0.02]	0.03* [0.02]	0.01 [0.02]	0.02 [0.02]
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes
Province-specific trends	Yes	Yes	Yes	Yes	Yes
Observations	1,651	1,651	1,651	1,651	1,651
F, monasteries instrument	22.91	21.84	12.54	9.08	11.5
F, indebtedness instrument	0.001	113.5	0.01	132.8	80.82
F, indebtedness X repartition instrument			12.89	21.05	57.90

Notes: Standard errors are clustered by province separately before and after the 1861 emancipation reform. Post-emancipation is a dummy, which is switched on in 1861. Share of serfs with land-buyout started reflects the share of serfs, who started land buyout operations at every point in time, as a share of rural population. It equals 0 in all provinces for the years before 1862 and then gradually reaches the share of serfs in the corresponding province. In the non-western provinces this happened by 1882, and in western provinces in 1863. Indebtedness is the number of serfs in the province used as collateral in landlords' debt contracts in 1858 as a share of total number of serfs in the province.

\*\*\* indicates p-value <0.01, \*\* p-value <0.05, \* p-value <0.1.

Table 4. The abolition of serfdom and peasant living standards: draftees' height

	(1)	(2)	(3)
Dependent var:	Height	Height	Height
	OLS	IV, 2nd stage	OLS
Share of serfs X Post-emancipation	0.91** [0.38]	1.7** [0.85]	0.91** [0.37]
Demeaned log distance to Moscow X Post-emancipation	0.43 [0.37]	0.66 [0.66]	0.42 [0.36]
Demeaned crop suitability X Post-emancipation	0.15** [0.06]	0.17*** [0.06]	0.15*** [0.06]
Share of state peasants X Post-1866	No	No	Yes
Share of royal peasants X Post-1859	No	No	Yes
Year fixed effects	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes
Province-specific trends	Yes	Yes	Yes
Observations	644	632	644
R-squared	0.9	0.9	0.9
F, monasteries instrument		20.85	

Notes: Standard errors are clustered by province separately before and after the 1861 emancipation reform. Post-emancipation is a dummy, which is switched on in 1861. We instrument the share of serfs times post-emancipation dummy with monasteries in 1764 per capita interacted with post-emancipation period. First-stage regression output is reported in column 1 of Table A5 in the online appendix.

\*\*\* indicates p-value <0.01, \*\* p-value <0.05, \* p-value<0.1.

Table 5. The abolition of serfdom and peasant living standards: demographics

Dependent var:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Mortality (deaths per capita)			Fertility (births per capita)			Ln (population)		
	OLS	IV, 2nd stage	OLS	OLS	IV, 2nd stage	OLS	OLS	IV, 2nd stage	OLS
Share of serfs X Post-emancipation	-0.007** [0.003]	-0.009 [0.009]	-0.006** [0.003]	0.011*** [0.003]	0.025*** [0.01]	0.014** [0.006]	0.202** [0.09]	0.472* [0.268]	0.11 [0.076]
Demeaned log distance to Moscow X Post-emancipation	-0.005* [0.002]	-0.006 [0.006]	-0.004 [0.002]	0.016*** [0.004]	0.027*** [0.007]	0.016*** [0.004]	-0.024 [0.068]	0.167 [0.137]	-0.045 [0.077]
Demeaned crop suitability X Post-emancipation	0.001* [0.001]	0.001** [0.001]	0.001* [0.001]	0.001* [0.000]	0.001 [0.001]	0.001* [0.000]	-0.011 [0.017]	-0.012 [0.015]	-0.0081 [0.015]
Share of state peasants X Post-1866	No	No	Yes	No	No	Yes	No	No	Yes
Share of royal peasants X Post-1859	No	No	Yes	No	No	Yes	No	No	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province-specific trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	501	483	501	501	483	501	588	578	588
R-squared	0.55	0.55	0.55	0.64	0.64	0.65	0.98	0.98	0.98
F, monasteries instrument		21.79			21.79			22.13	

Notes: Standard errors are clustered by province separately before and after the 1861 emancipation reform. Post-emancipation is a dummy, which is switched on in 1861. We instrument the share of serfs times post-emancipation dummy with monasteries in 1764 per capita interacted with post-emancipation period. First-stage regression output is reported in columns 2-4 of Table A5 in the online appendix.

\*\*\* indicates p-value <0.01, \*\* p-value <0.05, \* p-value<0.1.

Table 6. The abolition of serfdom and industrial development

Dependent var:	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	Ln (industrial output) IV, 2nd stage	OLS	Ln (industrial employment) OLS	IV, 2nd stage	OLS
Share of serfs X Post-emancipation	1.62*** [0.46]	2.9* [1.65]	2.01*** [0.41]	2.95*** [0.73]	3.4*** [1.23]	2.79*** [0.48]
Demeaned log distance to Moscow X Post-emancipation	2.02** [0.8]	2.98** [1.217]	2.13*** [0.81]	4.1216*** [0.59]	4.34*** [0.95]	4.37*** [0.53]
Demeaned crop suitability X Post-emancipation	0.08 [0.1]	0.06 [0.01]	0.08 [0.01]	-0.09 [0.09]	-0.08 [0.07]	-0.16 [0.1]
Share of state peasants X Post-1866	No	No	Yes	No	No	Yes
Share of royal peasants X Post-1859	No	No	Yes	No	No	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region-specific trends	Yes	Yes	Yes	No	No	No
Observations	285	279	285	129	125	129
R-squared	0.91	0.9	0.91	0.94	0.94	0.95
F, monasteries instrument		27.45			22.54	

Notes: Standard errors are clustered by province separately before and after the 1861 emancipation reform. Post-emancipation is a dummy, which is switched on in 1861. We instrument the share of serfs times post-emancipation dummy with monasteries in 1764 per capita interacted with post-emancipation period. First-stage regression output is reported in columns 5 and 6 of Table A5 in the online appendix.

\*\*\* indicates p-value <0.01, \*\* p-value <0.05, \* p-value <0.1

Table 7. The abolition of serfdom: channels of improvements

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent var:	Ln (arable land)		Share of summer crops		Grain yield	Grain yield
	OLS	IV, 2nd stage	OLS	IV, 2nd stage	OLS	IV, 2nd stage
Share of serfs X Post-emancipation	0.32 [0.36]	0.22 [0.73]	0.27* [0.16]	0.44* [0.24]	1.84*** [0.5]	2.96*** [0.62]
Share of serfs X Post-emancipation X Implicit contracts					-1.78*** [0.6]	-1.44** [0.57]
Share of serfs with land-buyout started					-0.7** [0.27]	-1.35*** [0.32]
Demeaned log distance to Moscow X Post-emancipation	0.4 [0.56]	0.32 [0.73]	-0.63 [0.19]	-0.54** [0.234]	-0.6 [0.5]	0.23 [0.5]
Demeaned crop suitability X Post-emancipation	0.13** [0.05]	0.13*** [0.04]	0.07*** [0.03]	0.07*** [0.02]	0.01 [0.04]	0.01 [0.05]
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Province-specific trends	No	No	Yes	Yes	Yes	Yes
Observations	131	129	376	361	1,648	1,617
R-squared	0.89	0.89	0.969	0.974	0.53	0.53
F, monasteries instrument		10.6		10.18		21.86
F, monasteries X implicit contracts instrument						61.26
F, indebtedness instrument						110.7

Notes: Standard errors are clustered by province separately before and after the 1861 emancipation reform. Post-emancipation is a dummy, which is switched on in 1861. Share of serfs with signed charters is a proxy for the presence of an implicit contract between the landlords and peasants before emancipation. Large estate is a dummy for whether an average-size estate in a province before the emancipation had more than 100 male serfs. We instrument the share of serfs times post-emancipation dummy with monasteries in 1764 per capita interacted with post-emancipation period. We instrument the share of serfs with land by out started with the indebtedness instrument, which is a linear interpolation between (1-indebtedness) and 1 in the interval 1862-1882. First-state regression output is reported in columns 7-14 of Table A5 in the online appendix.

\*\*\* indicates p-value <0.01, \*\* p-value <0.05, \* p-value <0.1.

# Online Appendix

## A. Historical background

### A1. Legal status of Russian peasants, who were not serfs

*State peasants:* Formerly, state peasants (40.4% of rural population) were free individuals living and working on the land belonging to the state. By law, they had personal and property rights and could change their occupation and place of living. The required administrative procedure for moving was so complicated, however, that few actually did this.<sup>35</sup> State peasants had to pay a tax (in a form of quitrent) to the state in the amount fixed by the law in return for the ability to cultivate the land. A special ministry regulated the magnitude of the quitrent as well as the types of actual agricultural production. The ministry changed the quitrent only rarely (three times in the 18th and four times in the 19th century). Historians agree that, on average, the living standards of state peasants were higher, individual land plots were larger in all but two provinces, and the system of quitrent was more transparent than that of serfs (Druzhinin 1958). In the late 1830s - 1840s the government conducted the so-called Kiselev reforms, which guaranteed a minimal-size land plot to each state-peasant household and improved the administration of the state-peasant villages. If the population in these villages grew above the minimum required land-household ratio, the state initiated migration programs to virgin lands in the south and east of the empire (Druzhinin 1958; Crisp 1976).

We count former military dwellers, i.e., soldiers in special regiments who were supposed to participate full-scale in agriculture along with their military service, as state peasants. The state established the group of military dwellers in 1810 to economize on military expenditures. For that purpose, the government selected several regular regiments and settled them down on state lands in military settlements. Military settlements were abandoned in 1857 and former military dwellers legally became state peasants.

*Free agricultural laborers:* Free peasants with or without land titles constituted 12.6% of the rural population in 1858. This group consisted of Cossacks with communal land title, former soldiers (including soldiers in reserve and soldiers' children, so called cantonists) who became free after retirement, colonists who cultivated land under various land arrangements, and non-Russians in the Astrakhan and Bessarabiya provinces without land, foreigners in rural areas and peasants under the supervision of various ministries. In addition, after the 1819 reform, the largely landless peasants in the three Baltic provinces became free laborers.

*Appanage peasants:* Royal ("appanage," *udel'nye*) peasants constituted another, much less numerous, group of the peasantry. They were serfs belonging to the royal family on quitrent. They were managed by a special ministry (Department of Appanages), were emancipated in 1859, and got a subsequent land reform in 1863.

### A2. The timing of the abolition of serfdom

The Russian government had discussed the emancipation reform for a long period before the abolition of serfdom actually happened in 1861. Already, Alexander I (1801-1825), influenced by the spread of ideas of Enlightenment and emancipation reforms in the Habsburg and Prussian empires (1781 and 1809, respectively), considered various projects regarding restrictions of landlords' authority over serfs, including the abolition of serfdom altogether. But the vast

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<sup>35</sup> Note that the state peasants were free only relative to serfs, particularly, in the 18<sup>th</sup> century, as we describe below, until 1801, the tsars often granted state lands with state peasants on these lands to nobility as private estates in exchange for military service; in that case, state peasants acquired the status of serfs. In addition, state peasants were subject to several other administrative restrictions, which were largely removed by the first quarter of 19th century (Crisp 1976). The state peasants described themselves in the following way in the 18<sup>th</sup> century: "*we are not free, we belong to the state*" (Crisp 1976 p. 76).

majority of the suggested plans remained unrealized. Alexander I ventured to liberate serfs only in the outskirts of the empire, in particular in the three Baltic provinces (1816-1819), and to implement reforms that only marginally affected serfdom (such as the 1801 and 1803 decrees allowing landlords to liberate peasants on their private will, or the 1809 prohibition on landlords penalizing serfs by sending them to penal works in Siberia).

Similarly, Alexander's successor, Nicolas I (1825-1855) considered an emancipation reform. During his reign he organized a number of secret committees to discuss how to deal with serfdom, which also failed to find a solution (Mironenko 1990; Zajonckovskij 1968).

The gentry's opposition to emancipation was the main concern forcing the government to postpone the reform. Serfdom remained profitable for the gentry until its very end. Dormar and Machina (1984) disentangled prices on serfs and land from historically known prices of estates (the law prohibited selling serfs without land in the first half of the 19th century) and showed that serfs had positive value. The prices of licenses in the 1840s and 1850s that allowed the serfs to avoid the draft into the army were high: 485 silver rubles or about ten times the annual GDP per capita (Obruchev 1871). Historical literature views these licenses as a proxy for the price of serfs because of life-span military service before the 1874 military reform.

The defeat in the Crimean War (1853-1856) demonstrated that Russia lacked modern industries and technologies to compete with most developed countries. This convinced the skeptics of the necessity for deep reforms, including the abolition of serfdom. While the new government of Alexander II (1855-1881) used the defeat as a motivating factor to overcome the gentry's opposition to the liberation of serfs, it took the government more than five years to enact the reform (Zakharova 1984).

### **A3. The details of the land reform**

Emancipated serfs were obligated to buy out the land from the landlord in the future. The law explicitly prohibited peasants from quitting the countryside without the buyout of land within nine years of emancipation. After 1870, in order to quit their village without buying the land, peasants had to satisfy a number of restrictive conditions. In practice, less than one percent of peasants chose quitting without the buyout of land (Litvak 1972). The landlord and the peasant commune had to negotiate the precise terms of the buyout, namely the amount of land, the price, and the timing. If the landlord and the peasants could not reach an agreement, the law prescribed the terms of the fallback deal. The rules varied across regions. For example, in the western provinces (for instance, the right-bank Ukraine, Byelorussia and Lithuania), the terms of the fallback option were less favorable for gentry, and the parties were given less time to implement the land reform.<sup>36</sup> The land reform was completed when the peasants got communal property rights title on their land. This happened with varying speed in different provinces, but by 1882 the land reform was fully completed in all provinces. In western provinces, where the land reform was the fastest, the legislation mandated that peasants and landlords start the buyout operation in 1863, following the Polish rebellion.

The negotiations between the peasants and the landlord proceeded in two stages. During the first two years after the emancipation (until 1863), the landlord and the peasants had to agree on the terms of the regulatory charter (*ustavnaya gramota*) that fixed the land plots in peasants' use, and the obligations they had to perform in exchange for the use of the land during the transition period, before the actual start of the buyout operation.<sup>37</sup>

Once the charter was produced, the buyout operation could be initiated, i.e., the buyout contract signed, either by mutual agreement between the landlord and the peasants, or at the

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<sup>36</sup> Initially, the rules were similar throughout the empire. The change in the rules was caused by the 1863 Polish rebellion. The government introduced pro-peasant changes for political reasons. The vast majority of former serfs were Ukrainians or Byelorussians in these regions, whereas the landlords were Polish. The new legislation for the western provinces required no land cuts and reduced redemption payments for peasants.

<sup>37</sup> Before the regulatory charter was produced, peasants had to continue to carry out their obligations, as they existed before the emancipation; but the law limited their amount (Litvak 1972, p321; Zajonckovskij 1968, p244).

request of either the landlord or the peasants under the terms specified by the law. The charter's terms were used as a focal point for determining the value and the exact plots of the land for the buyout contract, such that the land price was often determined as capitalized quitrent (or corvee equivalent) fixed in the charter (Complete ... 1861). The start of the buyout operation marked the second and final stage of the land reform, i.e., the transfer of the communal land ownership title to the peasants in exchange for the obligatory redemption of the value of the land and the cessation of any temporary obligations of the peasants to the landlord.

At the first stage, the landlord was supposed to produce a draft of the charter, which the peasants could accept or reject. Some (but far from all) landlords did not revise their peasants' obligations under serfdom; in this case, the landlord and the peasants considered the level of obligations as an implicit long-term contract. If such an implicit contract existed and the charter closely followed its terms, it was easier for the peasants and the landlord to reach agreement. The charter had to be authorized by a local official (*mirovoj posrednik*), and if there was of no agreement, the local official had to produce the fallback document on his own, following the law (Easley 2008). About one-half of all former serfs signed the regulatory charters following an agreement with the landlord (Zajonckovskij 1968). The law defined the maximum and minimum amount of land that peasants could get as a result of the land reform, and outlined the peasants' obligations per each unit of land.<sup>38</sup> After the emancipation, the land became the main asset of the landlords, and they tried to keep as much land in their possession as possible. According to calculations by Soviet historians, peasants lost up to one-third of all peasant pre-reform land as a result of the first stage of the land reform (Litvak 1974; Zajonckovskij 1968).

At the second stage, the buyout contract determined the amount that peasants needed to pay to buy out the land into the communal ownership.<sup>39</sup> Peasants paid twenty percent of the land price and the state provided a loan for the other eighty percent of the value of the land. Peasants had to repay this loan to the state in annual installments during the next 49 years. On average, the annual redemption burden was not higher than previous quitrent or corvee (Gerschenkron 1965 p. 741).

An initiation of the buyout operation by the peasants or the landlord without a mutual agreement implied some losses for the initiator. If peasants launched the buyout operation, they could buy out only small plots around their houses in the village, but not the arable land. In addition, in that case, they did not get a loan from the government. If the landlord launched the operation, peasants did not pay their initial twenty percent of the land price. Potential losses forced both peasants and landlords to search for mutual agreement, postponing the start of the buyout operation and providing substantial sources of variation in the timing of the completion of the land reform. Fifteen percent of former serfs postponed the buyout operation until 1881, when a new law prescribed an obligatory start of the buyout operation by the beginning of 1883 for all peasants who had not yet done so. State peasants, who were formerly free, went through land reform in 1866. The local authorities issued special commune land title documents (*vladennie zapisi*). These documents guaranteed former state peasants land usage rights in return for a fixed quitrent over the next twenty years, after which the quitrent was replaced by

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<sup>38</sup> The maximum and the minimum varied across provinces. They were equal to about 3 and 7 *desyatinas* per male, respectively, in Russia's non-"black earth" regions, and about 2 and 6 *desyatinas*, respectively, in the black earth regions. (*Desyatina* is a measure of area: 1 *desyatina* = 0.37 acre.) "Step" provinces represented an exception, where the law determined the precise size of the peasant plot. If peasants cultivated more land before the emancipation than the legal maximum stipulated, the landlord had to cut both their plots and obligations. If peasants had less land than the legal minimum, the law prescribed the landlord to increase their plots. In practice land cuts were more widespread than land extensions. The law also guaranteed the landlord a minimum of land that he or she could keep in his or her possession, even if peasants got less land than the legal minimum prescribed. The landlords' minimum also varied across provinces; it ranged from one-third to one-half of the total size of the estate. Landlords of estates with less than twenty-one male serfs had some additional privileges (Complete ... 1861).

<sup>39</sup> In the case of a mutual agreement, peasants could take one-quarter of the maximum land plot stipulated by law without any payment to the landlord, a so-called gifted pauper plot (*darstvennij nadel*). Peasants could also request a gifted pauper plot if the landlord initiated the buyout operation. About a million peasants, or about 4 percent of former serfs, got gifted pauper plots as a result of the land reform (Zajonckovskij 1968).

obligatory redemption payments. In western provinces, redemption payments for former state peasants were introduced in 1867. Similar to the case of serfs, the land value for state peasants was estimated as capitalized quitrent for forty-six years. The land plots that state peasants got as a result of their land reform were on average twice as large as the plots of serfs (Zajonckovskij 1968; Druzhinin 1978).

Royal peasants experienced land reform in 1863. Their terms of land reform were similar to the terms of serfs (Zajonckovskij 1968). In the Baltic provinces, former serfs did not have land reform, as they did not have to buy out land.

#### **A4. Nationalization of monasterial lands in 1764**

The royal family and individual landowners granted lands to the Orthodox Church since the Christianization of Russia. Peasants who lived on church land became serfs belonging to the Orthodox Church with the establishment of serfdom in the late 16<sup>th</sup> – mid-17<sup>th</sup> century. The bulk of church property belonged to monasteries. Monasteries accumulated 2 million serfs by the 18<sup>th</sup> century. Monasterial serfs faced the same constraints as other privately owned serfs and used the same agricultural technologies and practices (Zakharova 1982). We did not find any evidence in historical literature of a systematic difference in the quality of land that was donated to monasteries or in the literacy rate of monasterial serfs. This is not surprising, as religiosity was the overriding motive behind the flow of testaments and private donations of land to the Orthodox Church.

The modern state built in Russia in the 18<sup>th</sup> century accumulated enough power to progressively confiscate Church property. As the first step, Peter the Great took all Orthodox Church property under state control in 1701. The government created a special department that managed church estates and collected all revenues from them, transferring a part of the revenues to church institutions to finance their activities. In 1744, however, the Church managed to regain control over revenues from its property. Finally, Catherine the Great nationalized Church property. This nationalization took place in 1764 in the core part of the Russian Empire, in 1786-1788 in Ukrainian provinces, and in 1793-1795 in provinces integrated into the empire as a result of the partitions of Poland. Former monasterial serfs got legal status of state peasants as a result of this reform (Shchapov 1989). The government did not grant estates with former monasterial serfs into private possession of gentry, in order to avoid antagonizing the church further.

Zverinskij (1890, 1897) collected and systemized data on all monasteries that ever existed in the Russian Empire. Zverinskij (1890) provides information on all monasteries closed by 1764, and Zverinskij (1897) provides information on all monasteries that continued to operate during the reign of Catherine the Great. Using this information we construct a number of monasteries (both open and closed) by province, and normalize it by provincial population in 1897.<sup>40</sup>

#### **A5. Gentry indebtedness in 1858**

The government had provided credit to Russian gentry since the late 18<sup>th</sup> century. The landlords had the privilege of taking long-term loans, with serfs as collateral, from the state financial institutions (so called *Ssudnaya kazna* and *prikazi obshchestvennogo prizreniya*), which was their main source of credit due to the poorly developed financial market. The government viewed the credit privilege of the landlords as another way to secure the political loyalty and economic welfare of the gentry. The terms of credit improved over time. Four years before the emancipation of serfs, the state decreased the interest rate for gentry from five to four percent. The new interest rate was above the profitability rate of an average estate, which was about five percent. In anticipation of emancipation, the state stopped issuing new loans in 1858 (Gur'ev 1904).

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<sup>40</sup> We use 1897 census figures for provincial population because of data quality.

Russian gentry widely used state loans for status consumption (such as real estate in the capital cities, imported luxury goods, etc.) rather than investment in production within their estates (Korf 1906). Due to the status consumption, the level of indebtedness was orthogonal to the productivity of the estates. About forty-four thousand estates had debts and about 7.1 million male serfs, about sixty-three percent of all serfs, were used as collateral by 1858 (Skrebitskii, 1862-1866 vol. 4). In an average province in our sample this number is fifty-nine percent.

As noted above, during the land reform, which was an integral part of the abolition of serfdom, the state provided loans to former serfs to finance buyouts of land from landlords. The land prices were set to fully compensate landlords for their loss in income due to emancipation (the reform postulated the land price to be equal to capitalized quitrent), and the buyout was obligatory. The state paid landlords directly with special bonds that had a five percent interest rate. The landlords got these bonds only if they did not have debts to the state themselves. Indebted landlords had to pay their debts back to the state first once the buyout operation was launched. Thus, for the landlords with debts, the buyout operation meant a drop in revenues. They got five percent from the market value of their estate in the form of quitrent before the land reform (including the period after the emancipation), and paid four percent back to the state; this left them one percentage point of revenue. The indebted landlords lost this one percent once the buyout operation was launched. The state provided loans to landlords with fixed maturity, and which could not be refinanced after 1858. As a result, the pool of landlords who could enjoy the one percentage point privilege shrunk over time.

#### **A6. The shift from traditional to modern crop varieties**

The three-fields system (an annual rotation of summer crops, winter crops, and fallow on the same plot) dominated in Russian agriculture before the emancipation. The winter rye was the main winter cereal in European Russia for centuries because of its better resistance to harsh climate (short summers, cold winters, and frequent droughts), and correspondingly higher productivity under the use of traditional agricultural technologies, provided that local soil conditions were not taken into consideration. Oat was a traditional summer crop that was mostly used to feed horses and cattle. Summer wheat, barley, or buckwheat were not widespread because they were believed to require milder climates and/or more inputs. In places where wheat and barley were cultivated, these crops were mostly sold, whereas peasants grew winter rye for their own consumption. Gradual accumulation of agricultural knowledge and slow improvements in agricultural technology (e.g., the development and adoption of new seed varieties, a shift to a more sophisticated multi-field crop rotation systems, and better use of knowledge about crop productivity on different types of local soil) allowed for extending the area of cultivation of the advanced summer crops, and secure their higher productivity in localities which previously were considered to be ill-suited for summer crop cultivation. Technological advances, together with growing market demand for wheat in Western Europe, led to a gradual shift away from winter rye to summer crops in European Russia. This shift was well recognized by the 19<sup>th</sup> century (Nifontov 1974).

We do not have systematic data on cereal cultivation by crops before the emancipation. Governor reports provide only aggregated figures on all cereals, without distinction of particular crops. We aggregate data on corresponding winter and summer crops to construct comparable measures for the late 19th century.

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## **B. The definition of the 15 regions**

We use the standard classification reported in imperial statistical volumes with two modifications discussed in the literature (Rossiya [Russia] in *Entsiklopedicheskii ... 1890—1907*). First, we construct a special region for capital provinces, namely for Moscow and Saint Petersburg. Second, we separate Astrakhan' from Low Volga, treating it as a separate region. Moscow and Saint Petersburg were the only two large cities in an agrarian country. Astrakhan' was very different from other Low Volga provinces in terms of geography (desert vs. step) as well as in terms of serfdom (local non-Russians who formed the majority in the Astrakhan' province were free).

1. North: Arkhangelsk, Vologoda and Olonets provinces;
  2. North-West: Novgorod and Pskov provinces;
  3. West: Smolensk, Vitebsk and Mogilev provinces;
  4. Belorussia and Lithonia: Minsk, Grodno, Vil'no and Kovno provinces;
  5. Central Industrial Region: Vladimir, Nizhnij Novgorod, Kostroma, Yaroslavl' and Tver' provinces;
  6. Central Black Earth Region: Kaluga, Tula, Ryasan', Orel, Tambov, Kursk, Voronezh provinces;
  7. Middle Volga: Kazan', Penza and Simbirsk provinces;
  8. Left Bank Ukraine: Chernigov, Poltava and Khar'kov provinces;
  9. Right Bank Ukraine: Kiev, Podoliya, Volyn' and Bessarabiya provinces;
  10. South: Kherson, Tavrida, Ekaterinoslav, Don and Stavropol' provinces;
  11. Low Volga: Saratov and Samara provinces;
  12. Astrakhan': Astakhan' province;
  13. Urals: Orenburg, Vyatka and Per'm provinces;
  14. Capitals: Moskovskaya and Saint-Peterburgskaya.
- In addition, Estlyandiya, Lifyandiya and Kurlyandiya provinces composed the Baltic region.

### **C. Counterfactual scenarios of Russian economic growth in the case of earlier abolition of serfdom**

To illustrate the magnitude of the overall effect of the institution of serfdom on economic development, we estimate the level of per capita income in Russia in 1913 under three alternative counterfactual scenarios. In each of which we set the counterfactual date for the abolition of serfdom to 1820 instead of 1861. We consider 1820 as the year of the early abolition of serfdom in the counterfactual scenarios because of the serious political discussions in Russian society about emancipation reform under the rule of Alexander I (1801-1825). The emancipation of peasants in Prussia occurred just 13 years before (in 1807) our considered counterfactual year. Table A16 below in this online appendix summarizes our counterfactual estimates. The text below describes the derivation of these figures.

Our starting point is Maddison's (2007) estimate of Russian GDP per capita in 1820, which is \$688 in 1990 USD. We assume that the industrial structure of the Russian economy was approximately stable before Russia's industrialization in the late 19<sup>th</sup> century, and estimate the value added in industry, agriculture, and services in 1820.

We apply data on industrial structure as of 1860, which is the earliest available date for these figures. The shares of each sector in value added are obtained from Goldsmith (1961), who gives figures for the shares of each of the three sectors in 1913, and their growth rates, between 1860-1913. In particular, according to Goldsmith (1961), agriculture, industry, and service sectors accounted for 50%, 20%, and 30% of national income in 1913, respectively. These sectors grew on average by 2%, 5%, and 2% per year, respectively. Rolling back these growth rates, we estimate the shares of agriculture, industry, and service sector in 1860 as 59.3%, 5.1%, and 35.6%, respectively.

We obtain the counterfactual estimates of sectorial output in 1820 by momentarily increasing the level of output in each sector according to the following multipliers:

For the agricultural sector, we apply the effect for grain productivity (10% increase, or 1.1 multiplier) because grain was the main product produced by Russia's agricultural sector in the 19<sup>th</sup> century. Grain production accounted for about half of total agricultural output in 1913 (Markevich and Harrison 2013). This share is unknown for the earlier years but was most probably higher.

For the industrial sector, we apply the effect of the abolition of serfdom on industrial output (3.69 multiplier), rather than on industrial employment (4.62 multiplier) in order to be on the conservative side.

For the service sector, we take the average multiplier in industry and agriculture weighted by the size of these sectors.

We sum the sectorial estimates to get a counterfactual value added in the total economy in 1820, and get \$49,177.3 million in 1990 USD. Then, we divide this figure by Maddison's estimate of the total population in 1820 (54.765 million people) to get the counterfactual level of GDP per capita in 1820: \$898 in 1990 USD.

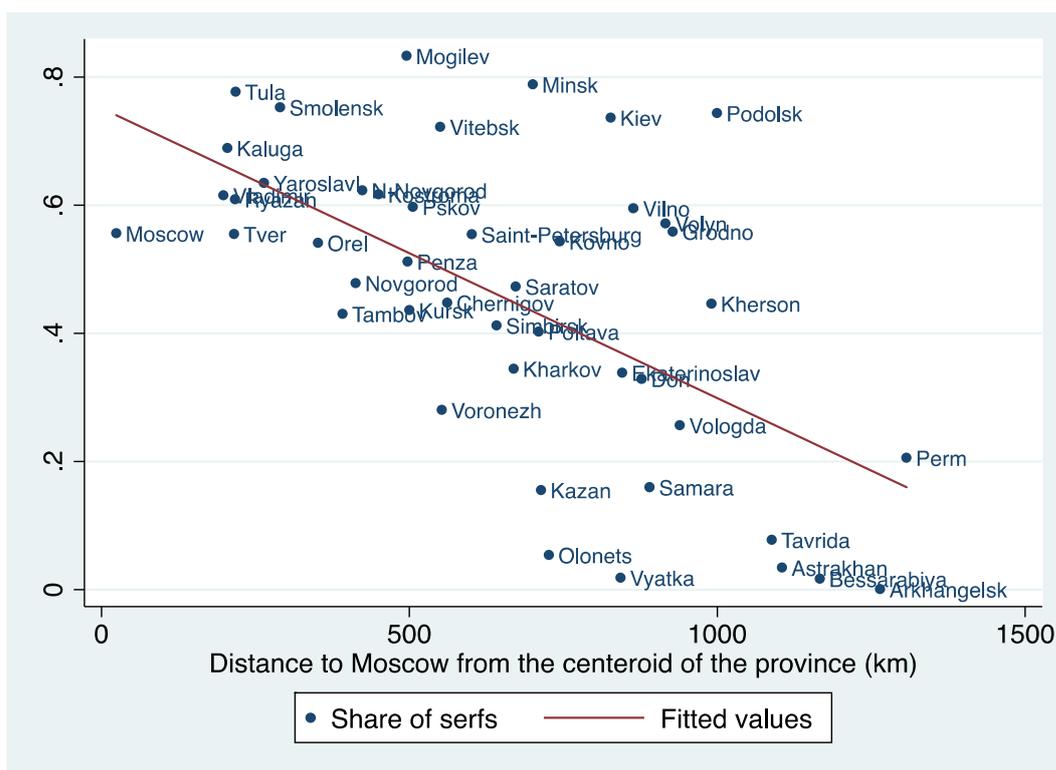
Finally, we allow GDP per capita to grow at three different rates: 1) The rate it actually grew after the emancipation during the industrial spurt, (1.06% per year between 1870 and 1913). We call this "the optimistic scenario." 2) Its actual historical rates (0.83% per year between 1820 and 1913). We call this "the pessimistic scenario." 3) The average rate of growth between 1820 and 1913 of the Eastern and Central European countries, which abolished serfdom in the late 18<sup>th</sup> – early 19<sup>th</sup> century (1.15% per year). We call this "the East-European scenario." We obtain \$1,935, \$2,392 and \$2,602 (in 1990 USD) as our counterfactual estimates of the GDP per capita in 1913 in these three scenarios, respectively.

For the optimistic scenario we use 1870 because this is the closest year to 1861 for which Maddison provides an estimate of GDP. For the East-European scenario, we use GDP growth rates for countries available from Maddison (reported in Table A15 below in this online appendix). Note that these territories only partially correspond to territories with emancipation reforms in the late 18<sup>th</sup> – early 19<sup>th</sup> centuries (namely, Austria, Bohemia, Denmark and Prussia). We do not allow a scenario with a decreasing growth rate after the emancipation reform because all Eastern European countries that abolished serfdom in the late 18<sup>th</sup> – early 19<sup>th</sup> century had increasing growth rates throughout the 19<sup>th</sup> century.

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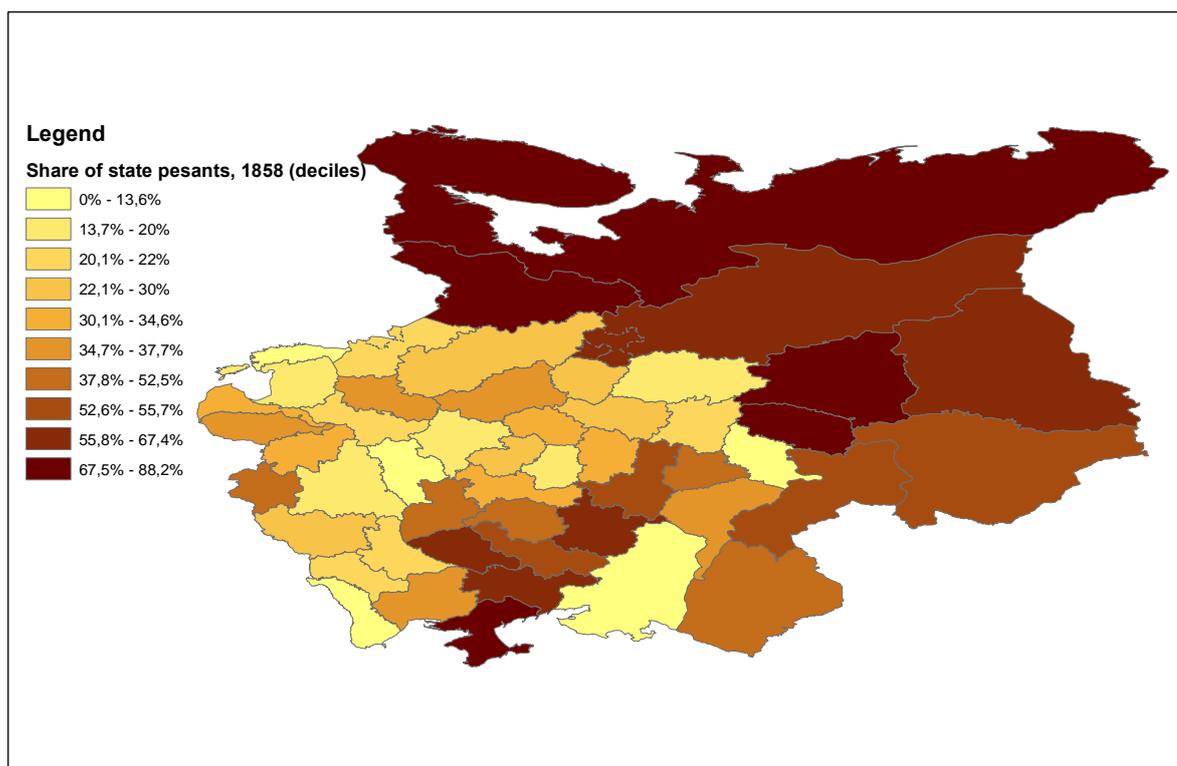
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Figure A1. Geography of serfdom: share of serfs in 1858 and the distance to Moscow



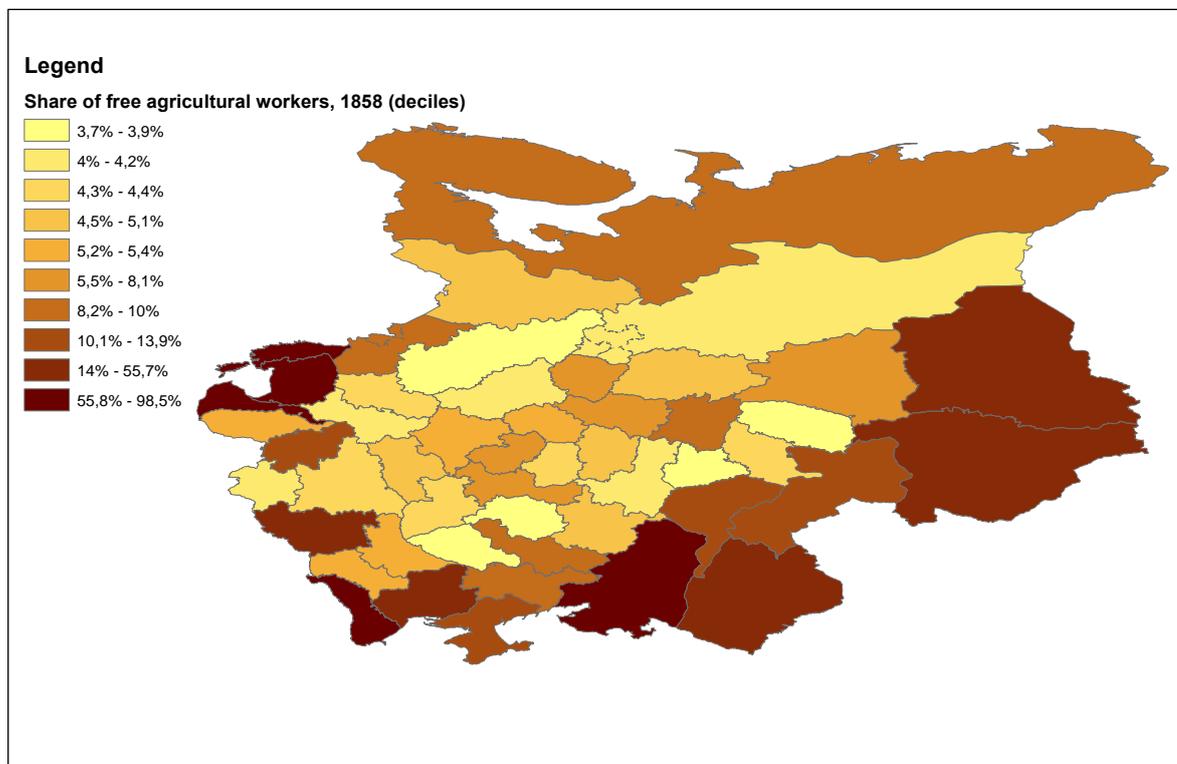
Coef: -0.0005; SE=0.00009;  $R^2 = 0.36$ .

Figure A2. Geography of serfdom: state peasants in 1858 as a share of rural population



Note: Equiarectangular projection used.

Figure A3. Geography of serfdom: free agricultural workers in 1858 as a share of rural population



Note: Equirectangular projection used.

Table A1. Data sources.

<b>Outcome variables</b>		
Variable:	Years:	Source:
Grain yield	1795 and 1858	Kessler and Markevich (2015)
	1800s-1820s, 1840s and 1850s by decade	Koval'chenko (1959)
	1857, 1859-1863 by year	Vilson (1869)
	1864-1866 by year	Obruchev (1871)
	1870-1876 by year	Materialy ... (1880)
	1883-1887 by year	TsSK MVD (1888)
	1888-1900 by year	Urozhaj v ... (1889-1901)
Winter and summer grain seeds planted	1858	Kessler and Markevich (2015)
	1893-1900 by year	Urozhaj v ... (1889-1901)
Height of draftees	1853-1862 by year	Vseobshchaya ... (1886)
	1863	Sbornik ... (1887)
	1865-1866 by year	Sbornik ... (1890)
	1875	Sbornik ... (1897)
Number of births	1856	Statisticheckie ... (1858)
	1858	Kessler and Markevich (2015)
	1867	Statisticheckii ... (1872)
	1868-1870 by year	Statisticheckii ... (1877, 1879)
	1875	Statisticheckii ... (1883a)
	1880	Statisticheckii ... (1883b)
	1885	Statisticheckii ... (1890)
	1890	Statisticheckii ... (1895)
	1896	Statisticheckii ... (1898)
Number of deaths	1856	Statisticheckie ... (1858)
	1858	Kessler and Markevich (2015)
	1867	Statisticheckii ... (1872)
	1868-1870 by year	Statisticheckii ... (1877, 1879)
	1875	Statisticheckii ... (1883a)
	1880	Statisticheckii ... (1883b)
	1885	Statisticheckii ... (1890)
	1890	Statisticheckii ... (1895)
	1896	Statisticheckii ... (1898)
Industrial output	1796	Kessler and Markevich (2015)
	1849	Statisticheckie ... (1852)
	1856	Statisticheckie ... (1858)
	1858	Kessler and Markevich (2015)
	1882	Sbornik ... (1884)
	1884	Statisticheckii ... (1887)
	1897	Kessler and Markevich (2015)
Industrial employment	1847	Statisticheckie ... (1849)
	1882	Sbornik ... (1884)
	1897	Kessler and Markevich (2015)
Population	1800s-1850s by decade	Kabuzan (1971)
	1849	Statisticheckie ... (1852)
	1856	Statisticheckie ... (1858)

	1858	Kessler and Markevich (2015)
	1870	Statisticheckii ... (1875)

Table A1 continued

Population	1883	Statisticheckii ... (1886)
Arable land	1800, 1858	Kessler and Markevich (2015)
	1871, 1877	Statistika ... (1880-1886)
Potato yield	1800s-1820s and 1840-1850s by decade	Koval'chenko (1959)
	1858	Kessler and Markevich (2015)
	1864-1866 by year	Obruchev (1871)
	1870-1876 by year	Materialy ... (1880)
	1883-1887 by year	TsSK MVD (1888)
	1888-1900 by year	Urozaj v ... (1889-1901)
<b>Explanatory variables</b>		
Variable:	Years:	Source:
Distribution of rural population by status	1858	Bushen (1863)
	1857	Kabuzan (1971)
Redemption payments	1862-1876 by year	Vilson (1878)
Monasteries	1763	Zverinskij (1890, 1897)
Gentry debts and mortgages	1858	Skrebetskii (1862-1866)
Signed and unsigned regulatory charters	1863	Vilson (1878)
Serfs per estate	1857	Troinitskii (1858)
Land cuts (in percentage to peasants land before the emancipation)	1863	Zaionchkovskii (1960)
Crops suitability	Modern day; under the assumption of rain-fed low-input agriculture for the main crops grown in the area	GAEZ Portal: <a href="http://www.gaez.iiasa.ac.at/">http://www.gaez.iiasa.ac.at/</a>
Temperature	1795-1900	The Global Land Surface Databank (Rennie et al, 2014) <sup>41</sup>
Re-partition commune dummy	1905	Durbrovskii (1963)
Zemstvo expenditures	1864	Statisticheckii ... (1866)
Court reform	1864-1896	Ministry of Justice (1902)
Railways density	1795-1900	Sollogub (1874), Sbornik ... (1884), Kessler and Markevich (2015) <sup>42</sup>

<sup>41</sup> To construct our historical yearly temperature series, we use weather station data provided by the Global Land Surface Databank (Rennie et al, 2014). We use the "IDW (inverse distance weighted)" tool of ArcGIS software to perform interpolation. IDW is an interpolation technique that determines cell values using a linearly weighted combination of a set of sample points. The weight is a function of inverse distance of the cell and sample points. Before performing the interpolation, we compute the temperature at sea level for each weather station. We assume that for every one thousand meters the temperature falls by 6.4 C degrees. After the IDW interpolation, we calculate the temperature at the exact altitude for the whole raster data. Lastly, we import the interpolated data into Stata and calculate the mean temperature at the province level.

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<sup>42</sup> Sollogub (1874) provides a cross-section on the lengths of railways in provinces in 1874 by railway lines and dates of construction of these lines. We combine the two pieces of data to construct pre-1874 railway dynamics. We use data from Sbornik (1884) to repeat a similar procedure for the 1874-1884 decade. Kessler and Markevich (2015) report data for the 1897. We use various sources to reconstruct the 1884-1896 and 1898-1900 dynamics of railway construction.

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Table A2. The effect of the abolition of serfdom on productivity in agriculture on the sample including Baltic provinces

Panel A: Main results

	(1)	(2)	(3)	(4)
Dependent var:	Grain yield	Grain yield	Grain yield	Grain yield
	OLS	OLS	OLS	OLS
Share of serfs X Post-emancipation	0.69** [0.3]	0.83** [0.33]		
Share of non-Baltic serfs X Post-1861			0.73** [0.31]	0.997*** [0.32]
Share of Baltic serfs X Post 1820			0.55 [0.73]	0.37 [0.75]
Demeaned log distance to Moscow in non-Baltic provinces X Post-1861	-0.93** [0.44]	-0.93** [0.44]	-0.9* [0.46]	-0.82* [0.45]
Demeaned log distance to Moscow in Baltic provinces X Post-1861	0.76 [1.44]	-0.05 [1.49]	0.9 [1.72]	0.33 [1.78]
Demeaned crop suitability in non-Baltic provinces X Post-1861	0.02 [0.05]	0.02 [0.05]	0.02 [0.05]	0.01 [0.05]
Demeaned crop suitability in Baltic provinces X Post-1861	0.3*** [0.09]	0.38*** [0.11]	0.29*** [0.09]	0.38*** [0.1]
Share of state peasants X Post-1866	No	Yes	No	Yes
Share of royal peasants X Post-1859	No	Yes	No	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes
Province-specific trends	Yes	Yes	Yes	Yes
Observations	1,891	1,891	1,891	1,891
R-squared	0.54	0.54	0.54	0.54

Notes: Standard errors are clustered by province separately before and after 1861 emancipation reform.  
 \*\*\* indicates p-value <0.01, \*\* p-value <0.05, \* p-value<0.1.

Table A3. Dynamics of the results of the abolition of serfdom

Dependent var:	(1)	(2)
	Grain yield OLS	Height OLS
Share of serfs X (1840s)	0.09 [0.6]	
Share of serfs X (1850-1855)	-0.08 [0.66]	
Share of serfs X (1856-1860)	-0.1 [0.64]	
Share of serfs X (1861-1865)	0.8 [0.63]	
Share of serfs X (1866-1870)	0.73 [0.69]	
Share of serfs X (1871-1875)	1.26* [0.75]	
Share of serfs X (1876-1880)	1.9** [0.86]	
Share of serfs X (1881-1885)	0.71 [0.86]	
Share of serfs X (1886-1890)	1.35* [0.75]	
Share of serfs X (1891-1895)	0.77 [0.78]	
Share of serfs X (post 1895)	1.21 [0.87]	
Share of serfs X (1855-1856)		0.03 [0.28]
Share of serfs X (1857-1858)		0.39 [0.28]
Share of serfs X (1859-1860)		0.22 [0.37]
Share of serfs X (1861-1862)		1.25*** [0.35]
Share of serfs X (1863)		1.26*** [0.33]
Share of serfs X (1865-1866)		1.48*** [0.36]
Share of serfs X (1875)		1.26 [0.79]
Demeaned log distance to Moscow X Post-emancipation	-0.73* [0.42]	0.76** [0.32]
Demeaned crop suitability X Post-emancipation	0.04 [0.06]	0.1** [0.04]
Share of state peasants X Post-1866	Yes	Yes
Share of royal peasants X Post-1859	Yes	Yes
Year fixed effects	Yes	Yes
Province fixed effects	Yes	Yes
Region-specific trends	Yes	No
Observations	1,756	644
R-squared	0.48	0.88

Notes: Standard errors are clustered by province separately before and after 1861 emancipation reform.

\*\*\* indicates p-value <0.01, \*\* p-value <0.05, \* p-value <0.1.

Table A4. The effect of the abolition of serfdom on productivity in growing potatoes

Panel A: Main results					
Dependent var:	(1) Potato yield OLS	(2) Potato yield IV, 2nd stage	(3) Potato yield OLS	(4) Potato yield IV, 2nd stage	(5)
Share of private serfs X Post-emancipation	0.68 [0.63]	-0.32 [1.32]	1.53** [0.73]	0.81 [1.6]	
Share of private serfs X Post-emancipation X Large Estate			-0.89** [0.38]	-1.09** [0.49]	
Demeaned log distance to Moscow X Post-emancipation	-1.95*** [0.68]	-2.75** [1.27]	-1.49** [0.61]	-2.14 [1.35]	
Demeaned crop suitability X Post-emancipation	0.04 [0.1]	0.06 [0.1]	0.04 [0.1]	0.06 [0.09]	
Year fixed effects	Yes	Yes	Yes	Yes	
Province fixed effects	Yes	Yes	Yes	Yes	
Province-specific trends	Yes	Yes	Yes	Yes	
Observations	1,391	1,334	1,391	1,334	
R-squared	0.33	0.33	0.33	0.34	
Panel B: First stages					
Dependent var:		Share of private serfs X Post- emancipation	Share of private serfs X Post- emancipation	Share of private serfs X Post- emancipation X Large Estate	
		IV, 1st stage	IV, 1st stage	IV, 1st stage	
Monasteries 1764 per capita X Post-emancipation		-2.68*** [0.53]	-2.7*** [0.53]	-2.96*** [0.76]	
Monasteries 1764 per capita X Post-emancipation X Large Estate			1.22 [0.95]	12.85*** [2.34]	
Demeaned log distance to Moscow X Post-emancipation		-0.8*** [0.11]	-0.75*** [0.12]	0.17 [0.14]	
Demeaned crop suitability X Post-emancipation		0.05** [0.02]	0.05*** [0.02]	0.04 [0.03]	
Year fixed effects		Yes	Yes	Yes	
Province fixed effects		Yes	Yes	Yes	
Province-specific trends		Yes	Yes	Yes	
Observations		1,334	1,334	1,334	
F, monasteries instrument		25.85	25.72	15.16	
			1.649	30.15	

Notes: Standard errors are clustered by province separately before and after 1861 emancipation reform.  
 \*\*\* indicates p-value <0.01, \*\* p-value <0.05, \* p-value <0.1.

Table A5. The first stage results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	
Dependent var:	Share of serfs X Post- emancipation	Share of serfs X Post- emancipation	Share of serfs X Post- emancipation	Share of serfs X Post- emancipation	Share of serfs X Post- emancipation	Share of serfs X Post- emancipation	Share of serfs X Post- emancipation	Share of serfs X Post- emancipation	Share of serfs X Post- emancipation	Share of serfs X Post- emancipation	Share of serfs with land- buyout started	Share of serfs X Post- emancipation X Implicit contracts
Dependent var at the 2nd stage:	IV, 1st stage Height	IV, 1st stage Mortality (deaths per capita)	IV, 1st stage Fertility (births per capita)	IV, 1st stage Ln (population)	IV, 1st stage Ln (industrial output)	IV, 1st stage Ln (industrial employment)	IV, 1st stage Ln (arable land)	IV, 1st stage Winter to summer grain crops ratio	IV, 1st stage Grain yield	IV, 1st stage Grain yield	IV, 1st stage Grain yield	IV, 1st stage Grain yield
Monasteries 1764 per capita X Post-emancipation	-2.68*** [0.59]	-2.64*** [0.57]	-2.64*** [0.57]	-2.71*** [0.58]	-2.69*** [0.51]	-3.3*** [0.7]	-2.2*** [0.68]	-2.57*** [0.81]	-5.17*** [1.1]	-4.28*** [1.06]	-5.66*** [0.88]	
Interpolation b/w (1-indebtedness) and 1 in the interval 1862-1882									0.03 [0.17]	2.67*** [0.25]	-0.07 [0.09]	
Monasteries 1764 per capita X Post-emancipation X Implicit contracts									4.67** [1.87]	2.79 [1.71]	11.02*** [1.41]	
Demeaned log distance to Moscow X Post-emancipation	-0.83*** [0.12]	-0.82*** [0.113]	-0.82*** [0.113]	-0.78*** [0.114]	-0.78*** [0.115]	-0.77*** [0.145]	-0.97*** [0.111]	-0.79*** [0.171]	-0.77*** [0.120]	-0.59*** [0.118]	-0.27*** [0.073]	
Demeaned crop suitability X Post-emancipation	0.05** [0.02]	0.05** [0.02]	0.05** [0.02]	0.04** [0.02]	0.04** [0.02]	0.07*** [0.02]	0.05*** [0.02]	0.04 [0.03]	0.06*** [0.02]	0.04** [0.02]	0.002 [0.01]	
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province-specific trends	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes
Region-specific trends	No	No	No	No	Yes	No	No	No	No	No	No	No
Observations	632	483	483	578	279	125	129	389	1,617	1,617	1,617	
R-squared	0.96	0.97	0.97	0.96	0.96	0.93	0.96	0.999	0.97	0.96	0.97	
F, monasteries instrument	20.85	21.79	21.79	22.13	27.45	22.54	10.60	9.974	21.86	16.27	41.53	
F, indebtedness instrument									0.0375	110.7	0.589	
F, monasteries X Implicit contracts instrument									6.233	2.663	61.26	

Notes: Standard errors are clustered by province separately before and after 1861 emancipation reform. \*\*\* indicates p-value <0.01, \*\* p-value <0.05, \* p-value <0.1.

Table A6. The effect of the abolition of serfdom on productivity and potential confounding factors

Dependent var:	(1) Grain yield OLS	(2) Grain yield OLS	(3) Grain yield OLS	(4) Grain yield OLS	(6) Grain yield OLS
Share of serfs X Post-emancipation	0.91*** [0.3]	0.88*** [0.32]	1.01*** [0.33]	0.9*** [0.34]	0.7** [0.32]
Ln(railways)	0.03** [0.02]				0.04*** [0.02]
Temperature		-0.19*** [0.07]			-0.19*** [0.07]
Court reform			-0.05 [0.17]		0.06 [0.17]
Zemstvo expenditures per capita in 1869 X Post-1864				-0.002* [0.001]	-0.001 [0.001]
Demeaned _og distance to Moscow X Post-emancipation	-0.86* [0.45]	-0.77* [0.46]	-0.85* [0.47]	-1.09** [0.5]	-0.85 [0.52]
Demeaned _rop suitability X Post-emancipation	0.02 [0.05]	-0.04 [0.04]	0.01 [0.05]	0.005 [0.04]	-0.05 [0.04]
Share of state peasants X Post-1866	Yes	Yes	Yes	Yes	Yes
Share of royal serfs X Post-1859	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes
Province-specific trends	Yes	Yes	Yes	Yes	Yes
Observations	1,729	1,701	1,756	1,756	1,674
R-squared	0.52	0.52	0.51	0.51	0.53

Notes: Standard errors are clustered by province separately before and after 1861 emancipation reform.  
 \*\*\* indicates p-value <0.01, \*\* p-value <0.05, \* p-value<0.1.

Table A7. The effect of the abolition of serfdom on height and potential confounding factors

Dependent var:	(1) Height OLS	(2) Height OLS	(3) Height OLS	(4) Height OLS	(5) Height OLS
Share of serfs X Post-emancipation	0.9** [0.37]	0.86** [0.38]	0.9** [0.37]	0.9** [0.37]	0.81** [0.37]
Ln(railways)	-0.04 [0.03]				-0.04 [0.03]
Temperature		0.02 [0.04]			0.03 [0.05]
Court reform			0.12 [0.15]		0.21 [0.16]
Zemstvo expenditures per capita in 1869 X Post-1864				-0.001 [0.001]	-0.002** [0.001]
Demeaned log distance to Moscow X Post-emancipation	0.36 [0.38]	0.37 [0.37]	0.41 [0.36]	0.42 [0.36]	0.27 [0.38]
Demeaned crop suitability X Post-emancipation	0.17*** [0.06]	0.15** [0.06]	0.14*** [0.05]	0.15*** [0.06]	0.15*** [0.06]
Share of state peasants X Post-1866	Yes	Yes	Yes	Yes	Yes
Share of royal serfs X Post-1859	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes
Province-specific trends	Yes	Yes	Yes	Yes	Yes
Observations	641	639	644	644	636
R-squared	0.9	0.9	0.9	0.9	0.9

Notes: Standard errors are clustered by province separately before and after 1861 emancipation reform.

\*\*\* indicates p-value <0.01, \*\* p-value <0.05, \* p-value<0.1.

Table A8. Land reform sensitivity: land cuts

Dependent var:	(1)	(2)	(3)
	Grain yield OLS	Grain yield OLS	Grain yield OLS
Share of serfs X Post-emancipation	1.24*** [0.4]	1.03** [0.4]	1.14*** [0.4]
Share of serfs with land-buyout started	-0.54* [0.28]	0.18 [0.31]	0.28 [0.31]
Share of serfs with land-buyout started X repartition commune		-0.95*** [0.35]	-0.9*** [0.34]
Land cuts X Post-emancipation	-0.005 [0.005]	-0.007 [0.005]	-0.007 [0.005]
Demeaned log distance to Moscow X Post-emancipation	-0.37 [0.57]	-0.69 [0.6]	-0.72 [0.6]
Demeaned crop suitability X Post-emancipation	0.06 [0.05]	0.06 [0.05]	0.05 [0.05]
Share of state peasants X Post-1866	No	No	Yes
Share of royal peasants X Post-1859	No	No	Yes
Year fixed effects	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes
Province-specific trends	Yes	Yes	Yes
Observations	1,622	1,622	1,622
R-squared	0.53	0.53	0.53

Notes: Standard errors are clustered by province separately before and after 1861 emancipation reform.

\*\*\* indicates p-value <0.01, \*\* p-value <0.05, \* p-value <0.1.

Table A9. Robustness to using 1857 tax census data: the effect of the emancipation of serfs and the implementation of the land reform on productivity in agriculture

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent var:	Grain yield	Grain yield	Grain yield	Grain yield	Grain yield	Grain yield	Grain yield	Grain yield
	OLS	OLS	IV, 2nd stage	OLS	IV, 2nd stage	OLS	IV, 2nd stage	OLS
Share of serfs X Post-emancipation	1.04*** [0.23]	0.96*** [0.26]	1.06** [0.46]	0.8* [0.4]	0.55 [0.73]	1.18*** [0.42]	1.26** [0.52]	2.43*** [0.94]
Share of serfs with land-buyout started							-0.74** [0.29]	-1.39*** [0.37]
Demeaned log distance to Moscow X Post-emancipation		0.04 [0.27]	0.31 [0.34]	-1.12** [0.55]	-1.12* [0.65]	-1.05* [0.55]	-0.65 [0.58]	0.12 [0.66]
Demeaned_rop suitability X Post-emancipation		-0.1*** [0.04]	-0.12*** [0.03]	0.05 [0.06]	0.03 [0.06]	0.02 [0.06]	0.04 [0.07]	0.06 [0.07]
Share of state peasants X Post-1866	No	No	No	No	No	Yes	No	No
Share of royal peasants X Post-1859	No	No	No	No	No	Yes	No	No
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province-specific trends	No	No	No	Yes	Yes	Yes	Yes	Yes
Observations	1,376	1,355	1,325	1,355	1,325	1,329	1,328	1,309
R-squared	0.53	0.53	0.54	0.56	0.56	0.56	0.56	0.56

Panel B: First stages of 2SLS regressions				
Dependent var:	Share of serfs X Post-emancipation	Share of serfs X Post-emancipation	Share of serfs X Post-emancipation	Share of serfs with land-buyout started
	IV, 1st stage	IV, 1st stage	IV, 1st stage	IV, 1st stage
Monasteries 1764 per capita X Post-emancipation	-2.27*** [0.69]	-2.17*** [0.64]	-2.11*** [0.66]	-2.12*** [0.7]
Interpolation b/w (1-indebtedness) and 1 in the interval 1862-1882			-0.0701 [0.175]	2.52*** [0.28]
Demeaned log distance to Moscow X Post-emancipation	-0.72*** [0.12]	-0.7*** [0.11]	-0.6869*** [0.114]	-0.51*** [0.12]
Demeaned crop suitability X Post-emancipation	0.02 [0.02]	0.02 [0.02]	0.0187 [0.021]	0.01 [0.02]
Year fixed effects	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes
Province-specific trends	No	Yes	Yes	Yes
Observations	1,325	1,325	1,309	1,309
F, monasteries instrument	10.86	11.64	10.3	9.17
F, indebtedness instrument			0.161	83.57

Notes: Standard errors are clustered by province separately before and after the 1861 emancipation reform. Post-emancipation is a dummy, which is switched on in 1861. Share of serfs with land-buyout started reflects the share of serfs who started the land buyout operation at every point in time, as a share of rural population. It equals 0 in all provinces for the years before 1862 and then gradually reaches the share of serfs in the corresponding province. In the non-western provinces this happened by 1882, and in western provinces in 1863. Indebtedness is the number of serfs in the province used as collateral in landlords' debt contracts in 1858 as a share of total number of serfs in the province.

\*\*\* indicates p-value <0.01, \*\* p-value <0.05, \* p-value <0.1.

Table A10. Robustness to using 1857 tax census data: the effect of the abolition of serfdom on draftees' height

Dependent var:	(1) Height OLS	(2) Height IV, 2nd stage	(3) Height OLS
Share of serfs X Post-emancipation	0.7 [0.5]	1.85* [1.1]	0.58 [0.5]
Demeaned log distance to Moscow X Post-emancipation	0.18 [0.42]	0.6 [0.75]	0.14 [0.42]
Demeaned crop suitability X Post-emancipation	0.11* [0.07]	0.17*** [0.06]	0.13** [0.07]
Share of state peasants X Post-1866	No	No	Yes
Share of royal peasants X Post-1859	No	No	Yes
Year fixed effects	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes
Province-specific trends	Yes	Yes	Yes
Observations	566	560	540
R-squared	0.9	0.91	0.91
F, monasteries instrument		10.57	

Notes: Standard errors are clustered by province separately before and after the 1861 emancipation reform. Post-emancipation is a dummy, which is switched on in 1861. We instrument the share of serfs times post-emancipation dummy with monasteries in 1764 per capita interacted with post-emancipation period. First-stage regression output is available from the authors upon request.

\*\*\* indicates p-value <0.01, \*\* p-value <0.05, \* p-value <0.1.

Table A11. Robustness to using 1857 tax census data: the effect of the abolition of serfdom on demographic variables

Dependent var:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Mortality (deaths per capita)			Fertility (births per capita)			Ln (population)		
	OLS	IV, 2nd stage	OLS	OLS	IV, 2nd stage	OLS	OLS	IV, 2nd stage	OLS
Share of serfs X Post-emancipation	-0.006** [0.003]	0.012 [0.013]	-0.01** [0.004]	0.01*** [0.004]	0.049*** [0.016]	0.015*** [0.004]	0.223** [0.103]	0.711* [0.364]	0.063 [0.092]
Demeaned log distance to Moscow X Post-emancipation	-0.002 [0.003]	0.01 [0.008]	-0.002 [0.003]	0.013*** [0.004]	0.04*** [0.011]	0.013*** [0.004]	0.034 [0.087]	0.324 [0.198]	0.003 [0.091]
Demeaned crop suitability X Post-emancipation	0.002*** [0.001]	0.003*** [0.001]	0.002*** [0.001]	0.002*** [0.001]	0.003*** [0.001]	0.002*** [0.001]	-0.014 [0.023]	0.002 [0.018]	-0.003 [0.015]
Share of state peasants X Post-1866	No	No	Yes	No	No	Yes	No	No	Yes
Share of royal peasants X Post-1859	No	No	Yes	No	No	Yes	No	No	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province-specific trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	384	375	384	384	375	384	524	519	524
R-squared	0.492	0.476	0.492	0.593	0.535	0.598	0.976	0.975	0.976
F, monasteries instrument		21.79			10.20			10.86	

Notes:

Standard errors are clustered by province separately before and after the 1861 emancipation reform. Post-emancipation is a dummy, which is switched on in 1861. We instrument the share of serfs times post-emancipation dummy with monasteries in 1764 per capita interacted with post-emancipation period. First-state regression output is available from the authors upon request.

\*\*\* indicates p-value <0.01, \*\* p-value <0.05, \* p-value <0.1.

Table A12. Robustness to using 1857 tax census data: the effect of the abolition of serfdom on industrial development

Dependent var:	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	Ln (industrial output) IV, 2nd stage	OLS	Ln (industrial employment) OLS	IV, 2nd stage	OLS
Share of serfs X Post-emancipation	1.18*** [0.35]	2.03* [1.08]	2.62*** [0.53]	2.29** [0.87]	2.41 [1.71]	2.43*** [0.47]
Demeaned log distance to Moscow X Post-emancipation	0.81* [0.45]	1.5* [0.84]	2.08** [0.84]	3.8*** [0.65]	3.93*** [1.27]	4.04*** [0.61]
Demeaned crop suitability X Post-emancipation	-0.1* [0.06]	-0.09* [0.05]	0.11 [0.1]	-0.21** [0.1]	-0.21*** [0.08]	-0.31*** [0.11]
Share of state peasants X Post-1866	No	No	Yes	No	No	Yes
Share of royal peasants X Post-1859	No	No	Yes	No	No	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region-specific trends	Yes	Yes	Yes	No	No	No
Observations	248	245	248	104	102	104
R-squared	0.89	0.89	0.92	0.96	0.96	0.97
F, monasteries instrument		11.57			8.003	

Notes: Standard errors are clustered by province separately before and after the 1861 emancipation reform. Post-emancipation is a dummy, which is switched on in 1861. We instrument the share of serfs times post-emancipation dummy with monasteries in 1764 per capita interacted with post-emancipation period. First-state regression output is available from the authors upon request.

\*\*\* indicates p-value <0.01, \*\* p-value <0.05, \* p-value <0.1

Table A13. Robustness to the restricted sample with the data from governor reports only: the effect of the abolition of serfdom on grain productivity

Panel A: Main results

Dependent var:	(1)	(2)	(3)	(4)	(5)	(6)
	Grain yield OLS	Grain yield OLS	Grain yield IV, 2nd stage	Grain yield OLS	Grain yield IV, 2nd stage	Grain yield OLS
Share of serfs X Post-emancipation	1.06*** [0.17]	0.72*** [0.22]	1.09*** [0.26]	0.72** [0.31]	1.29*** [0.47]	0.97*** [0.33]
Demeaned log distance to Moscow X Post-emancipation		-0.69** [0.34]	-0.2 [0.29]	-0.7 [0.46]	-0.06 [0.41]	-0.66 [0.45]
Demeaned crop suitability X Post-emancipation		-0.03 [0.03]	-0.06** [0.03]	0.02 [0.04]	-0.01 [0.04]	0.01 [0.04]
Share of state peasants X Post-1866	No	No	No	No	No	Yes
Share of royal peasants X Post-1859	No	No	No	No	No	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Province-specific trends	No	No	No	Yes	Yes	Yes
Observations	952	931	906	931	906	931
R-squared	0.46	0.46	0.46	0.5	0.49	0.5

Panel B: First stages of 2SLS regressions

Dependent var:	Share of serfs X Post- emancipation	Share of serfs X Post- emancipation
	IV, 1st stage	IV, 1st stage
Monasteries 1764 per capita X Post-emancipation	-2.75*** [0.53]	-2.67*** [0.61]
Demeaned log distance to Moscow X Post-emancipation	-0.81*** [0.1]	-0.78*** [0.12]
Demeaned crop suitability X Post-emancipation	0.05*** [0.02]	0.05** [0.02]
Year fixed effects	Yes	Yes
Province fixed effects	Yes	Yes
Province-specific trends	No	Yes
Observations	906	906
F, monasteries instrument	26.49	19.34

Notes: Standard errors are clustered by province separately before and after the 1861 emancipation reform. Post-emancipation is a dummy, which is switched on in 1861.

\*\*\* indicates p-value <0.01, \*\* p-value <0.05, \* p-value <0.1

Table A14. Counterfactual estimates of Russian economic development in the case of earlier abolition of serfdom, 1820-1913 (in 1990 USD)

	Agriculture	Industry	Service	All sectors
GDP per capita in 1820				688 <sup>(1)</sup>
1860 sectorial shares	59.3 <sup>(2)</sup>	5.1 <sup>(2)</sup>	35.6 <sup>(2)</sup>	
Value added in 1820	22,347 <sup>(3)</sup>	1,923 <sup>(3)</sup>	13,408 <sup>(3)</sup>	37,678 <sup>(4)</sup>
The multiplier effect due to the abolition of serfdom	1.1 <sup>(5)</sup>	3.69 <sup>(5)</sup>	1.32 <sup>(5)</sup>	
Counter-factual estimates of value added in 1820 (mln USD 1990)	24,581.3 <sup>(6)</sup>	7,097 <sup>(6)</sup>	17,745.8 <sup>(6)</sup>	49,177.3 <sup>(6)</sup>
Counter-factual estimates of GDP per capita in 1820				898 <sup>(7)</sup>
Counter-factual estimate of GDP per capita in 1913 (pessimistic scenario)				1,935 <sup>(8)</sup>
Counter-factual estimate of GDP per capita in 1913 (East-European scenario)				2,602 <sup>(9)</sup>
Counter-factual estimate of GDP per capita in 1913 (optimistic scenario)				2,392 <sup>(10)</sup>

Sources: (1) and (4) – Maddison (2007); (2) – estimated from Goldsmith (1961), see text on the previous page for details; (3) – estimated as (4) multiply by (2) and divide by a 100; (5) – authors’ estimates from this paper; (6) – estimated as (3) multiply by (5); (7) – estimated as (6) divided by Maddison (2007) estimate of Russian population in 1913; (8) – estimated as (7) multiplied by actual GDP per capita growth in 1820 – 1913 from Maddison (2007); (9) – estimated as (7) multiplied by average GDP per capita growth in 1820 – 1913 in the Eastern European countries abolished serfdom in the late 18<sup>th</sup> – early 19<sup>th</sup> centuries (Maddison 2007); (10) – estimated as (7) multiplied by actual GDP per capita growth in 1870 – 1913 from Maddison (2007).

Table A15. Growth rates of GDP per capita in the Eastern European countries that abolished serfdom in the late 18<sup>th</sup> – early 19<sup>th</sup> century

	1700-1820	1820-1870	1870-1913
Germany	0.001	0.011	0.016
Austria	0.002	0.008	0.014
Czechoslovakia	n.d.	0.006	0.014
Denmark	0.002	0.009	0.016

Source: Maddison (2007).