

Economic Effects of Coerced Labor: Evidence from the Emancipation of Serfs in Russia

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Abstract.

Using the variation in the shares of serfs across provinces of the Russian empire in the 19th century and the difference in timing of emancipation of different types of serfs, we estimate the effect of serfdom on agricultural productivity, peasants' living standards, and industrial development using difference-in-differences estimator with region-specific trends. In contrast to the 19th century US, on average, agriculture based on forced labor was less productive in Russia than agriculture involving free labor. The emancipation caused substantial increases both in agricultural productivity and peasant food consumption. Contractual differences in organization of serfdom were associated with different levels of productivity and wellbeing of serfs. Estates where serfs were obliged to work on the landlord's farm for a certain amount of time (*corvee*, *barschina*) were less productive and were associated with lower nutrition of peasantry, particularly, in smaller estates as compared to estates where serfs were required to make in kind payment to the landlord out of product produced on peasant-cultivated plots (*quitrent*, *obrok*). Emancipation caused a boost to Russia's industrial development: provinces with higher prevalence of serfdom experienced higher increases in industrial output and the number of industrial workers.

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1. Introduction.

Over centuries forced labor was a dominant form of labor relations. Free labor market is a relatively recent phenomenon. The vast literature on economic history and long-term economic development agrees that the emergence of free contract labor relations contributed to economic development through its effects on incentive structure of laborers and superior institutions. For example, North and Thomas (1970) argued that the rise of the Western Europe in the middle of the second millennium occurred because of early development of the institution of private property and disappearance of serfdom. More recently Engerman and Sokoloff (1997), Nunn (2008), Nunn and Wantchekon (2011) and Acemoglu et al. (2012) provided evidence on the channel: slave labor and slave trade contributed to emergence of inferior formal and informal institutions. There is, however, fairly little systematic evidence on the effect of serfdom on agricultural productivity or industrial development in Europe. The best documented is the case of slavery in the U.S. In the Americas of the 17th-19th century, as demonstrated by Fogel and Engerman (1974) and Fogel (1989), cotton, sugar cane, and tobacco production on large farms with slaves was more productive than on farms that relied on free labor. The main reasons for this difference were specialization and economies of scale, which were better realized in slave farms due to the state-of-the-art technology available at that time.

In this paper, we investigate the effects of forced as opposed to free labor in agriculture on agricultural productivity, peasant consumption and industrial development in the 19th century Russian Empire exploring the cross-province variation in the prevalence of serfdom and over-time variation generated by the emancipation of different types of serfs in different provinces. There is long-lasting debate among historians on the effects of serfdom for Russia's economic development. Gershenkron (1966), Kovalchenko (1967), and Fedorov (1974) argued that serfdom was inefficient: it substantially slowed down growth of agricultural productivity and was even unprofitable during several last decades before the emancipation. In contrast, Moon (1996), Mironov (2010), and Dennison (2006, 2011) viewed serfdom as a flexible institution

with some positive effects on economic development for several reasons. For instance, landlords could guarantee and enforce social order; they were better at adopting new technologies than peasants in free communes, and they could accumulate resources to launch new projects when access to credit was limited, and they could provide some minimum consumption during famines. In addition, Hoc and Wilson (1979) and Domar and Machina (1984) described case-studies suggesting that serfdom remained profitable for gentry till its very end. These waves of historical research based their argumentation entirely on sporadic anecdotal evidence. Systematic data analysis of serfdom is very recent (we describe the main contributions below).

This paper is the first to estimate the effects of emancipation of serfs on agricultural productivity, living standards of peasants, and industrial production and employment in Russia. Our first contribution is in constructing a unique province-level panel dataset with several measures of agricultural productivity, draftees height, and industrial development for the European part of the Russian empire in the 19th century. Our second contribution is in estimating the effects of forced labor on these outcomes using geographical variation in the prevalence of serfdom across Russian provinces before emancipation and over-time variation generated by differences in timing of emancipation of different types of serfs in different provinces. We estimate difference-in-differences regressions with the interactions of post-emancipation dummies with the shares of peasants of a particular type in a province as our main explanatory variables and province and time fixed effects and region-specific trends as the main control variables.

We consider three main types of peasants in Russia before the emancipation: private serfs, state peasants, and free agricultural laborers. (i) Private serfs constituted 43% of rural population in the European Russia in 1858. These peasants were the property of the nobility, who had full formal usage and transfer ownership rights over their serfs, subject to maintaining minimal living standards of serfs, rarely enforced by the state. The nobility determined the form and the amount of labor obligations of serfs to them. Endogenously, two main types of

“contractual” arrangements emerged between serfs and their lords depending mostly on what was viewed as more profitable for nobility: corvee (*barschina*) in which peasants worked a certain amount of time determined by the landlord on the landlord’s farm; and quit rent (*obrok*) in which serfs had to make a certain amount of in kind or in cash payments to the landlord, again the amount determined fully by the landlord and can be revised any time at landlord’s will. The Peasant Reform of 1861 liberated private serfs throughout the empire. The emancipation transformed private serfs into free agricultural workers and initiated the transfer of communal land ownership titles to peasants in exchange for the obligatory redemption of the value of the land (determined in negotiations between state authorities and the nobility). Installment plans were established for the peasants’ redemptions, 80% of which were financed by the state to compensate landlords momentarily. In three Baltic provinces, private serfs were emancipated forty years earlier, namely between 1816 and 1819.

(ii) State peasants were the second most numerous group of rural labor force, constituting 40% of rural population in the European Russia in 1858. Formerly, state peasants were free landless individuals living and working on the land belonging to the state. By law, they could change their occupation and place of living. The required administrative procedure for moving was so complicated, however, that few actually did this. Importantly, the tsar often granted state lands with state peasants living on these lands to nobility as private estates in exchange for military service; in this case, state peasants acquired the status of private serfs. Thus, even though the state peasants were formerly free, de facto they were the property of the state. State peasants had to pay quit rent to the state in the amount fixed by the law in return for the ability to cultivate the land. The magnitude of the quit rent as well as the actual agricultural activities allowed on the land were regulated by a special ministry and were changed only rarely. Historians agree that, on average, state peasants were treated better than private serfs. Emancipation of state peasants occurred in 1866, when the state initiated the transfer of state

land into the communal peasant ownership in exchange for the obligatory redemption. The amount of redemption was lower on average than for private serfs.

(iii) The third group—free agricultural laborers with or without land titles—constituted 12.6% of rural population of the European Russia in 1858. This group consisted of Cossacks with commune land title, colonists, who cultivated land under various land arrangements, local non-Russians in Astrakhan and Bessarabiya provinces without land, as well as all largely landless peasants in three Baltic provinces after 1819.

The prevalence of different types of peasantry varied a lot across provinces. For example, the share of private serfs in total population in 1858 varied from 69% in Smolenskaya province to zero in the Baltics with median province having 42% of population being private serfs (as in Tambovskaya and Kurskaya provinces). This variation was largely determined by the distance to Moscow (as nobility preferred to estates closer to their place of royal service) and historical location of Orthodox monasteries (which initially accumulated a lot of land, subsequently expropriated in favor of the state by Catherine the Great in 1764). We use data on the shares of different types of peasants in rural population by province in the 49 provinces of the European Russia as of 1858 (Bushen 1863).¹

It is important to note that different regions of the Imperial Russia were likely to have different development trajectories, due to Russia's vast size and different climatic and soil conditions. Thus, it is crucial to control for these different trajectories in the estimation of the effects of emancipation. The data that we collected allow us to do this. Our measures of grain and potato productivity are available for 34 different time periods in the 19th century, with 6 of them before the emancipation. Thus, we have long enough time dimension of the panel to control for province-specific trends. For the other outcomes, such as draftees height, cattle per capita,

¹ Royal ("appanage," *udel'nye*) peasants constituted another much less numerous group of peasantry. They constituted 4% of the rural population in 1858. Formerly, royal peasants were private serfs belonging to the royal family on quit rent. They were managed by a special ministry (Department of Appanages) and got emancipated in 1863. In our regression analysis, we always control for the presence of royal peasants.

industrial production, and the number of industrial workers, we have fewer data points per province, and therefore, we do not have enough power to control for province-specific trends. In this case, we control for trends in 14 mega-regions of the empire, which are commonly considered by contemporaries as having different development trajectories².

Our difference-in-differences estimation yields the following results. First, in contrast to the 19th century US, forced labor in Russia was less productive than free labor. The emancipation caused a significant increase in grain productivity (i.e., the ratio of grain yield to seed, our best available measure of productivity) and the use of cattle (cattle per capita in rural areas) relative to the trend. On average, one standard deviation increase in the share of private serfs in a province (i.e., an increase of the share of private serfs in rural population by 25 percentage point) before the emancipation increased grain productivity post-emancipation by 28 percentage point or 8 percent. This is a large effect, as compared to the aggregate trend in grain productivity, which, on average, increased by 10 percentage point in a decade in the 19th century. Emancipation of state peasants also led to productivity improvements, but smaller in size compared to emancipation of privately owned serfs. A one standard deviation increase in the share of state serfs in a province before emancipation led to a 14 percentage point increase in grain productivity post emancipation.

We also estimate the economies of scale in agriculture before emancipation. On average, we find no effect of the size of the estate before emancipation on grain productivity. However, productivity of estates under corvee system, prevalent in the Black earth provinces, in which serfs were forced to work on the landlords' farm (the closest to the American slavery), significantly increased with the size of the estate.

² We employ 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 mega-region for capital provinces, namely for Moscow and Saint-Petersburg. Second, we separate Astrakhan' from Low Volga, adding another mega-region. Moscow and Saint-Petersburg were the only two large cities in an agrarian country. Astrakahn' was very different from other Low Volga provinces in terms of geography (desert vs. step') as well as in terms of serfdom (local non-Russian who composed majority in the province were free). We provide precise lists of mega-regions and their provinces in the appendix.

Emancipation also substantially increased living standards of peasants. In particular, nutrition, as measured by draftees' height increased by 0.5 centimeters and the number of deaths per thousand rural inhabitants decreased by 2.4 deaths among emancipated serfs relative to average increase by 0.35 centimeters and 1.8 deaths, correspondingly.

We also find a significant positive effect of emancipation on industrial development of Russia's provinces. A one standard deviation increase in the share of private serfs in a province before emancipation led approximately to a 25% increase industrial employment and a 52% increase in industrial output. This is despite the consensus among historians about the adverse effect of the communal system of land titles post-emancipation on mobility of peasants to urban areas (this system was abolished only in 1906 by Piotr Stolypin). The effect probably would have been even larger if the land titles were individual rather than communal.³

Prior to this paper, there were few attempts to study the effects of serfdom in Russia using systematic data analysis. The most important contribution is Nafziger (2013), who describes serfdom at district (*uezd*, the second tier administrative division) level. He was the first to document the spatial patterns in prevalence of different types of peasantry in the European part of the Russian empire. Nafziger (2013) also reports significant cross-sectional association between the prevalence of serfdom before emancipation and long-term post-emancipation land inequality and human capital. Finkel et al. (2012) estimate the effect of emancipation of Russia's serfs on peasants' rebellion and find a significant increase in protest activity by peasants after the liberation. Our results on the increase of serfs' wellbeing as a result of emancipation give support to the idea of Finkel et al. (2012) that peasant riots were a results of a mismatch between expectations and the realization of reform rather than a decrease in the peasants' standard of living.

³ Nafziger (2011) provides some evidences that the emancipation indeed increased off-farm activities of former serfs; Chernina et. al. (2013) show that rural-urban migration increased further after the Stolypin reform.

Our paper contributes to the literature on the systematic analysis of the effects of forced labor. While Acemoglu et al. (2012), Nunn (2008), Dell (2010), Bertocchi and Dimicio (2012), and Miller (2009) focus on the long run effects of forced labor through its effects on institutional development, we address the question of the immediate effects of emancipation of Russia's serfdom on agricultural productivity, industrial development and living standards through its effect on the economic incentives. Our results do suggest substantial effects of serfdom on long-term development of Russia through a simple counterfactual exercise: Russia would have been about twice as rich by 1913 had it abolished serfdom around 1820 as was considered by Alexander I and demanded by the Dekabrist.

The paper proceeds as follows: in section 2, we provide the historical background; section 3 describes our empirical strategy; in section 4, we present the data; section 5 reports the results. Section 6 concludes.

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 this right of migration starting in the late 16th century. The 1649 Code of Law (*Sobornoye Ulozhenie*) proclaimed peasants the property of their estates and made migration out of the estates a criminal offence. Even retroactively, the peasants who fled from their estates before 1649 were ordered to be returned. Peasants became attached to the land which belonged to their landlord and whose orders they had to follow. They had to carry out duties and obligations in various forms for the landlords.

Russian serfdom reached its apogee during the reign of Catherine II in the second half of 18th century when nobility got the right to sell their serfs without families, like slaves. (Before serfs could be bought or sold only as a part of the estate, i.e., with their families and land they

were attached to.) In contrast to slaves, serfs could possess some personal property (even though formerly it all belonged to the landlord) and the state guaranteed their minimal subsistence standard of living.⁴ Since the reign of Pavel I in the late 18th century the government started to limit nobility's rights over their serfs and regulating relations between serfs and landlords. For example, at that time, a formal limitation on the amount of time serfs worked on landlord's farms (no more than three days per week) was introduced.

As we mentioned in the introduction, the two main types of “contractual” relations between nobility and their private serfs were corvee [*barshchina*] and quit rent [*obrok*]. The corvee system implied that estate land was separated into two parts landlord's farm and land plots given for peasants' cultivation. Serfs paid their duties to the landlord in labor, carrying out labor at landlord's farm. In the time free from work on the landlord's farm, peasants could cultivate plots provided to them by landlord. Under quit rent system all land in an estate was allocated among peasants who cultivated their plots and paid fixed annual quit rent to the landlord either in cash or in kind. Under both systems it was the landlord who determined magnitude of peasants' obligation as well as size of land plots. The landlord had a formal right to revisit and change the type and the amount of serf's obligations at his/her will.⁵

Both corvee and quit rent systems were associated with severe incentive problems. Under corvee, peasants' effort during work on the landlord's farm was largely unobservable to the landlord as monitoring was very costly. In the case of quit rent, the lack of credible commitment on the part of the landlord not to revise its size in the future reduced peasant effort due to ratchet effect. There is anecdotal evidence that some landlords were able to commit to a fixed amount of quitrent, maximizing stream of payments over long horizon (Dennison 2011); however, this was far from being a common practice.

⁴ In the extreme cases of starvation and torcher of serfs by landlords, the state could (and often did) take private estates into government external management. For example, in 1849 the government operated 180 private estates because of tocher and other 88 because of wastefulness (Statisticheskie ... 1852), i.e. less than a quarter of percent in total.

⁵ Under both systems of corvee and quitrent peasant also had to carry out additional obligations to landlords like provision of timber supply, transportation services, etc.

Landlords had full control over the choice of the system – corvee vs. quit rent – and, therefore, chose what was most profitable to them. Corvee system, despite severe incentive problems, allowed landlords to utilize economies of scale better, especially in large estates, and introduce new technological advances in agriculture.

2.2. Geographical variation in serfdom in the mid 19th century.

The Russian empire was a predominantly agricultural society up to the middle of the 19th century. More than a ninety percent of the population of the empire lived in the rural areas (Bushen 1863). The bulk of rural population was unfree. However, less than half of all peasants were privately-owned serfs. In the European part of empire (without Poland and Finland, see figure 1) in 1858, there were 22,546,732 private serfs out of 52,392,030 rural residents (43.03%). The rest, as we described briefly in the introduction, were state peasants (40.4%), free population (12.6%), and royal peasants (4%). Historians argued based on anecdotal evidence (Druzhinin 1958) that state peasants had better living standards, larger individual land plots, and more transparent quit rent. The state changed the size of the quit rent only once in the 19th century (Druzhinin 1958). In the late 1830s - 1840s the government conducted a so-called Kiselev's reform, which guaranteed a minimal land to each state peasant household. If population in a state villages grew bypassing the minimum required land household ratio, the state initiated migration campaigns to virgin lands in the South and East of the empire.

The composition of rural population substantially varied across provinces because of historical expansion of the Russian state and colonization of new territories (Nafziger 2012). Figures 2 and 3 present shares of private serfs and state peasants across the European provinces of the empire in 1858. The figures show that there were higher shares of private serfs in the “old” regions of the empire, which were closer to Moscow and more state peasants in the outskirts of the empire. The reason for this was that the introduction of serfdom in Russia was closely connected to the construction of the army. In the 16th and 17th centuries, being short of cash, the

government provided state lands with free peasants to gentry in return to their military service. The government transferred lands to gentry more often in regions close to the capital, Moscow, because of two reasons: (1) gentry had to be mobilized to the capital quickly in case of a war; (2) government had more authority nearby the capital (Semevsky 1881, p. 29-30). Over time, with short supply of state lands in the old regions and colonization of new territories, the state started to transfer more distant lands with state peasants to gentry as well. The government continued such practice of transfers during the whole 18th century even after the 1704 military reform, which introduced regular army instead of the estate one.

In addition, often gentry captured state lands (with state peasants on them), eventually legalizing their titles. Using 1684-1686 census data, Vodarsky (1988) estimated that gentry captured 36 percent of all privately owned estates. This share was higher in “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).

There was also a transfer from private ownership of lands (and serfs) to state ownership in the 18th century. In particular, in 1764 church land holdings were confiscated by the state. The bulk of church serfs belonged to the monasteries and therefore, the historical location of monasteries affected the distribution of state peasants across provinces of the empire (Semevsky 1901). Importantly, the confiscated church lands as a rule were not subsequently transferred to gentry in order to avoid conflict with the church (Semevsky 1906).

Overall, the distribution of types of peasantry across Russia’s provinces became relatively stable by the year 1801, as Alexander I, who assumed the throne in this year, ordered to stop the practice of transfers of state lands to private ownership of nobles. Prior to Alexander I, there were many transfers like this: Catherine II (1762-1796) transferred 800 thousand state

peasants to private owners; Pavel I (1796-1801) transferred another 400 thousand (Semevsky 1882, 1906).

The large shares of free agricultural workers were concentrated in very particular regions of Russia, as shown on Figure 4. In particular, Cossacks in Don region were free because in the 17th century the government needed them to protect the country from the nomadic invasions 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 of (relatively) free rural population after the conquest of this province in 1811.⁶ Peasants in the three Baltic provinces were emancipated in 1816-1819. In addition, over the course of the 18th and very early 19th century the government invited colonists from Europe to settle in virgin land of the empire in the South and the East; however, there were not many of them.

2.3. The emancipation.

Emancipation (1861) made serfs “free” and extended their opportunities to make decisions. Privately-owned serfs were granted personal freedom, which came with an obligation to buy out land from the landlord. The precise terms of buy-out operation were regulated by law and varied a bit across provinces. Peasants and landlords also had some choice within rule implied by the government.⁷ The emancipation was a relatively slow process. Peasants temporarily continued to carry out their obligations during another two years (till 1863) during which they had to come to an agreement with the landlord on the terms of the land buyout (namely, size of the plot and price). Formally, land price was supposed to be determined as capitalized quit rent that peasants used to pay; however, there was a lot of bargaining over the exact terms. Once the terms were

⁶ Tsaryane were formally free. They could move between landlords' estates; they cultivated land in return of obligation (Antsupov 1978).

⁷ If peasants did not want to buy out land, they could get so called pauper plot for free. Its size was ¼ of a normal plot. Only 3 per cent of all peasants chose this option.

agreed upon, peasants started the buyout operation. Peasants paid twenty per cent of agreed land price and the state lent the other eighty which peasants had to pay back during 49 years.

The main outcome of the abolition of serfdom was that peasants became full owners of their labor; their obligations became fixed and eventually abolished, i.e., the incentive problems associated with serfdom disappeared. This, probably, was the main channel through which the emancipation affected agricultural productivity. The commune system of land ownership severely constrained the mobility of peasants after the emancipation and limited incentives to invest in the land plots (Lenin 1898, Gershenkron 1966, Gregory 1982, Nafziger 2007). The commune became the owner of land that peasants bought out from the landlord. The commune divided this land into “strips” (land plots) and periodically redistributed them between households. This limited peasants’ incentives to invest in land preventing growth of productivity via this channel. The commune also regulated production decisions that restricted individual freedom, and, in particular, constrained adaptation of new technologies. The commune also implied mutual responsibility to pay taxes that restricted mobility (a peasants had to ask permission from the commune to migrate) and accordingly prevent free allocation of labor. These constraints reduced the potential effect of emancipation on productivity in agriculture and urbanization (Dower and Markevich 2013); they were removed only by the 1906 Stolypin reform.

The 1861 emancipation reform affected privately-owned serfs in the European provinces of Russian empire with the exception of peasants in three Baltic provinces, who were emancipated forty years earlier.⁸ Royal serfs were emancipated in 1863.⁹ State peasants were liberated by the land reform of 1866. The precise terms of these two reforms were very similar to the 1861 emancipation reform.

3. Empirical methodology and hypotheses.

⁸ In Baltic provinces, former serfs did not have to buy out land as a result of emancipation.

⁹ Royal peasants formerly were declared free in 1856, but real changes in their status and corresponding land reform was conducted only in 1863.

We use the cross-province variation in the shares of different types of peasantry and over-time and across-provinces variation in emancipation to estimate the effect of forced labor on agricultural productivity, draftees height, and industrial output and employment. We run difference-in-differences regressions controlling for time and province fixed effects. As different regions are expected to have different development trajectories and the cross-province variation in the type of peasantry is non-random, it is crucial to control for these trajectories. Thus, in all specifications we also control for region-specific trends. For this purpose, we define regions in two different ways depending on data availability. For outcomes with a large enough time dimension of the data, we control for linear trends for each of the 50 provinces. For outcomes with only few snapshots before and after the emancipation, we control for the linear trends for each of the 15 geographic regions, each of which groups several provinces that are commonly considered as having similar development trajectories. In addition, we verify robustness of our results to controlling for linear trends specific to each level provincial agricultural suitability, measured by the median level of suitability across all provincial lands.

In particular, our main specification is as follows:

$$\begin{aligned}
Outcome_{it} = & \beta * Share_private_i * Post_Emancipation_private_{it} \\
& + \gamma * Share_state_i * Post_Emancipation_state_{it} + \xi * Share_royal_i * Post_Emancipation_royal_{it} \\
& + \psi_i + \bar{\alpha}_t + \Lambda_i * D_i * year_t + \varepsilon_{it}.
\end{aligned}$$

Subscripts i and t index province and time periods. Time periods could be years or decades, depending on data availability for a particular outcome. We consider the following outcomes (denoted as *Outcome*): grain yield (harvest/seed ratio), potato yield (harvest/seed ratio), cattle per capita, height of draftees in centimeters, log(industrial employment), log(industrial output), mortality (ratio of the number of deaths to rural population) and fertility (ratio of the number of births to rural population). *Share_private*, *Share_state* and *Share_royal* denote shares of privately owned serfs, state peasants, and royal serfs in a province in before the emancipation,

respectively. *Post_emancipation_private* denote the dummy indicating the time after emancipation of private serfs, it varies both over time and across provinces. This dummy switches on in 1861 in all provinces with the exception of the three Baltic provinces, where it switches on in 1819. *Post_emancipation_state* is a dummy indicating the period of emancipation of state peasants, namely, post 1866 for all provinces. Similarly, *Post_emancipation_royal* is a dummy indicating emancipation of royal serfs, which is turned on starting in 1863, also in all provinces. Province and year fixed effects are denoted by ψ_i and $\bar{\sigma}_t$, respectively. $\Lambda_i * D_i * year_t$ stand for province- or region-specific linear trends. The error term is assumed to be uncorrelated across provinces, autocorrelated within provinces. Thus, we adjust standard errors to clustering at the province level. Coefficients β and γ estimate the effect of the emancipation of private serfs and state peasants on the outcomes of interest.

We also explore the differential effects for different median sizes of the states of the nobility and for the different contractual systems within private estates, i.e., corvee or quit rent. In order to do this, we include the interaction of these variables with $Share_private_i * Post_Emancipation_private_{it}$ as an additional regressor in the baseline specification.

3.2. Hypotheses.

What do we expect to find? Adverse incentive effects created by serfdom should be alleviated with emancipation. Therefore, we should expect to observe a higher boost to agricultural productivity after the emancipation in provinces with higher share of serfs as compared to the shares of free rural population or state peasants (who were emancipated later). Similarly, as state peasants were de facto a property of the state, we expect agricultural productivity to increase more after 1866 in provinces with higher share of state peasants. However, since the state had higher commitment not to revise the level of quit rent compared to gentry, we expect the productivity effect of emancipation of state peasants to be smaller than that

of the private serfs. If economies of scale were present in agriculture in the 19th century Russia, as many historians suggest, we would expect productivity effects of emancipation to be smaller in provinces with larger median size of the estates.

A priori, it is not clear whether one should expect nutrition, and therefore, peasants' (draftees') height and mortality, to be affected by emancipation. The reason for this is that nobility might have considered serfs as a valuable and scarce input into the production and, therefore, they might have made sure that serfs are well fed, as nutrition directly affects peasant productivity. It could also be the case, however, that nobility set serfs obligations at the level insufficient for proper nutrition of peasants' children, as children are not productive in the short run.

Personal freedom given to former serfs and land titles given to them and to state peasants should, in principle, increase mobility from the rural to urban areas, where productivity, and therefore, wages were larger. This, in turn, should have had a positive effect on the development of industry. However, the land titles were not individual, but given to the peasant communes. The communes made selling land plots by individual peasants very costly (Chernina et al. 2013; Dower and Markevich 2013). Thus, whether the emancipation affected industrial development of Russia is an empirical question, the answer to which mostly depends on whether peasants were able to quit communes. In addition, gentry could explore potential advantages of higher urban wages for peasants before the emancipation, switching them to quit rent and allowing temporarily migrate to cities for seasonal work and the like.

4. Data.

We combine various sources to construct a unique province-level panel dataset on development of European provinces of the Russian empire in the 19th century. In particular, we collected data on grain and potatoes yields (evaluated as harvest to seed ratio) from governor reports for the years before 1883 (from Kovalchenko 1959, Kessler and Markevich 2013, Obruchev 1871,

Materialy ... 1880) and Central Statistical Agency (TsSK MVD) statistics for the post-1883 years (TsSK MVD 1888, Urozhaj v ... 1889-1901), as well as on cattle and population from various official statistical books (Vilson 1857, Statisticheskii ... 1852, 1858; Statisticheskii ... 1875, 1886) and, Kabuzan (1971) and Kessler and Markevich (2013). We gathered information on industrial output and employment also from various official books (Statisticheskii ... 1849, 1852, 1858; Sbornik ... 1884; Statisticheskii ... 1887) and Kessler and Markevich (2013). Finally, we collected figures on height of draftees borne in 1853-1863, 1865-1866 and 1875 from records of the Ministry of defence (Vseobshchaya ... 1886, Sbornik ... 1887, 1890, 1897) and number of births and deaths from official publications (Statisticheskii ... 1858; Statisticheskii ... 1872, 1877, 1879, 1883a, 1883b, 1890, 1895, 1898) and Kessler and Markevich (2013).

Data on the distribution of rural population by status before the emancipation comes from 1858 police data (Bushen 1863) and 1857 tax census data (Kabuzan 1971). 1858 and 1857 figures are highly correlated but different. There is no consensus in historical literature which source has the most likely figures (Kabuzan 1971). In our baseline regressions we rely on police data since they have more observations. 1857 tax census data were re-estimated by Kabuzan (1971) and reported according to 1805 borders that cut number of observations because of administrative changes in the number and size of provinces. We use 1857 tax census data for robustness checks (results reported in tables A2-A5 of the appendix). Finally, our data on 1857 private serfs obligations and private estates size are from Trointiskii (1858) and Skrebitskii (1862-1866).

The constructed panel is unbalanced. Moreover, we have different number of cross-sections for our dependent variables: decade data for 1800, 1810, 1820, 1830, 1840, 1850 and annual data for 1847, 1849, 1856, 1858, 1864-1866, 1870-1876, 1883-1900. The largest number is for grain. The smallest is for industrial employment: 1847, 1882, 1897. Table B1 in the appendix provides details list of available cross-sections and our sources.

In table 1 we report descriptive statistics. Panel A of the table shows substantial variation in serfdom across provinces. In an average province, according to our preferable source - the 1858 police data (Bushen 1863), private serfs composed forty two per cent of rural population; state peasants – thirty eight percent; royal peasants – four percent and free population – sixteen percent, correspondingly. 1857 census data give similar figures. There was about a hundred and forty serfs per estate in an average province. As presented in the Panel B of the table, about two thirds of private serfs worked under corvee system; almost thirty were in quit rent and the rest were servants in the estates. As figures 5 and 6 demonstrate there were more corvee serfs in the West of the empire, while quit rent dominated in the North East, i.e. in the non-black earth region.

We present development outcomes in panel C of the table. There was about a million and two hundred thousands rural citizens in a province in an average year in the 19th century. Population grew rapidly; there were almost five births per thousand of rural population in a year and only three and a half deaths. Average province was highly agricultural; there were only thirty one thousand industrial workers in a province who produced about 18 million rubles of output. Grain was the main economic output in the empire. We do not know area under crops before 1883 in the Russian empire (not to mention labor inputs) that is why we measure grain productivity as grain yield to grain seed ratio – a measure widely used in Russian agriculture before late 19th century. Yield to seed ratio of grain was about 3.95 in an average province in an average year, increasing from about 3.5 to 4.5 over the century. Potato was more labor-intensive crop than grain with higher yield to seed ratio (about 4.4 in average); it represented a modern technology that was slowly spreading over time and space during the period under consideration. Animal husbandry had secondary importance. There was in average one head of cattle per two rural citizens in the empire. Height of a draftee was in average 164.5 centimeters¹⁰.

¹⁰ Rural citizens composed more than ninety percent of the population and was the main source of draftees for the army.

5. Results: Economic Consequences of Emancipation of Serfs.

Table 2 reports the estimation results of our baseline specification with various measures of agricultural productivity. Columns 1 and 2 present results for the grain yield; columns 3 and 4 – for potato yield, and column 5 – for cattle per capita. Results for grain and potato yields are presented for specifications with province-specific trends (columns 1 and 3) and with region-specific trends (columns 2 and 4). For cattle, we can only present results with region-specific trends, as the time dimension of the data is insufficient to estimate specification with province specific trends.

We find evidence of a substantial positive effect of emancipation, or, conversely, a negative effect of coerced labor on agricultural productivity. The coefficients on the interactions of post-emancipation dummies with pre-emancipation shares of private serfs and state peasants are positive and statistically significant for grain yield and cattle. We find no significant effects on potato yield. The coefficient on emancipation of private serfs is positive, but imprecisely estimated. Potatoes were a new technology and were not yet widespread in the 19th century Russia.

The magnitudes of the effects are substantial. One standard deviation increase in the share of private serfs in a province (i.e., an increase of the share of private serfs in rural population by 25 percentage points) before the emancipation led to an increase in grain productivity by 29 percentage points or 8 percent after emancipation. One standard deviation increase in the share of state serfs (i.e., an increase by 22 percentage points) before 1866 reform improved grain productivity to a smaller extent after the reform: by 14 percentage points or 4 percent. These are large effects, as compared to the aggregate trend in grain productivity, which, on average, increased by 10 percentage points in a decade in the 19th century. Finally, one standard deviation increases in shares of private serfs and state peasants before the emancipation

led to growth of cattle per capita by 5 and 6 percentage points after the emancipation or by 10 and 12 percent, correspondingly.

In **Table 3** we explore possible channels of low productivity under serfdom. Instead of the interaction between share of privately owned serfs and post emancipation period we include corresponding interactions of shares of privately owned serfs under corvee and quitrent as well as share of privately owned serfs who were servants (*dvorovie*). We find that in case of grain both quit rent and corvee are equally low productive for private serfs (the difference is statistically insignificant), but worse than state peasants (column 1). For potatoes we find that quitrent was especially unproductive (column 4). Coefficients are imprecisely estimated for animal husbandry (column 7). We further investigate the economy of scale effect, accounting for the estate size. We divide all provinces into two groups: with an average estate smaller and larger 100 serfs. Then we run regressions adding triple interactions between shares of corresponding groups of privately owned serfs, post emancipation period and large estate province dummy (columns 2, 3 and 4, 5). As expected we find evidence of economy of scale effect in the case of grain production under corvee system, but not under quit rent. Large estate compensated half of negative effect of corvee, making it equally productive with quit rent. Again coefficients are imprecisely estimated for potatoes.

In **table 4** we explore the effect of serfdom for peasants' nutrition looking at height of draftees as an outcome variable. First, we compare all those who were born before the 1861 reform with all those who were born after it (column 1). Then we compare the oldest cohort (born in 1853) with all those who were born after the 1861 serfs' emancipation (column 2). Finally, we repeat these exercises accounting for shares of privately owned serfs of different types (columns 3 and 4). As coefficients on the corresponding interactions of share of privately owned serfs demonstrate, serfdom negatively affected child nutrition. One standard deviation increase in share of privately owned serfs before the emancipation led to 0.3 centimeters increase in height of draftees born after the emancipation. That was not the case for state peasants and

royal serfs. Columns 3 and 4 show that all of the negative effect of serfdom on nutrition comes from corvee. Quit rent serfs were able to feed their children.

We further study consequences of emancipation for peasants' living standards in table 5, considering the effect of serfdom onto mortality (column 1) and fertility (column 2). We find further support of positive effect of emancipation on peasants' living standards, mainly onto decrease of mortality. The coefficient on the interaction of post-emancipation dummies with pre-emancipation share of private serfs is negative and statistically significant in the columns 2 and positive but not statistically significant in column 3. One standard deviation increase in share of privately owned serfs before the emancipation decreased mortality by one and a half death per a thousand of rural population after the emancipation. State peasants reform of 1866 did not affect their mortality and fertility rates.

Finally, we explore the effect of serfdom onto industrial development in table 6. We find positive effect of the emancipation onto both industrial output and industrial employment. We report results in levels (columns 1 and 2) and logs (columns 3 and 4). One standard deviation increase in share of privately owned serfs before the emancipation increased industrial output by 52 percent and industrial employment by 25 percent after the emancipation. Again we do not find an effect of emancipation of state serfs onto industrial growth.

In table A2-A6 of the appendix we repeat all these exercises but with 1857 tax census data as robustness check. Our main results hold. We also repeat all these estimations, adding interactions between post emancipation period and distance to Moscow as well as land suitability types. We find similar results (not reported).

6. Conclusion.

We estimate the effect of the abolition of serfdom on agricultural productivity, peasants' living standards, and industrial development of 19th century Russia and find particularly large positive effects of the emancipation of private serfs on all most important outcomes of interest. 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 yields that if serfdom were abolished in 1820, by 1913 Russia would have been twice as rich as it actually was. In 1913, according to Maddison (2007), Russia's GDP per capita was \$1488 (measured in 1990 US dollars). Our estimates suggest that the abolition of serfdom in 1820 would have implied per capita GDP in a range between \$2550 and \$3041. Thus, by 1913 Russia's would have had a level of GDP per capita comparable to Sweden (\$3073 in 1913) or Norway (\$2447).¹¹ The history of Europe would have been completely different.

¹¹ The counterfactual exercise is as follows: We come our findings with Maddison (2007) estimate of Russian GDP per capita in 1820 and industrial structure of Russian economy in 1860 by Goldsmith (1961) and in 1913 by Markevich and Harrison (2013). Assuming that industrial structure of Russian economy was the same in 1860 and 1820, we estimate the value added in industry, agriculture and services in 1820. Then, we momentarily increase the output in agriculture and industry according to the effects of the abolition of serfdom, that we have estimated, times 0.42 (the fraction of serfs in the country). Then, we allow the economy to grow either at the rate it actually grew after the emancipation, i.e., between 1870 and 1913 (the optimistic scenario), or at its actual historical rates (the pessimistic scenario).

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Table 1. Summary statistics.

Panel A. Distribution of rural population by status in 1858 and 1857.

Variable	Obs	Mean	Std. Dev.	Min	Max
1858 police data					
Share of private serfs	49	0.42	0.25	0	0.83
Share of state peasants	49	0.38	0.22	0	0.88
Share of royal peasants	49	0.04	0.08	0	0.47
Share of free rural population	49	0.16	0.24	0.04	0.99
1857 tax census data					
Share of private serfs	36	0.49	0.23	0	0.87
Share of state peasants	36	0.38	0.2	0.07	0.81
Share of royal peasants	36	0.03	0.06	0	0.2
Share of free rural population	36	0.16	0.23	0.04	0.93

Panel B. Distribution of private serfs by type of obligations and estate size in 1857.

Share of corvee peasants	44	0.65	0.27	0.12	0.98
Share of quitrent peasants	44	0.28	0.28	0.00	0.84
Share of estate peasants	44	0.07	0.05	0.01	0.18
Average number of serfs per landlord	49	138.54	312.64	0	2232.5

Panel C. Development outcomes.

Variable	Obs	Mean	Std. Dev.	Min	Max
Grain productivity (yield to seed ratio)	1572	3.95	1.32	0.59	12.3
Potatoes productivity (yield to seed ratio)	1488	4.39	1.56	0.01	40.19
Cattle per capita (units)	216	0.42	0.25	0.04	1.50
Industrial output (mln current rubles)	278	18.3	37.4	0.07	334
Industrial workers (000)	142	31.3	56	31	496.1
Rural population (000)	1275	1234. 7	715.7	37.5	3981.9
All Births / rural population ration	531	0.047	0.008	0.02	0.12
Male births / rural population ration	531	0.024	0.004	0.01	0.03
Female births / rural population ration	531	0.023	0.005	0.01	0.10
Deaths / rural population ratio	531	0.035	0.008	0.02	0.12
Height of draftees (centimetres)	686	164.4 9	1.21	161.86	171.6

Figure 1. Russian European provinces.



Figure 2. Geography of serfdom: private serfs in 1858 (share of rural population).

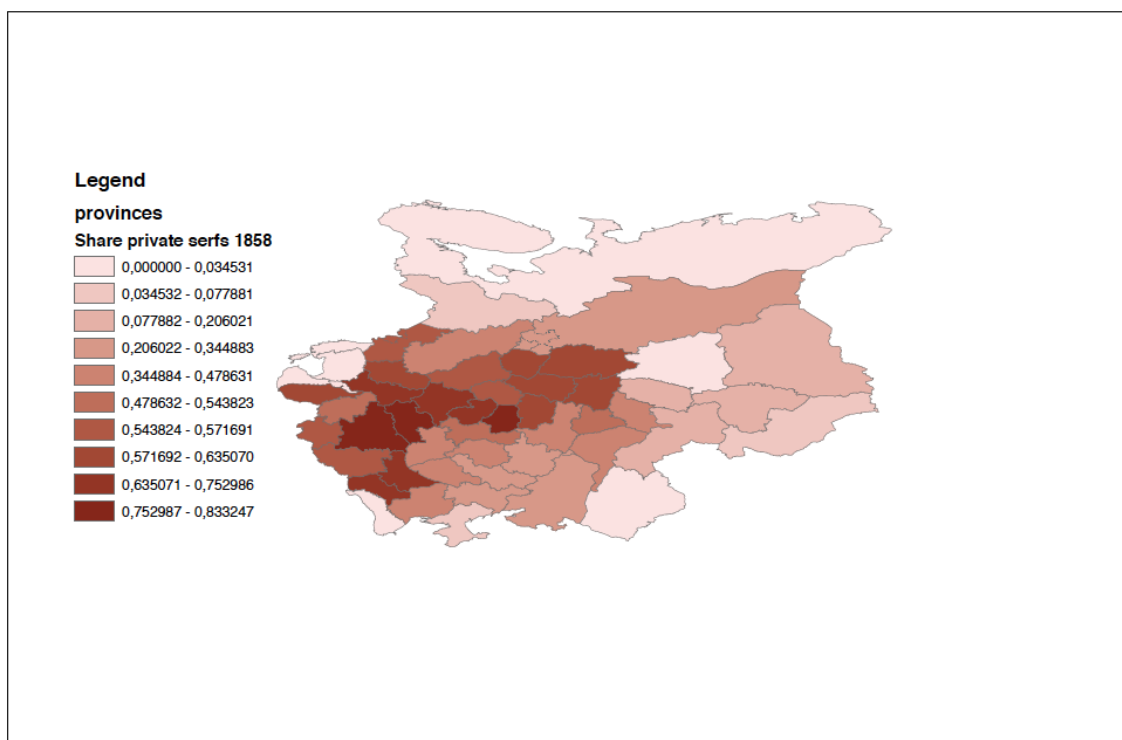


Figure 3. Geography of serfdom: state peasants in 1858 (share of rural population).

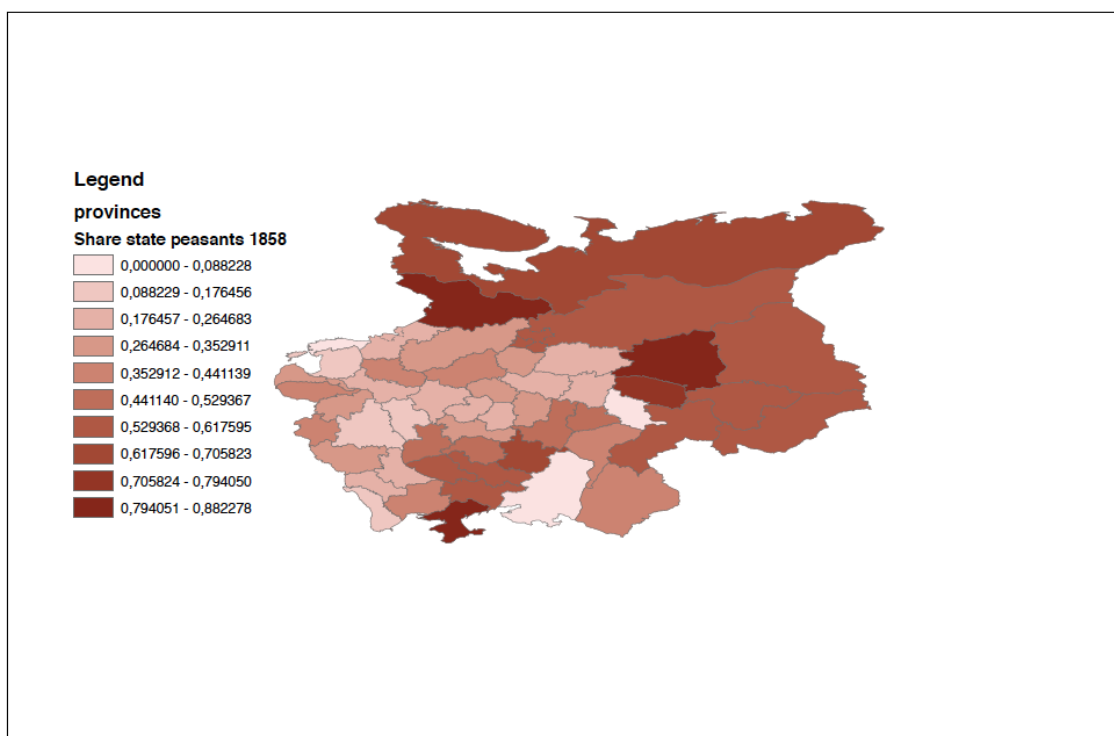


Figure 4. Geography of serfdom: free population in 1858 (share of rural population).

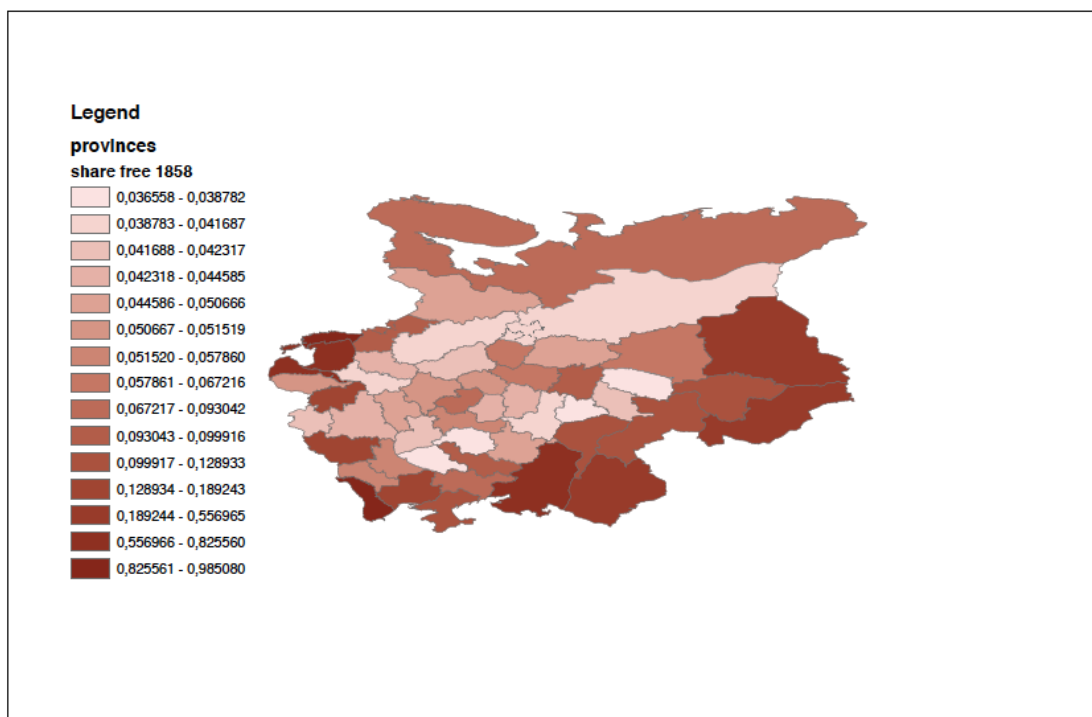


Figure 5. Geography of serfdom: corvee system in 1858 (share of private serf under corvee).

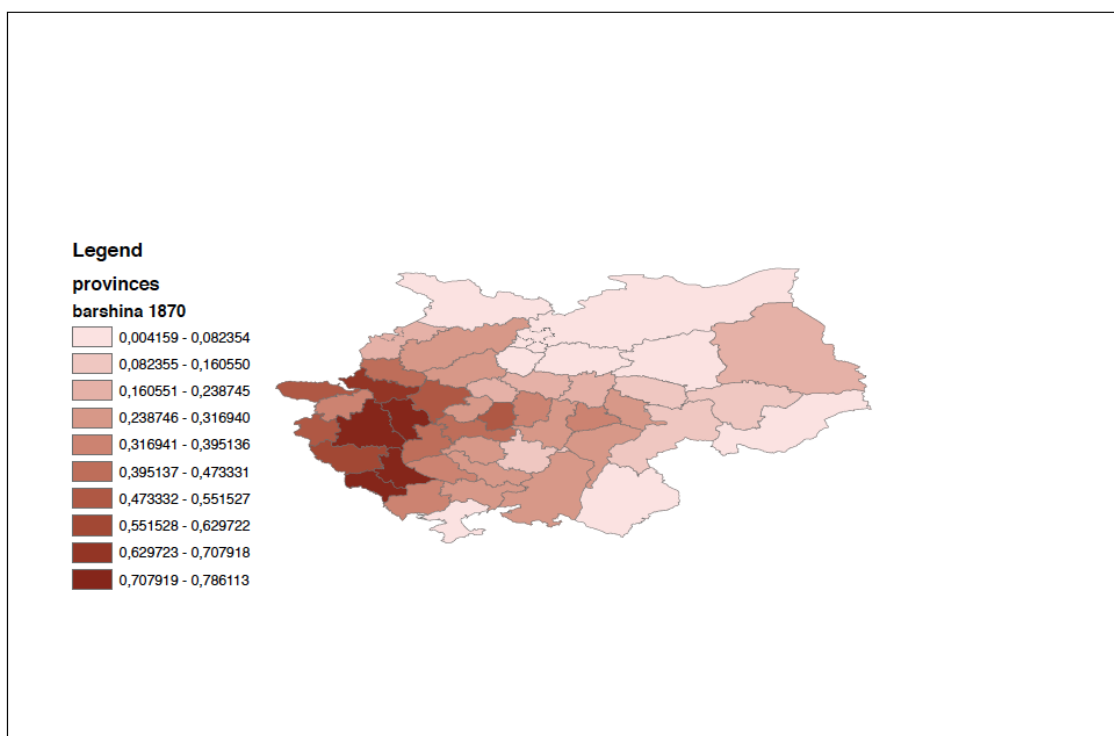


Figure 6. Geography of serfdom: quit rent in 1858 (share of private serf under quit rent).

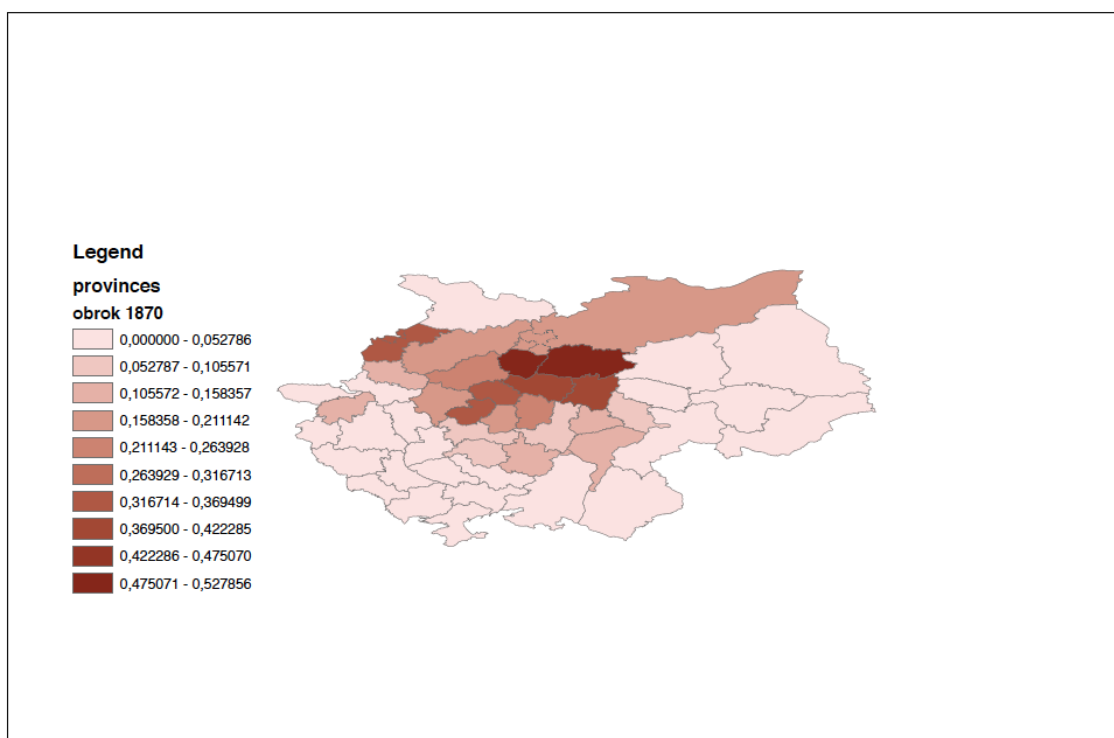


Figure 7. Grain productivity in “free” “state” and “serf” provinces (raw data, net of common macro shocks).

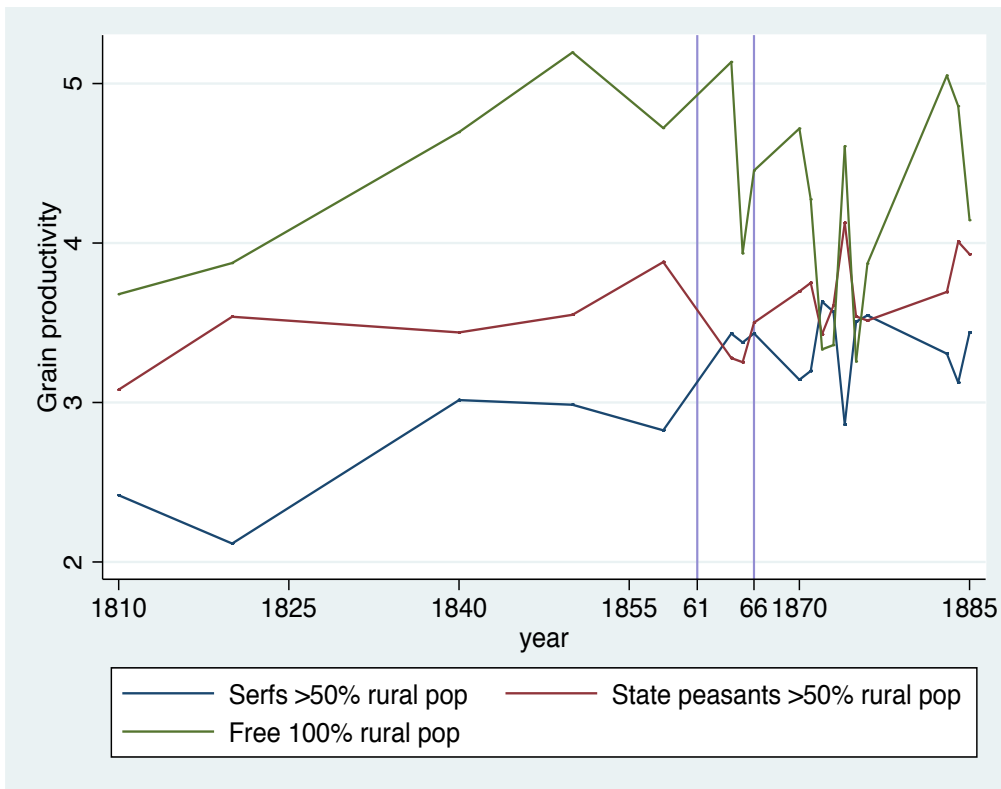


Figure 8. Grain productivity relative to “free” provinces (raw data, net of common macro shocks).

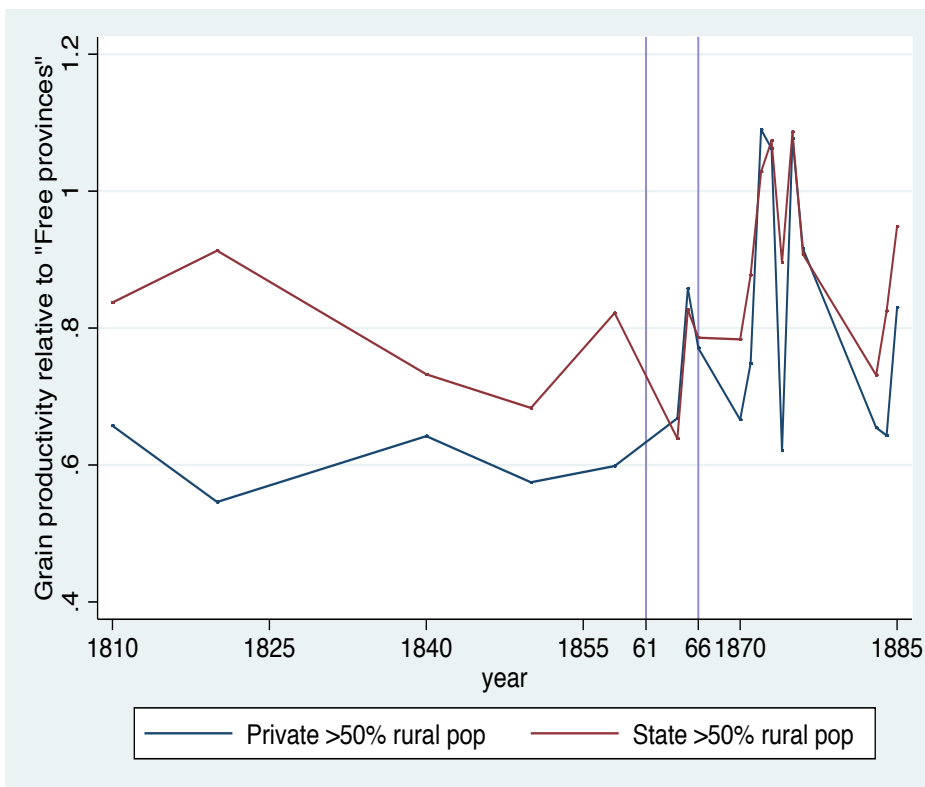


Figure 9. Height of draftees in “free” “state” and “serf” provinces (raw data, net of common macro shocks).

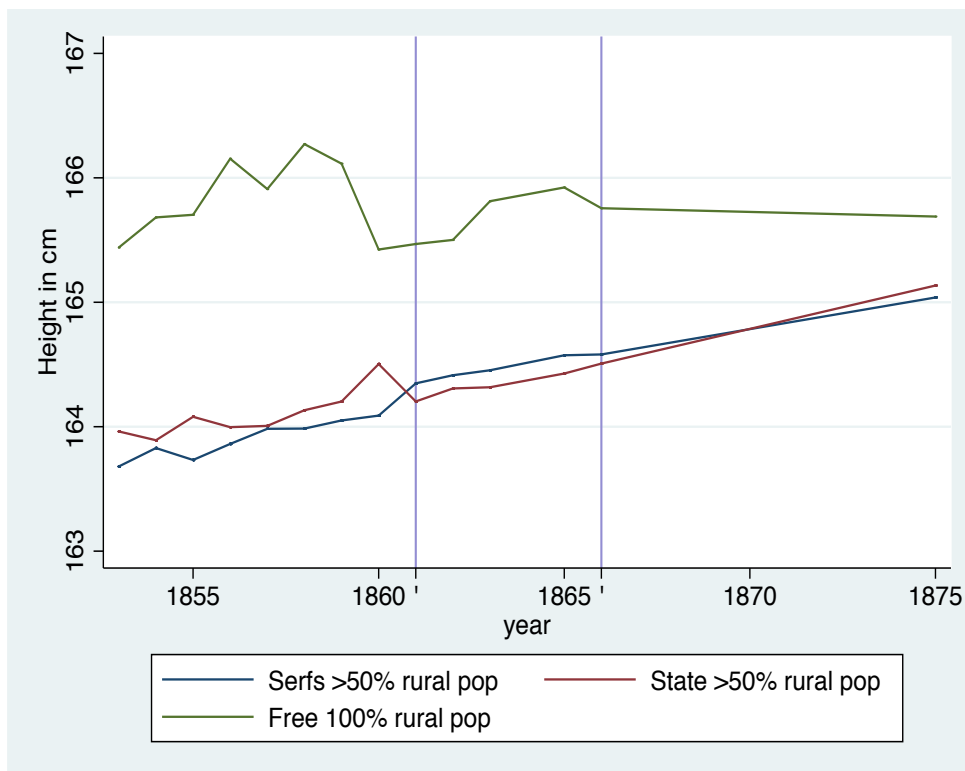


Figure 10. Height relative to “free” provinces (raw data, net of common macro shocks).



Table 2. Grain, potatoes productivity and cattle per capita.

VARIABLES	(1) Grain productivity	(2) Grain productivity	(3) Potatoes productivity	(4) Potatoes productivity	(5) Cattle per capita
Share of private serfs * post1861(1820)	1.1481*** [0.422]	1.0277*** [0.340]	2.1411 [1.462]	1.8901 [1.158]	0.1884*** [0.068]
Share of state peasants * post 1866	0.6347* [0.352]	0.7672*** [0.282]	-0.0843 [0.729]	-0.0025 [0.548]	0.2818*** [0.087]
Share of royal peasants * post1863	0.6407 [0.903]	-0.2653 [0.858]	1.9614 [2.406]	0.0760 [1.553]	0.0535 [0.234]
Land suitability * post1861	0.1925** [0.080]	0.1895*** [0.063]	-0.0738 [0.206]	0.0353 [0.133]	0.0086 [0.015]
Province-specific linear trends	YES	NO	YES	NO	NO
Mega region-specific linear trends	NO	YES	NO	YES	YES
Time fixed effects	YES	YES	YES	YES	YES
Province fixed effects	YES	YES	YES	YES	YES
Constant	10.7814 [8.253]	33.9325*** [4.729]	-5.3497 [22.817]	-42.9548*** [7.997]	-1.7462 [1.734]
Observations	1,555	1,555	1,393	1,393	203
R-squared	0.356	0.331	0.201	0.172	0.862

Table 3. Why was productivity low under serfdom? Corvee vs. quit rent in large and small estates.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7) Cattle per capita
	Grain productivity			Potatoes productivity			
Share of private serfs on corvee* post1861	2.1796*** [0.671]		4.0534*** [0.948]	1.8267 [1.782]		3.7380 [2.465]	0.0562 [0.280]
Share of private serfs on quitrent*post1861	2.5694*** [0.784]		2.5634*** [0.726]	3.2887* [1.857]		4.0008* [2.262]	-0.2501 [0.312]
Share of private serfs-servants*post 1861	0.2471 [7.045]		-13.4293 [9.309]	16.4408* [8.909]		2.3269 [11.109]	-0.8825 [0.981]
Share of private serfs * post1861(1820)		1.0684** [0.453]			3.0475* [1.584]		
Share of private serfs on corvee*large estate dummy* post1861			-2.8783*** [1.006]			-2.2938 [1.513]	
Share of private serfs on quitrent* large estate dummy* post1861			-1.5455 [1.783]			-1.8374 [2.218]	
Share of private serfs-servants* large estate dummy* post 1861			48.0485** [22.911]			21.6706 [24.391]	
Share of private serfs * large estate dummy* post1861(1820)		0.1420 [0.364]			-1.3025** [0.531]		
Share of state peasants * post 1866	1.2252*** [0.401]	0.6494* [0.353]	1.2065*** [0.391]	0.0486 [0.827]	-0.1797 [0.704]	0.0084 [0.808]	0.0214 [0.288]
Share of royal peasants * post1863	1.1523 [0.844]	0.6234 [0.880]	0.4612 [0.828]	1.3332 [1.964]	2.1845 [2.305]	1.0578 [1.812]	-0.2084 [0.336]
Land suitability * post1861	0.0738 [0.096]	0.1917** [0.080]	0.0252 [0.095]	-0.0505 [0.216]	-0.0677 [0.201]	-0.1204 [0.246]	-0.0000 [0.016]
Province-specific linear trends	Yes	Yes	Yes	Yes	Yes	Yes	No
Mega region-specific linear trends	No	No	No	No	No	No	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	17.2789 [12.514]	10.6239 [8.254]	13.7486 [12.229]	12.2280 [33.154]	-1.7012 [22.885]	5.5317 [31.217]	-2.0152 [1.825]
Observations	1,396	1,555	1,396	1,331	1,393	1,331	193
R-squared	0.374	0.356	0.376	0.205	0.203	0.206	0.878

Table 4. Did serfdom affect living standards? Draftees' height.

VARIABLES	(1) Full sample	(2) 1853 and post 1861 years	(3) Full sample	(4) 1853 and post 1861 years
Share of private serfs * post1861(1820)	0.8150*** [0.194]	1.2742** [0.488]		
Share of state peasants * post 1866	0.3115 [0.417]	0.0590 [0.407]	0.1216 [0.438]	-0.1330 [0.394]
Share of royal peasants * post1863	0.1979 [0.467]	0.5372 [0.629]	0.2739 [0.577]	0.5772 [0.737]
Share of private serfs on corvee* post1861			0.9188*** [0.255]	1.6446** [0.683]
Share of private serfs on quitrent*post1861			0.3559 [0.425]	0.1907 [0.925]
Share of private serfs- servants*post 1861			-2.9562 [2.409]	-2.8959 [5.202]
Province-specific linear trends	No	No	No	No
Mega region-specific linear trends	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes
Periods	Yes	Yes	Yes	Yes
Constant	126.5189* ** [16.234]	193.0435*** [8.721]	123.9318* ** [16.772]	192.4257*** [8.394]
Observations	644	276	616	264

Table 5. Did serfdom affect living standards? Mortality and fertility.

VARIABLES	(1) All deaths rural population ratio	(2) All births rural population ratio
Share of private serfs * post1861(1820)	-0.0056** [0.002]	0.0027 [0.006]
Share of state peasants * post 1866	-0.0027 [0.004]	-0.0013 [0.007]
Share of royal peasants * post1863	0.0065 [0.008]	-0.0125 [0.009]
Province-specific linear trends	No	No
Mega region-specific linear trends	Yes	Yes
Time fixed effects	Yes	Yes
Province fixed effects	Yes	Yes
Constant	0.8150*** [0.027]	0.6287*** [0.025]
Observations	501	501
R-squared	0.167	0.264

Table 6. Did serfdom affect industrial development?

VARIABLES	(1) Industrial output	(2) Industrial workers	(3) Ln (industrial output)	(4) Ln (industrial workers)
Share of private serfs * post1861(1820)	3.8178e+07** [14490843.541]	31,898.3594* [16,965.074]	1.1364** [0.456]	1.8894*** [0.375]
Share of state peasants * post 1866	2.0318e+07 [16422699.992]	8,010.8922 [25,372.468]	1.0263 [0.617]	-0.3794 [0.866]
Share of royal peasants * post1863	5532929.4214 [21457993.803]	18,899.9999 [74,485.852]	0.4638 [0.888]	10.5564*** [1.523]
Province-specific linear trends	No	No	No	No
Mega region-specific linear trends	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes
Constant	-1.7414e+08 [1.522e+08]	-354126.0756 [708,889.725]	29.1098*** [3.800]	-17.8398 [13.185]
Observations	263	133	263	133
R-squared	0.780	0.845	0.887	0.956

Appendix. Robustness checks using the distribution of rural population by status from 1857 tax census. All tables are similar to tables 2-6 from the main text.

Table A2. Grain, potatoes productivity and cattle per capita.

VARIABLES	(1) Grain productivity	(2)	(3) Potatoes productivity	(4)	(5) Cattle per capita
Share of private serfs * post1861(1820)	1.0369*** [0.353]	0.8359** [0.327]	0.7584 [0.460]	0.9278** [0.432]	0.2034** [0.081]
Share of state peasants * post 1866	0.2266 [0.298]	0.6152** [0.301]	-1.3570** [0.587]	-0.7501 [0.499]	0.3622*** [0.115]
Share of royal peasants * post1863	-0.9556 [1.504]	-1.4508* [0.818]	2.5899 [2.479]	0.5463 [1.565]	-0.2765 [0.423]
Land suitability * post1861	0.2053** [0.093]	0.1355* [0.075]	0.0514 [0.151]	0.0721 [0.104]	0.0205 [0.019]
Province-specific linear trends	YES	NO	YES	NO	NO
Mega region-specific linear trends	NO	YES	NO	YES	YES
Time fixed effects	YES	YES	YES	YES	YES
Province fixed effects	YES	YES	YES	YES	YES
Constant	0.6694 [9.643]	168.7766*** [19.335]	-27.4272** [11.470]	98.3413*** [25.483]	32.7981*** [3.611]
Observations	1,153	1,153	1,044	1,044	179
R-squared	0.385	0.374	0.279	0.248	0.871

Table A3. Why was productivity low under serfdom? Corvee vs. quit rent in large and small estates.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7) Cattle per capita
	Grain productivity			Potatoes productivity			
Share of private serfs on corvee* post1861	1.8081** [0.716]		3.2521** [1.288]	0.0553 [0.768]		1.9255 [1.716]	-0.0491 [0.469]
Share of private serfs on quitrent*post1861	2.3222*** [0.829]		2.0757** [0.812]	0.9820 [0.987]		1.3483 [1.230]	-0.2881 [0.473]
Share of private serfs-servants*post 1861			-9.2580 [10.849]	10.9308 [8.997]		-3.5611 [13.663]	-1.4743 [1.307]
Share of private serfs * post1861(1820)		0.9708** [0.363]			1.3396** [0.538]		
Share of private serfs on corvee*large estate dummy* post1861			-2.6363** [1.171]			-2.3232 [1.749]	
Share of private serfs on quitrent* large estate dummy* post1861			-2.8963 [1.882]			-1.0966 [2.188]	
Share of private serfs-servants* large estate dummy* post 1861			68.6752*** [19.918]			19.3531 [25.137]	
Share of private serfs * large estate dummy* post1861(1820)		0.1315 [0.437]			-0.9967 [0.602]		
Share of state peasants * post 1866	0.7464* [0.381]	0.2381 [0.303]	0.7377* [0.375]	-1.4213** [0.617]	-1.4214** [0.568]	-1.4700** [0.606]	-0.0491 [0.469]
Share of royal peasants * post1863	-0.5215 [2.184]	-0.8581 [1.532]	0.9334 [2.112]	1.2189 [3.081]	1.9451 [2.752]	1.1046 [3.403]	-0.7404 [0.556]
Land suitability * post1861	0.1142 [0.102]	0.2026** [0.093]	0.0367 [0.089]	0.1086 [0.139]	0.0676 [0.147]	0.0495 [0.154]	0.0017 [0.029]
Province-specific linear trends	Yes	Yes	Yes	Yes	Yes	Yes	No
Mega region-specific linear trends	No	No	No	No	No	No	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	8.0029 [10.751]	0.5393 [9.604]	4.9027 [8.790]	-19.9480 [17.013]	25.6359** [11.346]	-27.4311 [18.385]	15.5348 [20.776]
Observations	997	1,153	997	951	1,044	951	151
R-squared	0.398	0.385	0.403	0.284	0.281	0.286	0.895

Table 4. Did serfdom affect living standards? Draftees' height.

VARIABLES	(1) Full sample	(2) 1853 and post 1861 years	(3) Full sample	(4) 1853 and post 1861 years
Share of private serfs * post1861(1820)	0.7494*** [0.234]	1.1329** [0.549]		
Share of state peasants * post 1866	0.4137 [0.570]	0.3933 [0.499]	0.2410 [0.619]	0.1895 [0.485]
Share of royal peasants * post1863	1.4304* [0.815]	1.9626* [1.107]	2.4143*** [0.825]	2.9072** [1.324]
Share of private serfs on corvee* post1861			0.7301* [0.364]	1.4771 [0.970]
Share of private serfs on quitrent*post1861			0.1141 [0.459]	-0.0504 [1.055]
Share of private serfs- servants*post 1861			-1.9173 [2.697]	1.1281 [6.774]
Province-specific linear trends	No	No	No	No
Mega region-specific linear trends	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes
Periods	Yes	Yes	Yes	Yes
Constant	163.3633* * [76.142]	66.3600* [36.254]	85.1861 [73.122]	47.4146 [56.215]
Observations	566	211	434	186
R-squared	0.673	0.835	0.750	0.855

Table 5. Did serfdom affect living standards? Mortality and fertility.

VARIABLES	(1) All deaths rural population ratio	(2) All births rural population ratio
Share of private serfs * post1861(1820)	-0.0085 [0.005]	0.0028 [0.007]
Share of state peasants * post 1866	-0.0065 [0.007]	0.0031 [0.008]
Share of royal peasants * post1863	0.0146 [0.018]	-0.0067 [0.020]
Province-specific linear trends	No	No
Mega region-specific linear trends	Yes	Yes
Time fixed effects	Yes	Yes
Province fixed effects	Yes	Yes
Constant	-1.8670* [1.092]	-10.1612*** [0.911]
Observations	384	384
R-squared	0.160	0.227

Table 6. Did serfdom affect industrial development?

VARIABLES	(1) Industrial output	(2) Industrial workers	(3) Ln (industrial output)	(4) Ln (industrial workers)
Share of private serfs * post1861(1820)	4.5463e+07*** [16295215.553]	44,398.6467** [16,606.242]	1.5484*** [0.272]	1.7774*** [0.417]
Share of state peasants * post 1866	4.2170e+07** [17303426.917]	38,938.4908 [31,455.840]	1.9301*** [0.574]	0.4656 [1.416]
Share of royal peasants * post1863	1.6115e+07 [33824090.536]	60,604.5971 [59,999.583]	2.6836** [1.164]	10.6159*** [1.656]
Province-specific linear trends	No	No	No	No
Mega region-specific linear trends	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes
Constant	4.4380e+08 [4.984e+08]	-1.3310e+06** [590,473.560]	367.0455*** [46.385]	-83.0067*** [22.622]
Observations	226	108	226	108
R-squared	0.799	0.846	0.887	0.966

Table 1B. Data sources.

Variable	Years	Source
Distribution of rural population by status	1858	Bushen (1863)
	1857	Kabuzan (1971)
Private serfs obligations	1857	Skrebitskii (1862-1866)
Serfs per estate	1857	Troinitskii (1858)
Grain yield	1800s-1850s by decade	Kovalchenko (1959)
	1858	Kessler and Markevich (2013)
	1864-1866	Obruchev (1871)
	1870-1876	Materialy ... (1880)
	1883-1887	TsSK MVD (1888)
	1888-1900	Urozhaj v ... (1889-1901)
Potatoes yield	1800s-1850s by decade	Kovalchenko (1959)
	1858	Kessler and Markevich (2013)
	1864-1866	Obruchev (1871)
	1870-1876	Materialy ... (1880)
	1883-1887	TsSK MVD (1888)
	1888-1900	Urozaj v ... (1889-1901)
Cattle	1840	Vilson (1857)
	1856	Statisticheckie ... (1858)
	1858	Kessler and Markevich (2013)
	1870	Statisticheckii ... (1875)
	1883	Statisticheckii ... (1886)
Rural population	1800s-1850s by decade	Kabuzan (1971)
	1849	Statisticheckie ... (1852)
	1856	Statisticheckie ... (1858)

	1858	Kessler and Markevich (2013)
	1870	Statisticheskii ... (1875)
	1883	Statisticheskii ... (1886)
Height of draftees	1853-1862	Vseobshchaya ... (1886)
	1863	Sbornik ... (1887)
	1865-1866	Sbornik ... (1890)
	1875	Sbornik ... (1897)
Industrial output	1849	Statisticheskii ... (1852)
	1856	Statisticheskii ... (1858)
	1858, 1897	Kessler and Markevich (2013)
	1882	Sbornik ... (1884)
	1884	Statisticheskii ... (1887)
Industrial employment	1847	Statisticheskii ... (1849)
	1882	Sbornik ... (1884)
	1897	Kessler and Markevich (2013)
Births	1856	Statisticheskii ... (1858)
	1858	Kessler and Markevich (2013)
	1867	Statisticheskii ... (1872)
	1868-1870	Statisticheskii ... (1877, 1879)
	1875	Statisticheskii ... (1883a)
	1880	Statisticheskii ... (1883b)
	1885	Statisticheskii ... (1890)
	1890	Statisticheskii ... (1895)
	1896	Statisticheskii ... (1898)
Deaths	1856	Statisticheskii ... (1858)
	1858	Kessler and Markevich (2013)
	1867	Statisticheskii ... (1872)
	1868-1870	Statisticheskii ... (1877, 1879)
	1875	Statisticheskii ... (1883a)
	1880	Statisticheskii ... (1883b)
	1885	Statisticheskii ... (1890)
	1890	Statisticheskii ... (1895)
	1896	Statisticheskii ... (1898)

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