

LABOR COERCION AND HUMAN CAPITAL-PROMOTING INSTITUTIONS: EVIDENCE FROM RUSSIA

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Why are some countries leaders, and others laggards, in the accumulation of human capital? Recent evidence indicates that land inequality and labor-repressive agriculture have been persistent obstacles to the establishment of human capital-promoting institutions such as mass elementary education. Landowners who rely on cheap, immobile farm labor have a strong incentive to oppose investment in schooling as a subsidy to footloose agricultural workers. In this paper, I show that such incentives can be dampened by legacies of the preindustrial economy. In Russia until 1861, serfs paid their obligations either as labor services or as quitrents in cash and kind. I exploit spatial variation in pre-emancipation serf obligations to estimate the effect of quitrents on human capital in 1911. Former quitrent areas had higher male and female literacy rates, school enrollments, and per capita public investment in village schools, after controlling for preexisting differences in human capital.

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Why are some countries leaders, and others laggards, in the accumulation of human capital? Recent scholarship on the emergence of modern economic growth stresses the contribution of human capital (Barro, 1991; Mankiw, Romer and Weil, 1992; Glaeser, La Porta, Lopez-de-Silanes and Shleifer, 2004; Becker, Hornung and Woessmann, 2011). This empirical growth literature underscores the importance of understanding how and when “human capital-promoting institutions,” such as free public schools and child labor regulation, are established, particularly when these threaten to erode the position of entrenched economic elites.¹ Why, in particular, was tax-financed public elementary education achieved on a nearly universal basis in Prussia, several of the smaller German states, the non-southern United States, and Canada by the 1850s, whereas other countries at comparable levels of development, notably England, had to wait an additional quarter century or more? Recent studies have called attention to a diverse array of explanatory variables, including democracy (Lindert, 2004; Ansell, 2010); fiscal and political decentralization (Goldin and Katz, 2008; Gallego, 2010) and inter-state military rivalry (Aghion, Persson and Rouzet, 2012).

Land inequality represents a particularly formidable obstacle to the establishment of human capital-promoting institutions. In part as a consequence of landed resistance to human capital accumulation, high levels of land inequality during industrialization appear to have adverse effects on long-run economic development, productivity, and inclusiveness (Engerman and Sokoloff, 1997, 2000; Deininger and Squire, 1998; Easterly, 2007; Ramcharan, 2010; Baten and Juif, 2014).² Simple growth models help to reveal the basis of landed opposition to human capital investment: in a dual-sector growth model where labor is the only mobile factor, for instance, productivity growth in the modern sector – the result of substituting either physical or human capital for labor – causes excess workers in the traditional (agricultural) sector to desert the land for work at higher

¹The label was coined by Galor, Moav and Vollrath (2009). I use it to refer to institutions and policies which create incentives and/or remove disincentives either for parents to ensure that their children obtain schooling, or for employers to provide training to their labor force. Restrictions on child labor, for instance, are human capital-promoting institutions insofar as they lower the opportunity cost of sending one’s children to school instead of to the factory (Doepke and Zilibotti, 2005).

²Land inequality may also delay the adoption of human capital-promoting institutions through various indirect pathways, such as by obstructing or subverting electoral democracy (Boix, 2003; Acemoglu and Robinson, 2006a; Ziblatt, 2008, 2009).

wages in urban manufacturing (Lewis, 1954; Kuznets, 1955; Fei and Ranis, 1997). Rural education may also give rise to learning-by-doing effects and other spillovers which raise agricultural productivity (Foster and Rosenzweig, 1995, 1996; Unger, 2005). Both factors drive up agricultural wages until they converge with the modern sector wage rate, eroding the net return to land as a result.³ Since the returns to land are larger when landownership is highly concentrated, human capital policies are particularly threatening to the landed in agrarian economies where the distribution of holdings is highly unequal (Galor and Moav, 2006; Galor, Moav and Vollrath, 2009).⁴

But do landowners always have these incentives to oppose public investment in human capital? More generally, do the incentives and constraints created by agrarian economic institutions intervene in the relationship between economic primitives, such as land/labor ratios, and human capital accumulation? Growth models of the type just described would seem to suggest that, even if the distribution of holdings is highly unequal, landed resistance to human capital accumulation may be muted when mass literacy does not threaten to empty the countryside of cheap agricultural labor and peasant tenants. Consequently, the degree to which land inequality is conducive to human capital formation, I argue, depends in part on two *institutional legacies* of the preindustrial agrarian economy: (1) the source from which landowners – and thus, ultimately, peasants – receive their incomes, and (2) the viability of rural institutions charged with regulating labor mobility.

Where large market-oriented estates worked by casual laborers or tenants predominate, the landed elite indeed has an overriding incentive to block any investment in rural education as a subsidy to footloose agricultural workers. Likewise, a “labor-repressive” elite which lives off land rents squeezed out of sharecroppers and tenants has a vital interest in keeping its labor force immobile and illiterate (Moore, 1966). One or the other

³Even holding the human capital stock constant, when technology is labor-saving labor scarcity is likely to stimulate innovation which increases the productivity, though not necessarily the profitability, of traditional agriculture (Acemoglu, 2010; Hornbeck and Naidu, 2014).

⁴Data on land inequality in Russia before emancipation are not available. Lindert and Nafziger (2014) show that around 1904 inequality in private landownership – that is, excluding the allotment lands held in communal tenure by peasant communities – was high throughout the 50 provinces of European Russia. They estimate land Ginis of 0.79 and 0.85 for the 25% and 75% quantile provinces respectively.

of these situations has generally obtained in the small set of cases – such as the U.S. South, Prussia, England, and some Latin American latifundia economies – which originally informed the now conventional view that land inequality is at odds with human capital formation. On the other hand, when landowners receive rents from peasants who are employed primarily in nonagricultural pursuits, the need to keep the peasantry immobile must be weighed against the incentive to promote peasant participation in rural cottage industries and in urban-based services and manufacturing. Indeed, the landed may have incentives to foster access to literacy, numeracy, and other basic skills if these facilitate outwork and enable peasant households to insure themselves against adverse shocks by pooling agricultural and nonagricultural earnings. Landed resistance to human capital accumulation should be further attenuated when traditional rural institutions, such as communal land tenure and collective responsibility for taxes and obligations, survive and help to regulate peasant labor mobility. The upshot is that land inequality ironically may be a more formidable barrier to human capital accumulation when the agrarian elite are progressive, market-oriented “improving landlords” than when they are traditional parasitic absentees, content to sit back and collect a rent.

I test these conjectures using data from late imperial Russia. Russia witnessed rapid, sustained growth of public investment in rural education between about 1890 and 1913.⁵ Partly as a result of these investments, the proportion of literates in the Russian Empire rose from 21% in 1897 to about 40% on the eve of the First World War (Rashin, 1951). Among Russians who were between 12 and 16 years of age in 1920 – the last generation of children educated in the prerevolutionary schools – 71% of boys and 52% of girls were literate (*Gramotnost' v Rossii*, 1922).

Yet the growth of peasant literacy, elementary enrollments, and investment in rural education was extremely uneven – across the Russian Empire writ large, but also, in many cases, even across neighboring districts belonging to the same province. What can account for such variation?

Until serf emancipation in 1861, two types of seignorial obligations predominated in different parts of the Russian Empire. Serfs paid their obligations either as labor ser-

⁵The number of *zemstvo* (local public works council) elementary schools in rural areas, for instance, more than tripled between 1894 and 1914, from 13,129 to 44,879 (Brooks, 1985, 38).

vices (*barshchina*) on the lord's demesne, or as cash quitrents (*obrok*). The crux of my argument is that, although until 1861 serfowners were free to set serf obligation schedules, whichever regime prevailed locally just before emancipation became “locked-in” during subsequent decades due to persistence of the landed nobility's *de facto* power (Acemoglu and Robinson, 2006a,b). Persistence of agrarian class relations based on labor services and rents, in turn, created starkly different incentives for the landed nobility after emancipation. Landowners in former labor service areas either consolidated their holdings into market-oriented estates, or else leased their lands to the peasantry and continued to live as absentees; in either case they sought to maintain a pool of cheap, immobile farm labor. Landed nobles in quitrent areas, in contrast, had incentives to facilitate peasant participation in urban labor markets and other nonagricultural pursuits in which returns to literacy were large, since these activities increased the peasantry's capacity to pay taxes and rents. As such, in the long run we should expect to find higher levels of human capital, as well as more intensive public investment in rural human capital formation, in areas where rents predominated before emancipation.

Findings presented in this paper, which introduces a new district-level dataset of serf obligations and human capital outcomes spanning 45 provinces in the European part of the Russian Empire, are consistent with my hypothesis that local variation in serf obligations shaped post-emancipation patterns of human capital accumulation. Spatial variation in the proportion of serfs obligated for quitrents only in 1858 (depicted in figure 1a) predicts rural literacy rates in 1897, as well as rural elementary enrollment rates, per capita public expenditure, and local expenditure on rural primary schools in 1911. Least squares estimates are robust to conditioning on geographic, economic, and demographic covariates, as well as unobserved influences on the supply of education (controlled using a lagged outcome variable). Two-Stage Least Squares (2SLS) estimates which are identified from cross-district variation in the environmental suitability for cereal cultivation suggest that the effect of serf obligation systems is causal.⁶

To preview my main results, the 2SLS specifications imply that a one standard deviation increase in the prevalence of quitrents in 1858 (representing about 30% of a district's

⁶This instrumental variables strategy also enables me to correct for possible bias owing to error in the measurement of peasant obligations.

serf population) increases the rural literacy rate in 1897 by 8.1% for males and 4.5% for females, the female rural elementary enrollment rate by 4.7%, and local public school expenditure by 8 kopeks per capita. These estimates are generally larger than OLS estimates, and are of sufficient magnitude to imply that the prevalence of quitrents in some parts of European Russia can account for a substantial share of Russia's initial accumulation of human capital. These findings, I argue, highlight the utility of a class structural perspective on human capital accumulation, in which the form of "surplus extraction relations" intervenes in the relationship between land inequality and preferences over human capital investment (Moore, 1966; Brenner, 1976, 1986).

The paper is divided into nine parts. Section 1 offers an historical primer on Russian serfdom and contrasts the distinctive agrarian political economies associated with peasant labor services and quitrents. Section 2 elaborates my hypotheses and briefly surveys the evidence concerning the lock-in of agrarian institutions in the decades after emancipation of the serfs in 1861. Section 3 describes the data. Section 4 introduces the first of two identification strategies which I use to estimate the causal effect of serf obligations in 1858 on human capital accumulation half a century later, and section 5 reports the results of these lagged dependent variable (LDV) specifications. Section 6 then uses evidence from case studies to dismiss two alternative interpretations of my baseline LDV results. Section 7 articulates and defends my second identification strategy, an instrumental variables approach in which serf obligation effects are identified from cross-district variation in the environmental suitability for cereal cultivation, and part 8 conducts a simple falsification test to evaluate the plausibility of the exclusion restriction. Section 9 concludes.

1 Origins and development of obligation systems

This section, along with the next, prepares the ground for my empirical analysis by providing an historical primer on Russian serfdom. Specifically, in this section I address two questions. First, what were *obrok* and *barshchina*, and how did the distribution of serf obligations depicted in figure 1a emerge? Second, what were the distinctive features

of the agrarian political economies associated with rents and with labor services respectively? Part 2 then explains why these institutions became “locked in” after emancipation in 1861 and elaborates my hypotheses about the relationship between obligation regimes and elite incentives to invest in the peasantry’s human capital.

1.1 Origins

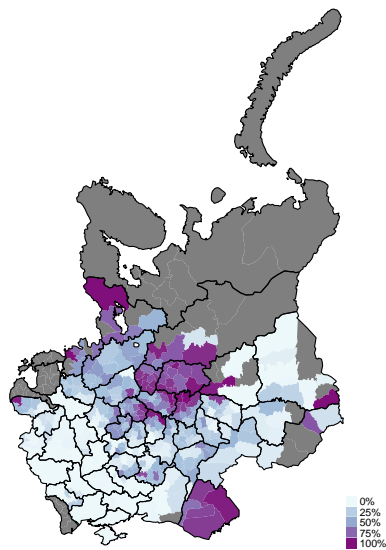
Labor services and rents paid in cash or kind represented the two principal forms of seigniorial obligations dating back to the establishment of serfdom in Russia during the first half of the 17th century. By the early 19th century, labor services on the lord’s demesne – as distinct from the “natural” obligations (*natural’nye povinnosti*) demanded by the state, such as carting, road maintenance, and postal services – were provided almost exclusively by seigniorial peasants (*pomeshchich’i krest’iane*), that is, rural dwellers legally bound to the owners of landed estates.⁷ The vast majority of state peasants, who accounted for 46.8% of the peasant population in 1858, paid a cash rent to the state, as did most appanage peasants (*udel’nye krest’iane*, 6.7% of the total) living on crown lands (Blum, 1961).⁸ As such, labor services were all but unknown in frontier districts, including parts of Arkhangel, Vologda, Viatka, and Orenburg, where serfdom had never put down deep roots.

Although the relative prevalence of labor services and quitrents varied dramatically across European Russia, by the 1840s and 1850s the level of each type of obligation had become relatively uniform across provinces, fixed by convention although not by law or contract.⁹ *Barshchina* typically required adult serfs of both sexes to work three days a week for the lord – a convention that was given official sanction by Emperor Paul I in a 1797 edict but never mandated – either farming the demesne or else working in nona-

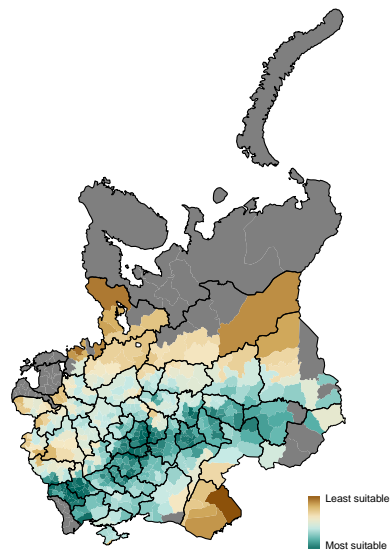
⁷Throughout this paper I refer to these state obligations as *corvée*, reserving the term labor services to denote *barshchina* more narrowly.

⁸Throughout I use the term serfs to refer exclusively to seigniorial peasants. Unlike serfs, state peasants were administered by an agency of the central government, the Ministry of State Domains, created in 1837 and headed for its first eighteen years by the energetic reformer Count P. D. Kiselev. Likewise, crown or appanage peasants – those owned by the imperial family – were overseen by the Department of Appanages.

⁹Except in the former Polish provinces, on which see the discussion in part 7.1.



(a) Quitrent obligations in 1858



(b) Environmental suitability

gricultural enterprises located on the estate (Blum, 1961; Moon, 1999). The obligation to work in nonagricultural enterprises owned by the lord was widespread, even in areas where agriculture was profitable thanks to favorable environmental conditions: estate proprietors had strong incentives to utilize serf labor as fully as possible, including in cottage industries, factories, and ancillary labor services such as carting, during the long off-season (Rudolph, 1985).

Quitrent obligations likewise remained entirely unregulated down to the moment of emancipation. Still, by about 1860 the average *obrok* per male peasant soul varied across provinces within a quite narrow band, ranging from 13.8 silver rubles for year in Perm' province (*guberniia*, pl. *gubernii*) and 17.5 in the northern forest province of Olonets to 30 rubles in Kherson and 30.3 in St. Petersburg (Mironov, 2012). More concretely, on the large estate of Voshchazhnikovo in Iaroslav *guberniia*, owned by the elite Sheremet'ev clan, the average annual rent in cash was fixed at 15 rubles throughout much of the early nineteenth century, with some ancillary obligations to be paid in kind (Dennison, 2011).

Why were rents predominant among the serf population in some parts of Russia,

and labor services in others? As depicted in figures 1a and 1b, on the eve of emancipation in 1858 the distinction between labor service and quitrent areas maps closely onto the natural environmental divide between the infertile, northern forest zone (with a few noncontiguous areas of high quitrent concentration elsewhere, such as in the arid Lower Volga basin) and the highly productive blacksoil steppe. This pattern, however, was actually a late development in the serf economy (Shepukova, 1966; Fedorov, 1974; Tikhonov, 1974). Until the 18th century, the majority of serfs in the Central Industrial region and the Lakes were on *barshchina*, with the major shift to cash rents in these areas taking place between 1700 and 1780. Thus fewer than 20% of serf households in the Central Industrial region were obligated for quitrents during the decade of the 1700s, but by the 1780s, 63% of serfs in the region paid rents either exclusively or with some ancillary nonagricultural labor services (Melton, 1987).

The shift to an *obrok*-based system intensified in the decades leading up to emancipation, until by 1858 more than 80% of serfs in Iaroslav, Kostroma, and parts of Nizhnii Novgorod and Vladimir provinces paid their obligations in cash. The switch to quitrents also made some progress in the Central Agricultural region, particularly in Kaluga and the northern districts of Riazan', Tula, and Tambov, close to the Moscow market. But even in these areas, the large-scale demesne farming which was in the process of being abandoned had only "developed relatively late" in connection with the growth of large interregional grain markets (Melton, 1987, 92).

What happened between 1700 and 1860, briefly, was the rise of an interregional division of labor within the serf economy, as the central and southern provinces grew into major grain surplus centers and as food prices and consumer demand increased in the more densely populated and urbanized north. During this period, high land/labor ratios and favorable environmental conditions for cereals tended to give rise to market-oriented demesne agriculture employing peasants on *barshchina*, whereas in areas of higher population density, and particularly those with poor soil and climate, serf-owners preferred to shift the risks of agriculture onto their peasants by breaking up the demesne, collecting rents, and encouraging their serfs to seek out side earnings in trade, cottage industry, and urban-based services and manufacturing. As one scholar concludes, "the proprietor often preferred to place the risk on the peasant rather than himself by sending

the peasant out to work his own poor land or to work in cottage industry and manufacture while the landlord could theoretically sit back and collect the *obrok* payment” (Rudolph, 1985, 57).

Despite this regional differentiation, it is important to emphasize that serf-owners retained full discretion in choosing the form and the level of obligations; they could, and did, switch their serfs from one obligation system to another as desired. Reversals of the shift from labor services to rents, even in long-settled areas, were far from unknown (Melton, 1987). In Tula, for instance, the serfs on Prince Iusupov’s steppe estates began paying quitrents around 1810, as population growth diminished the amount of land available for demesne agriculture. Reclamation of wastelands during the 1830s, however, brought new arable into the demesne and prompted the estate administration to switch most peasants back to labor services. As the example suggests, labor services and other features of the agrarian political economy could occur in various combinations, depending on district-level conditions and the proclivities of individual serf-owners. I exploit this idiosyncratic variation to identify the causal effect of serf obligation systems on subsequent human capital accumulation.

1.2 Development

Two features of the agrarian political economy in quitrent areas are relevant to my argument: first, the growth of rural crafts and cottage industries beginning during the 17th century, and second, the evolution of the peasant commune (the *mir* or *obshchina*) into an effective institution for regulating peasant labor migration.

Economic historians have long called attention to the early development, often under noble patronage, of rural manufactures in Russia’s Central Industrial region, highlighting in particular the concentration of handicrafts and textile production in “industrial settlements” owing to the unusual pairing of proto-industrialization and bonded labor (Vodarskii, 1972; Fedorov, 1974; Rudolph, 1985). The Soviet economic historian Murav’eva (1971) claims that there were more than 400 industrial villages in the Moscow region already in the 17th century. By the 1850s, the Central Industrial region had evolved three distinct proto-industrial clusters: the Moscow textile area, the Vladimir–

Ivanovo–Kostroma textile area, and the tanning and metalworking cluster centered on Bogorodsk district in Nizhnii Novgorod (Fedorov, 1974). As figure 1a suggests, it is in these same areas where by 1858 most labor obligations had been commuted to cash rents. Rural cottage industries “were strongly promoted by the proprietors of estates because the level of *obrok* payments was rising” (Rudolph, 1985, 58–59).

How did this spatial pattern of proto-industrial development shape the incentives of landed elites to supply rural education? In Russia, restrictions on whole-family peasant migration remained stringent even after emancipation in 1861. As a result of these barriers to factor mobility, but also endogenously due to increasing returns, to a considerable degree post-emancipation industrial development witnessed continued growth of industrial villages rather than a sudden shift to urban centers (Rudolph, 1985). This pattern helped to constrain spatial differentiation between modern and traditional sectors; entering the modern sector did not necessarily mean leaving the land. Consequently, in contrast to their peers in parts of European Russia which had not seen much proto-industrial development before emancipation, noble landlords in quitrent areas were after 1861 well positioned to continue patronizing rural cottage industries and encouraging temporary labor migration without incurring any serious risk of permanent exodus from the countryside.

Large-scale labor migration for nonagricultural earnings (called *otkhod*) was a second distinctive feature of the quitrent economy. In the first decade after emancipation, 1861–1870, on average 1.23 million passports were issued annually for labor migration within European Russia, most of them in core quitrent areas around Moscow, Vladimir, Kostroma, Nizhnii Novgorod, and Riazan’ (Mints, 1925). Seasonal labor migration expanded rapidly in the post-emancipation decades as urban demand for industrial and service labor increased, to such an extent that, by 1900, the number of passports issued each year was equal to 25% of the rural population in many districts in the Central Industrial region.¹⁰ Labor migrants preserved strong ties with the village and, indeed,

¹⁰Most of the historical scholarship focuses on the phenomenon of “peasant-workers,” that is, peasants employed in urban manufacturing. But service sector work, which was even more likely than factory employment to require literacy, was actually most sought after by peasant migrants due to the good working conditions (Brooks, 1985).

could be compelled to return home at harvest time, when demand for labor was at its peak (Burds, 1998). In the meantime, labor migrants helped to diversify the peasant household economy by earning incomes from nonagricultural sources, insuring their families – and their landlords – against the most dire consequences of adverse shocks to crop yields and prices.

The vitality of traditional rural institutions, in particular the village commune, was the *sine qua non* of the quitrent economy's continued development after emancipation. In the decades after 1861, peasant communes, landowners, urban employers, and state officials evolved an elaborate set of institutions to regulate and control the millions of peasant labor migrants (Burds, 1998). The commune prevented permanent resettlement from village to city – households could not leave the commune without the permission of the communal assembly, and were barred from alienating or abandoning their land allotments – but, at the same time, the institution was sufficiently flexible to manage labor migration on a huge scale (Gregory, 1994; Borodkin, Granville and Leonard, 2008). One scholar concludes: “While the typical *obshchina*...might have tolerated and even encouraged temporary ‘migration for side-earnings’ as a means of sustaining the fiscal and institutional vitality of the village, there were formidable constraints against the permanent resettlement of productive members away from the village community” (Burds, 1998, 15). After emancipation, as a result, landed elites in former quitrent areas found that it was possible to have it all: they could both charge high rents for peasant tenants and seek to promote the peasantry's capacity to pay rents and taxes by fostering literacy, without much risk of emptying the countryside.

2 Institutional lock-in after emancipation

My core contention is that, whereas serfowners had enjoyed nearly unlimited discretion to choose the form and level of peasant obligations, after emancipation, with the nobility's loss of personal control over peasant labor, whichever obligation regime prevailed in a locality just before 1861 was likely to become “locked-in” (Acemoglu and Robinson, 2006a,b). Having lost the *de jure* power allocated by now-defunct rural institutions,

the landed nobility used its *de facto* power – its wealth, influence, and capacity for collective action – to establish informal institutions that mimicked the functions of the coercively abolished formal institution, serfdom. Persistence of agrarian class relations based on rents and labor services, in turn, created starkly different incentives for the landed nobility to meet peasant demand for education. This section briefly discusses the two dimensions of institutional persistence that are central to my argument: sources of landlord income and the evolution of the peasant commune.

The abolition of serfdom left most of the arable, and nearly all pasture and forest, in the hands of the nobility. As such, the terms of the emancipation settlement, together with rapid peasant population growth after 1861, gave rise to an intense land hunger among the former serfs.¹¹ This had two consequences. First, persistence of “hidden unemployment” in rural areas discouraged the adoption of labor-saving, capital-intensive innovations by those members of the landed nobility who continued to farm their land. Second, peasant demand for the lease and purchase of noble land made it more profitable for large landowners in most parts of Russia to lease their land instead of farming it. By 1900, more than two-thirds of the nobility’s arable land was leased to peasant cultivators. To be sure, agricultural product and factor markets were highly developed by the late nineteenth century (Koval’chenko and Milov, 1974), and “manorial capitalism,” with market-oriented estates employing sharecroppers and casual laborers, flourished in some parts of the Central Agricultural region, the Baltic provinces, and the Middle Volga (Koval’chenko, Selunskaja and Litvakov, 1982). But most proprietors, north and south, continued to receive their incomes from rents paid by peasant tenants.

In the former labor service areas, the landowner’s overriding interest was in keeping agricultural wages low and rents high. This, in turn, meant keeping the rural population immobile, short of land, and dependent on agricultural incomes. The political economy of former *barshchina* districts after emancipation, marked by intensification of traditional forms of exploitation and by heated redistributive conflict over land, is thus similar to the ideal-type scenario of “labor-repressive” agriculture (Moore, 1966). Together with the fact that opportunities for labor migration and outwork were far less

¹¹Russia’s rural population increased by 17% between 1885–89 and 1897–1901 alone (Gregory, 1994).

common in former labor service centers, and that, instead, whole-family migration to areas with higher land/labor ratios predominated, the landed were faced with a clear economic incentive to resist any investment in education as a subsidy to footloose agricultural workers. Noble landowners in former quitrent areas, while also interested in keeping rents high, had a countervailing incentive to encourage peasant participation in urban labor markets and other nonagricultural pursuits in which returns to literacy were large. In particular, since the earnings with which peasants paid their rents and taxes to the gentry-dominated district institutions of local self-government were derived mainly from nonagricultural sources, noble landowners were able to capture a substantial part of the peasant's private return to education. The presence of established institutions for regulating labor mobility, meanwhile, allowed large landowners to continue to exercise control over peasant movement (Burds, 1998).

In short, the institutions that had developed to regulate peasant labor in the quitrent economy continued to shape the incentives of large landowners in the post-emancipation period. The continued vitality of traditional rural institutions in areas where quitrent had predominated before 1861 palliated the nobility's fear of losing its labor supply. The emergence of large urban markets for specialized agricultural products – in particular, labor-intensive dairy and livestock farming – in the Central Industrial region also allowed landlords to benefit from human capital spillovers on agricultural productivity. Indeed, much of the contemporary public debate over rural education focused precisely on such human capital spillovers, in particular what would now be called learning-by-doing effects (Foster and Rosenzweig, 1995, 1996). As the labor economist I. I. Ianzhul, one of Russia's foremost advocates of universal primary education, once asked rhetorically: "How will the news about an improvement reach our peasant or rural craftsman while the basic means of communication and transfer of ideas – literacy – is lacking?" (Ianzhul, Chuprov and Ianzhul, 1896, 50).

3 Data and measurement

In this section I describe my main variables of interest: peasant obligations around 1858, and an array of human capital outcomes both on the eve of emancipation and half a century later.

3.1 Peasant obligations

The data on serf obligations which I use in this paper were collected under the auspices of the Editing Commissions (*Redaktsionnye Komissii*) in 1858–1860, for the purpose of informing the commission’s debates as it prepared the emancipation legislation. Early in 1858, the central commission in St. Petersburg requested that its provincial committees report the total number of serfs living in each district, distinguishing in their counts among three categories of peasants: (1) household serfs (*dvorovye liudi*); (2) field serfs obligated to provide labor services or on mixed obligations (*izdel’nye krest’iane*), and (3) field serfs obligated exclusively for quitrents in cash or kind (*obrochnye krest’iane*). I use the resulting totals, reported by Skrebitskii (1862/1868, v. 3) to construct my main causal variable of interest, the estimated proportion of a district’s serf households which were obligated for quitrents only in 1858.¹²

Figure 1a depicts the estimated prevalence of quitrents in 443 districts. Of the 50 provinces typically classified as belonging to European Russia, only five lack representation in my dataset: Bessarabia *oblast’*, Arkhangel, and the three Baltic provinces, where serfdom had been abolished between 1816 and 1819. Data are also missing for a handful of localities in the remaining 45 provinces, in some cases due to the district committee’s failure to report its findings to St. Petersburg on time and in others to the absence of any serf population in the district.¹³

The serf obligations data admit measurement error from at least two sources. First, the Land Department (*Zemskii otdel*) of the tsarist Ministry of Internal Affairs (MVD),

¹²More accurately, the units of measurement are peasant *tiagla*, work teams constituted by two able-bodied adults, most often a husband and wife, along with draft animals. I refer to serf households rather than work teams purely for convenience.

¹³Several outlying districts in Olonets, Vologda, Viatka, Perm’, and Orenburg provinces are not represented in my dataset for this reason.

which tabulated the district-level counts using data provided by the provincial committees, did not distinguish between households which were obligated for labor services exclusively and those which paid their obligations partly in labor and partly in rent. Households belonging to the latter category are counted as *izdel'nye* even if they paid the majority of their obligations as a cash rent. By the 1850s, mixed obligations of quitrent with some ancillary labor services, often in nonagricultural enterprises on the lord's estate, were common in some places, particularly the Central Industrial region stretching north and east from Moscow (Fedorov, 1974). As such, my estimates of quitrent prevalence may be biased downward in these areas. This will result in OLS estimates being subject to attenuation bias. Second, in calculating district totals, the Land Department apparently excluded all households belonging to proprietors who failed to indicate the total number of work teams on the estate, which may also induce bias from measurement error (Shepukova, 1966, 407). A comparison of the Land Department's calculations with population totals produced concurrently for the 1858 tax census suggests that the number of households excluded as a result must be quite small.

3.2 Human capital outcomes, 1897 and 1911

I examine the effects of serf obligation regimes on three categories of post-emancipation human capital outcomes, including measures of human capital accumulation as well as ongoing investment in human capital formation: (1) rural literacy rates in 1897; (2) rural elementary enrollment rates, and (3) public expenditure on rural primary schools, both in 1911.

As the structure of serf obligations may have heterogeneous effects by gender, whenever possible I examine human capital outcomes separately for men and women. Data on rural literacy rates are taken from the provincial volumes of the 1897 population census.¹⁴ Literacy is understood as the ability to read (but not necessarily write) one's native language. It is worth emphasizing that even as late as 1897, literacy was the exception rather than the norm among rural dwellers in European Russia: on average,

¹⁴More accurately, the 1897 census volumes report the literacy rate among members of "rural estates" or *gramotnye litsa sel'skogo sostoianiia*, including, obviously, peasants, but also members of various other social estates, such as Cossacks and foreign colonists.

only 27.5% of men and 7.6% of women in rural areas were literate. Most of the progress in rural literacy that occurred under the tsarist regime was actually concentrated in the two decades immediately prior to 1917, so the 1897 figures capture the effects, if any, of serf obligation regimes on human capital outcomes at a relatively early stage.

I am able to construct district-level estimates of rural elementary enrollment rates, separately for boys and girls, for 1879, 1894, and 1911. The outcome of interest here is the estimated primary enrollment ratio among school-aged (7–14 years) children. For 1879 I use MVD estimates of male and female enrollment rates, which are constructed using contemporary age structure data. Estimates for 1894 are reported in a study of primary education conducted by the Imperial Free Economic Society, Russia's most highly esteemed learned society, during the 1890s (*Nachal'noe narodnoe obrazovanie v Rossii, 1900*). Finally, to estimate rural elementary enrollment rates in 1911, I use enrollment data reported in the school census carried out at the beginning of that year.¹⁵

I also use data from the 1911 school census to construct estimates of per capita public expenditure on rural primary schools in 1911. Importantly, this allows me to estimate the effect of serf obligation systems both on public primary school expenditure from all sources, including the central government, communes, urban employers, and school fees, and on local public expenditure in particular – that is, allocations financed by local taxes, primarily property taxes levied on land and real estate (*zemskie sbory i povinnosti*). In the 34 provinces where elective institutions of local self-government had been established by 1911, this latter variable represents *zemstvo* budget allocations to rural schools.¹⁶ Because most *zemstvo* assemblies were “family circles” dominated by close-knit networks of landed gentry, this measure of local public expenditure directly captures the nobility's willingness to invest in the human capital of the peasantry.¹⁷ In

¹⁵*Odnodnevnaia perepis' nachal'nykh shkol v imperii, proizvedennaia 18 ianvaria 1911 goda (1913/1916)*. Contemporaneous age structure data for 1911 are not available, so I use data from the 1897 population census. The resulting estimates are probably subject to some degree of measurement error, but nonetheless fall in line with expectations: the gross male enrollment rate in the mean district rises from 12.8% in 1879 to 24.1% in 1894 and 45.4% in 1911, and the mean gross enrollment rate for girls increases from 2.1% in 1879 to 5.2% in 1894 and 18.4% in 1911.

¹⁶All but one of these 34 provinces, Bessarabia, are represented in my dataset.

¹⁷In the district assemblies elected in 1890, for instance, nobles held 55.2% of all seats, although they made up 1% of the population. In 1903, 71.9% of all *zemstvo* board members were nobles (Nafziger, 2011).

both *zemstvo* and non-*zemstvo* districts, though, the landed effectively possessed veto power over the development of rural education. For instance, under the provisions of the 1874 primary school law, which remained in effect until 1917, district and provincial marshals of nobility served *ex officio* as chairmen of their respective school boards.

3.3 Rural schools before emancipation

Naive estimates of serf obligation effects on human capital are likely to be contaminated by omitted variable bias even in the presence of the most exhaustive conditioning set. One possible source of confounding is unobserved heterogeneity across serf estates or their proprietors: perhaps well educated and liberal-minded members of the nobility, nobles in possession of large estates, or nobles whose estate economies are characterized by a high degree of market integration, are more likely than others both to commute labor obligations to rents and, after emancipation, to recognize the economic value of mass education. Here I can only construct proxies for such omitted influences. I seek to bolster the internal validity of my estimates, however, by leveraging several different identification strategies whose validity turns on the weaker assumption of “selection on unobservables” (Altonji, Elder and Taber, 2005).

One approach is to control for a lagged outcome variable, which has the effect of capturing unobserved influences on the supply of rural education before emancipation. Specifically, I utilize a proxy for pre-emancipation human capital: the number of rural primary schools per 10,000 people operating in a district in 1856, which I calculate on the basis of retrospective data from a study of elementary education carried out by the Imperial Free Economic Society during the early 1890s (the same study referred to in part 3.1). Although it would be ideal to have a true lagged outcome, reliable pre-emancipation data on literacy rates, elementary enrollments and school expenditures at the district level do not exist.¹⁸ Still, the 1856 schools variable is an excellent stand-in

¹⁸On the basis of evidence from six provinces (Moscow, Pskov, Saratov, Simbirsk, Tula, and Vologda) in the 1860s, Mironov (1991) estimates that 5% of male serfs, and 9% of male state and appanage peasants, were literate, where literacy is defined as the ability to read. Retrospective analysis of age cohort data from the 1897 population census suggests a higher estimate – literates as 12% of rural dwellers of both sexes – but, on the assumption that literacy is positively correlated with income and health, this is probably

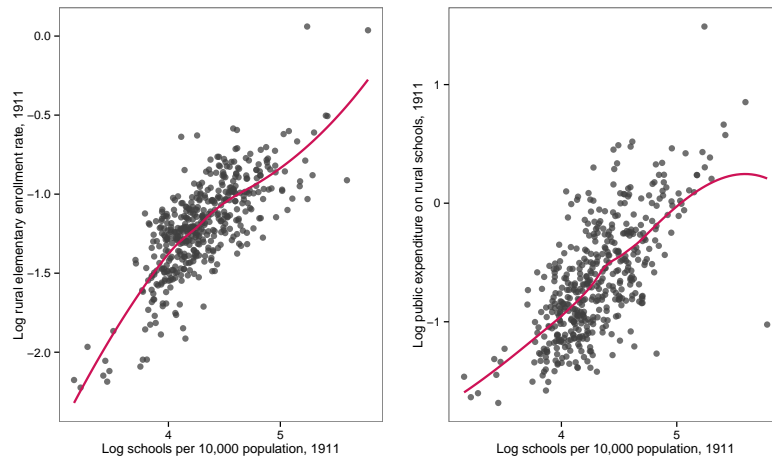


Figure 2: Human capital outcomes and rural schools per 10,000 people in 1911

for human capital investment on the eve of emancipation. As shown in figure 2, the number of rural primary schools per 10,000 people is very strongly correlated with rural elementary enrollment rates and with public expenditure on rural schools at a later date, 1911, for which both variables are available.

Who had access to rural schools in pre-emancipation Russia? The short answer is almost no one. My 1856 schools variable captures the four main categories of public elementary schools operating in rural Russia at the time: (1) Russian Orthodox parish schools (*tserkovno-prikhodskie shkoly*); (2) schools maintained by officially recognized non-Orthodox communities, that is, Lutherans, Roman Catholics, Jews, and Muslims; (3) secular schools for the state peasantry, and (4) secular schools administered by the Ministry of Public Instruction (MNP). Ministry schools, most of them catering to the towns, formed by far the largest category: of the 400,000 students enrolled in elementary schools of all types throughout Russia in 1856, more than 75% were in urban schools operated by the MNP (Rashin, 1951). Parish schools, administered by the Holy Synod from 1802, were few in number until the 1880s, when the government began promoting them aggressively as a counterweight to the politically suspect secular zemstvo schools.

contaminated by survivor bias.

Non-Orthodox schools were open only to members of their respective confessions. As for state peasant schools, the Ministry of State Domains began building them systematically only in 1842 in connection with Count Kiselev's reforms intended to improve the welfare of the state peasantry. Between 1842 and 1859 the number of schools for state peasants increased from 226 to 1,799, and enrollments rose from 13,800 to 76,800 – impressive, but still an absurdly small total considering that the state peasant population of European Russia numbered 23 million in 1858 (Rashin, 1951, 55).

4 Baseline empirical strategy

I use two strategies to identify and estimate the causal effect of serf obligation systems on post-emancipation human capital. As an empirical baseline, in this section I estimate quitrent effects using Ordinary Least Squares (OLS) with a lagged outcome variable to capture unobserved influences on the pre-emancipation supply of schooling. Specifically, as described above, since district-level data on literacy, elementary enrollment rates, and public investment in primary schools in 1858 are not available, I utilize a proxy for the underlying outcome: the number of rural primary schools per 10,000 residents in 1856.

The validity of these OLS estimates rests on the assumption that selection in treatment assignment operates on time-invariant unobservables at the district level. If the set of unmeasured influences on the supply of rural education varies substantially over time, these unobservables may not be fully absorbed into the lagged outcome proxy and, as a consequence, my estimates will lack a causal interpretation. I develop an instrumental variables approach in section 7 with the aim of weakening this identification assumption. Even if the assumption fails, though, the 1856 schools variable remains a useful stand-in for any unmeasured determinants of pre-emancipation human capital accumulation. Adjusting for pre-emancipation differences in access to schooling bolsters the internal validity of my estimates in two ways. First, parish and ministry schools established before 1861 might have been built disproportionately in areas with high latent (that is, unobserved) demand for literacy, and these same localities might continue

to generate higher demand for rural education after emancipation. Least squares estimates of *obrok* effects would then be biased if latent demand for schooling were correlated with the prevalence of quitrents locally in 1858. Second, even if parish and ministry schools were allocated before 1861 without consideration of local demand, the very fact of receiving a school might generate additional demand by giving either serf-owners or their peasants newfound appreciation for the value of schooling.

My baseline specification, which I estimate using either OLS or WLS (with 1858 serf population share weights), can be written as follows:

$$Y_i = \alpha_j + \beta R_i + \delta S_{1856,i} + \lambda X_i + \varepsilon_i \quad (1)$$

where the subscripts $i = 1, \dots, 443$ and $j = 1, \dots, 45$ index districts and provinces respectively.¹⁹

The main right-hand-side variable of interest is R_i , which is the estimated proportion of serfs in district i who were obligated for quitrents only in 1858. If selection on time-invariant unobservables holds, then β identifies the regression-adjusted mean effect, on some human capital outcome of interest, of a unit shift in the proportion of landowner serfs obligated for quitrents only, that is, the effect of moving from a district in which all serfs are obligated to perform labor services to a district in which all labor obligations have been commuted to rents.

X_i contains district-level covariates described below. The α_j are *guberniia* fixed effects included in some specifications to remove province-specific influences, such as the different educational policies pursued by provincial authorities after emancipation. Finally, ε_i is a disturbance term which captures all omitted influences, including any deviations from linearity. To correct for dependence in the error structure among districts located within the same province, in all specifications below I report heteroskedasticity consistent standard errors clustered at the 1911 province level. As such, the errors are typically estimated using a total of 45 clusters.²⁰

¹⁹ Although several of my outcomes of interest are expressed as proportions, I use least squares estimators to facilitate comparison with 2SLS estimates reported in 7.2.

²⁰ At the provincial level, the 1858 and 1911 administrative divisions are largely the same, with one major exception: in 1865 Orenburg province was split in two, creating a new province, Ufa, along with a

The particular set of district-level covariates included in X_i varies across different specifications of (1). In the most basic specifications, I include only the following time-invariant geographic covariates (in addition to the number of village primary schools per 10,000 rural population in 1856): (1) an indicator for whether the district has direct access to either Baltic or Black Sea ports; (2) an indicator for whether the district has access to navigable waterways; (3) an indicator for the district within each province that contains the regional administrative center (the *gubernskii* or *oblastnoi gorod*) as of 1911; (4) the log of district area in square kilometers; (5) the ruggedness of district terrain, as measured by the standard deviation of terrain slope; the district's (6) centroid latitude and (7) longitude, and (8–9) their squared terms.²¹ Including latitude and longitude allows me to control flexibly for any spatial correlation in treatment or outcomes. Access to ports, log area, and ruggedness are proxies for labor market access, which may shape peasant incentives to obtain schooling. The administrative center dummy accounts for possible substitution between urban and rural public investment in human capital. To evaluate the robustness of my baseline estimates, I introduce additional economic and demographic controls after presenting simple OLS results in the next section.

5 OLS estimates of serf obligation effects

Figure 4 depicts the bivariate relationship between the local prevalence of quitrents in 1858 and each of my four principal outcomes of interest: (1) the rural literacy rate in 1897; (2) the estimated rural elementary enrollment rate for school-age children in 1911, where school age is taken to be ages 7–14; (3) total public expenditure (in log nominal rubles per capita) on rural primary schools in 1911, and (4) per capita expenditure on rural primary schools from district taxes on land and real estate (*zemskie sbory i povinnosti*) in 1911.²² A glance at the loess regression fit to the data in each panel suggests that the

rump Orenburg. Using the boundaries from the later period increases the number of clusters from 44 to 45.

²¹All distance and area calculations were performed using the *geosphere* package in R version 3.1.0.

²²In the 34 provinces where elected organs of district self-government were established between 1864 and 1875, these *zemstvo* authorities set land tax rates and carried out property assessments. As a result of overrepresentation of the landed nobility in the assemblies, peasant allotments were usually taxed at

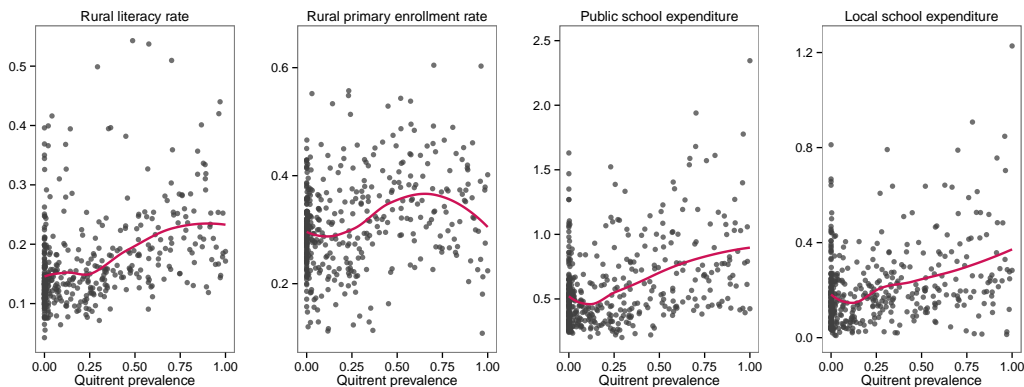


Figure 3: Bivariate relationship between quitrents and human capital outcomes

relationship between quitrent prevalence and human capital accumulation is positive and approximately linear, with the exception of the male elementary enrollment rate where there is some evidence of nonlinearity. The OLS “within” estimate of the quitrent effect in each of these four specifications is significant at the 5% level after adjusting for within-province clustering.

These bivariate relationships, of course, are only partial correlations and might be confounded by any number of omitted influences. Parts 5.1–5.3 below introduce the LDV identification strategy discussed in the previous section by including the 1856 schools variable, along with the “baseline” geographic covariates described above, in OLS and WLS specifications with and without province fixed effects.

These next three sections also probe the robustness of my estimates of serf obligation effects to two additional sets of controls: religious demography and local economic conditions on the eve of emancipation. Specifically, I control for the following socio-economic covariates: the number of (1) horses and (2) cattle per capita in the district; (3) rural population density in people per square kilometer; (4) the share of district population living in urban areas, and (5) the log of the district’s urban market potential. Urbanization and urban potential capture the extent to which a district had access to

substantially higher rates than were private holdings. Manning (1982) estimates that nobles paid only 11% of the zemstvo tax bill, whereas the peasantry paid two-thirds of zemstvo taxes.

urban product and labor markets in the initial post-emancipation period, thereby accounting for differential returns to schooling. My measure of urban potential is drawn from the empirical economic geography literature (Hanson, 2005; Amiti and Cameron, 2007). District i 's urban potential P_i is defined as the distance-weighted sum of the urban populations of all other districts $j \neq i$ represented in my dataset, excepting those without any towns of substantial size.²³ Horses and cattle per capita are proxies for peasant incomes. Rural population density captures the impact of land/labor ratios on the viability of peasant agriculture, and its corollary, the necessity of seeking out nonagricultural earnings to insure the household against agricultural income shocks.

Finally, in some specifications I include a vector of religious covariates: the proportions of a district's population which were registered as Roman Catholic, Protestant, Jewish, or Muslim in 1870, the earliest date for which data are available. A growing empirical literature highlights religion's importance for human capital accumulation, and Russia is no exception. According to Mironov (1991), for instance, Catholic and Protestant peasants in tsarist Russia were much more willing than their Orthodox counterparts to pay to maintain village schools and to ensure that all of their children, including daughters, learned to read and write.

5.1 Effects on literacy

Table 1 reports OLS estimates of serf obligation effects on male and female rural literacy rates in 1897. Columns (1) and (3) contain estimates from specifications which include only the geographic covariates described in section 4. Columns (2) and (4) add province fixed effects and my five additional socioeconomic controls. In all four estimations, the coefficient on quitrent prevalence in 1858 is consistently positive, substantively large and highly statistically significant. The "within" estimate in each case is about half as large as the pooled OLS estimate. Provided that they can be interpreted causally, my fixed effects estimates thus imply that a one standard deviation increase in the proportion of

²³Defined as towns with populations above 25,000. Formally, $P_i = \sum_{j \neq i}^n \mathbf{1} \{ \text{urban}_j \geq 25,000 \} \frac{\text{urban}_j}{\text{distance}_{j,i}}$, where $\mathbf{1} \{ \cdot \}$ denotes the indicator function and $\text{distance}_{j,i}$ is the centroid distance in kilometers between i and j .

	Male Literacy		Female Literacy		Male	Female
	(1)	(2)	(3)	(4)	(5)	(6)
Quitrent	0.134*** (0.022)	0.062*** (0.019)	0.087*** (0.024)	0.043*** (0.012)	0.022 (0.021)	-0.003 (0.022)
Proportion serf Q2					-0.006 (0.016)	-0.043*** (0.013)
Proportion serf Q2 × Quitrent					0.101*** (0.038)	0.151*** (0.042)
Proportion serf Q3					-0.027* (0.016)	-0.069*** (0.019)
Proportion serf Q3 × Quitrent					0.166*** (0.035)	0.141*** (0.040)
Proportion serf Q4					-0.052** (0.020)	-0.077*** (0.026)
Proportion serf Q4 × Quitrent					0.175*** (0.039)	0.135*** (0.049)
Rural primary schools, 1856	0.030** (0.014)	0.026** (0.013)	0.025 (0.017)	0.020 (0.015)	0.037*** (0.013)	0.022 (0.016)
Adj. R ²	0.417	0.727	0.332	0.720	0.499	0.413
Province FE	No	Yes	No	Yes	No	No
Geographic covariates	Yes	Yes	Yes	Yes	Yes	Yes
Economic covariates	No	Yes	No	Yes	Yes	Yes

Notes: Standard errors clustered by province in parentheses. Geographic covariates include access to ports, access to navigable waterways, administrative center dummies, log district area, terrain ruggedness, latitude, longitude, and their squared terms. Economic covariates include horses per capita, cattle per capita, rural population density, urbanization, and log urban market potential. *** denotes $p < 0.01$, ** denotes $p < 0.05$, and * denotes $p < 0.1$.

Table 1: Serf obligation effects on rural literacy rates in 1897

serfs obligated for quitrents exclusively on the eve of emancipation – representing about 30% of a district’s serf population – increases the proportion of male literates in rural areas, on average, by 1.9 percentage points and the female literacy rate by 1.3 percentage points. Since the female literacy rate in 1897 was lower than the male literacy rate, 7.6% as opposed to 27.5%, proportionally the estimated effect of quitrents on female literacy is several times larger. This pattern is consistent with the causal mechanisms detailed in part 2, particularly those involving obligation systems and incentives for household diversification. It is also interesting to note that my 1856 schools variable is consistently and positively correlated with male but not with female literacy, which can perhaps be interpreted as supporting my claim that the relationship between peasant obligation systems and elite preferences over human capital accumulation remained “latent” until

the decades following emancipation.

Columns (5) and (6) report estimates from OLS specifications where the prevalence of quitrents in 1858 is interacted with a vector of quantile indicators for the serf population share variable.²⁴ The effect of serf obligations on human capital outcomes, which I expect to be positive, is more precisely identified in these specifications because it can be distinguished from the presumably negative effect of having a large serf population before 1861. This is indeed the pattern which emerges from table 1: the prevalence of rents among a district's serf population is associated with male and female literacy in the second, third, and fourth quantile of the serf population distribution, but not in areas where serfs accounted for a more or less negligible percentage of the rural population in 1858. Moreover, in the case of male literacy, quitrent prevalence appears to have a larger effect in districts where there were more serfs prior to emancipation. As my theoretical argument implies, the obligation regime mattered most for subsequent human capital accumulation where it affected the widest swathes of the rural population. In fact, if these OLS estimates are to be believed, the adverse direct effect of serf population in 1858 is more than entirely offset by the conditional effect of those serfs being obligated for quitrents exclusively.

5.2 Effects on public school expenditure

OLS estimates of peasant obligation effects on public investment in human capital – more specifically, per capita and per pupil public expenditure on rural elementary schools in 1911 – are reported in table 2. In all specifications, I control for province fixed effects as well as for the proportion of serfs in a district's population in 1858. As was the case with rural literacy in section 5.1, the partial correlation between the prevalence of quitrent obligations and various measures of public investment in human capital is consistently positive, substantively meaningful, and statistically significant.

Point estimates of quitrent effects are minimally affected by the introduction of my socioeconomic covariates in columns (2), (4), (6) and (8). Estimates from these specifi-

²⁴In the 25% quantile district, the proportion of serfs in the population is almost exactly 0.250; in the median district it is 0.461, and in the 75% quantile district, 0.607.

	Per Capita		Local Per Capita		Per Pupil		Local Per Pupil	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Quitrent	0.201** (0.086)	0.197** (0.083)	0.092** (0.044)	0.086** (0.041)	3.935*** (1.155)	4.038*** (1.148)	1.790*** (0.646)	1.728*** (0.635)
Rural schools, 1856	0.037 (0.043)	0.029 (0.048)	-0.001 (0.032)	-0.007 (0.035)	-0.656 (0.489)	-0.652 (0.489)	-0.446 (0.373)	-0.475 (0.395)
Proportion serf	-0.087 (0.131)	0.022 (0.086)	-0.098 (0.084)	-0.030 (0.050)	-2.488** (1.156)	-2.081* (1.118)	-1.582** (0.652)	-1.171* (0.622)
Adj. R^2	0.598	0.635	0.510	0.559	0.575	0.581	0.618	0.624
Outcome mean	0.596	0.596	0.213	0.213	12.306	12.306	4.416	4.416
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographic covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Economic covariates	No	Yes	No	Yes	No	Yes	No	Yes

Notes: Standard errors clustered by province in parentheses. Geographic covariates include access to ports, access to navigable waterways, administrative center dummies, log district area, terrain ruggedness, latitude, longitude, and their squared terms. Economic covariates include horses per capita, cattle per capita, rural population density, urbanization, and log urban market potential. *** denotes $p < 0.01$, ** denotes $p < 0.05$, and * denotes $p < 0.1$.

Table 2: Serf obligation effects on public school expenditure in 1911

cations imply that a one standard deviation increase in the proportion of serfs obligated for quitrents exclusively on the eve of emancipation increases per capita expenditure on rural schools, on average, by about 6 kopeks, per capita expenditure from local taxes on land and real estate by 2–3 kopeks, per pupil expenditure by 1.2 rubles, and per pupil expenditure from local taxes by 52 kopeks. Proportional to the respective outcome means, these effects are all reasonably large in magnitude.

5.3 Effects on elementary enrollment rates

Table 3 reports least squares estimates of serf obligation effects on male and female rural elementary enrollment rates, estimated using enrollment data from school censuses conducted in 1879, 1894, and 1911. All specifications control for province fixed effects and for proportion of a district’s population that consisted of serfs in 1858. The results are broadly similar to those described in parts 5.1 and 5.2, although the relationship between quitrent obligations and rural enrollment rates is much less precisely estimated than the relationship between quitrents and literacy or between quitrents and public school expenditure. This may reflect attenuation bias arising from error in the mea-

	Male Rural Enrollment Rate			Female Rural Enrollment Rate		
	(1) in 1879	(2) in 1894	(3) in 1911	(4) in 1879	(5) in 1894	(6) in 1911
Quitrent	0.034* (0.019)	0.033* (0.018)	-0.010 (0.031)	0.015* (0.009)	0.026** (0.010)	0.031 (0.026)
Rural primary schools, 1856	0.063*** (0.016)	0.063*** (0.015)	0.035*** (0.013)	0.035*** (0.012)	0.032** (0.014)	0.027* (0.015)
Proportion serf	0.014 (0.024)	0.025 (0.027)	0.063 (0.048)	-0.008 (0.014)	-0.011 (0.017)	0.033 (0.024)
Adj. R^2	0.423	0.607	0.535	0.433	0.557	0.615
Outcome mean	0.128	0.241	0.454	0.021	0.052	0.184
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Geographic covariates	Yes	Yes	Yes	Yes	Yes	Yes
Economic covariates	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Standard errors clustered by province in parentheses. Geographic covariates include access to ports, access to navigable waterways, administrative center dummies, log district area, terrain ruggedness, latitude, longitude, and their squared terms. Economic covariates include horses per capita, cattle per capita, rural population density, urbanization, and log urban market potential. *** denotes $p < 0.01$, ** denotes $p < 0.05$, and * denotes $p < 0.1$.

Table 3: Serf obligation effects on primary enrollment rates in 1879, 1894, and 1911

surement of school enrollments: recall that to estimate enrollment rates in 1911 I used age structure data from the 1897 population census.

Alternatively, the over-time pattern – statistically detectable quitrent effects on male and female enrollments in 1879 and 1894, disappearing by 1911 – may also suggest the gradual fade-out of a causal effect which may have been reasonably strong during the initial post-emancipation decades.²⁵ Fade-out during this interval would be consistent with changes in rural school finance and administration which occurred during the first decade of the 20th century, particularly after the massive peasant uprisings of 1905 and 1906. Until this period elementary education had been extremely decentralized in terms of both finance and administration. After 1905, however, the central government dramatically ramped up its efforts to subsidize local school networks in under-served areas, with the threefold ambition of appeasing the restive peasantry, promoting Rus-

²⁵In WLS specifications, where the weights are given by the proportion serf in 1858, there is a significant relationship between quitrents and the female elementary enrollment rate in 1911. These estimates also imply somewhat larger quitrent effects on female enrollment rates during the two earlier periods: $\hat{\beta}_{1879} = 0.019$, s.e. = 0.006; $\hat{\beta}_{1894} = 0.036$, s.e. = 0.007, and $\hat{\beta}_{1911} = 0.084$, s.e. = 0.029. Because the WLS results are not robust to alternative specifications, though, I do not emphasize these findings here.

sification in the former Polish provinces, and curbing the autonomy of the politically “unreliable” zemstvo schools. As such, cross-district variation in public school investments during the period after 1905, and, as a consequence, enrollment rates, are heavily influenced by St. Petersburg’s political priorities as well as by the preferences and incentives of local landed elites.

6 Evaluating alternative explanations

One possible interpretation of these results is that some omitted variable, such as unobserved heterogeneity across serf estates or their proprietors, accounts for the correlation between the prevalence of quitrents in 1858 and post-emancipation human capital. More liberal-minded and better educated members of the nobility, for instance, or “improving landlords” with highly market-oriented estates, may have been disproportionately likely both to commute labor obligations to rents before 1861, and, following the emancipation settlement, to recognize the economic value of peasant literacy. Or gentry proprietors of small estates with relatively few serfs may have been more likely both to use serf labor on the demesne and, because of the fragility of their estate economies, to oppose local taxes imposed to support peasant schools. As discussed in section 4, my baseline identification strategy provides some defense against these confounds, since by controlling for the number of village primary schools in 1856 I capture all time-invariant influences on the supply of rural education. Still, if the factors shaping landowner preferences over public investment in education are both time-varying and correlated with the prevalence of quitrents on the eve of emancipation, effect estimates produced by OLS specifications such as (1) will lack a causal interpretation.

Even where some local notables favored mass schooling, however, their activism was rarely enough to overcome the obstacles to human capital accumulation engendered by a political economy based on labor-intensive agriculture. Moreover, there is no evidence for the claim that more progressive or market-oriented landlords were more likely than their peers to favor education for the peasantry. Case studies of two districts – Rostov in Yaroslav province, a hub of rural industry, and Aleksandrovsk in Ekaterinoslav, a steppe

district marked by labor scarcity and market-oriented wheat farming – in the decades after emancipation should help to illustrate both of these points.

6.1 Rostov

The large estate of Voshchazhnikovo in Iaroslav province, owned by the pedigreed and immensely wealthy Sheremet'ev family, illustrates the relationship (or lack thereof) between estate administration and the availability of rural schooling prior to emancipation. The subject of a careful case study by [Dennison \(2011\)](#), Voshchazhnikovo was in many ways a model quitrent estate, with a reasonably predictable bureaucratic administration that secured peasant property rights, enabled serfs to participate in land, labor, and credit markets, and mandated that peasant households maintain their strips of communal land as insurance against income and consumption shocks. Voshchazhnikovo exemplifies the type of landed estate that [Rudolph \(1985, 57\)](#) must have had in mind in describing how, throughout much of the Central Industrial region, “the proprietor often preferred to place the risk on the peasant...by sending the peasant out to work his own poor land or to work in cottage industry and manufacture while the landlord could theoretically sit back and collect the *obrok* payment.” Despite all this, the estate did not get its first school until 1868, more than half a decade after emancipation. Rostov district as a whole, with 88.7% of its serf households obligated for rents exclusively in 1858, had only three rural elementary schools in 1856, all of them parish schools operated by the Holy Synod.

Although the evidence is anecdotal, the Voshchazhnikovo case suggests two broader inferences about the relationship between serf obligations and noble attitudes towards education in the pre-emancipation period. First, until 1861 quitrent districts were not necessarily advantaged in terms of public school investments, even though, on average, they probably did possess larger human capital stocks. Second, it is not at all clear that we should expect to find a positive correlation between the more “progressive” mode of estate management and the proprietor’s encouragement of rural education. Estates like Voshchazhnikovo may have been effective in generating huge rents for their owners, but they embodied an essentially pre-capitalist mode of surplus extraction. The

prototypes of the “manorial capitalism” which developed in some parts of European Russia after emancipation were not the quitrent estates of Rostov district but, instead, “labor-repressive” estates worked by enserfed peasants on *barshchina* (Fedorov, 1974; Tikhonov, 1974; Koval’chenko, Selunskaiia and Litvakov, 1982). Here the proprietor, enjoying personal command of his labor force, could rationalize his estate as he saw fit. He felt no need to encourage his peasants to learn by doing. Only in former quitrent areas, where demesne was relatively rare and the landed gentry’s powers over the commune were less intrusive, did it make sense for landlords to promote peasant involvement in nonagricultural pursuits and to set them up as viable smallholders.

6.2 Aleksandrovsk

In the decades following emancipation, the cause of universal primary schooling won influential advocates from all strata of Russian society, including even noble landowners in former labor service areas. Among these was the author of the first (1870) Russian guide to school administration, and one of his country’s most energetic proponents of mass education, Baron Nikolai Korf, who was born in Khar’kov and spent much of his adult life on his landed estate in Aleksandrovsk. The fate of Korf’s efforts to win the support of the Ekaterinoslav gentry for an ambitious program of human capital investment, however, testifies to the obstacles that noble reformers faced when confronted with the indifference or open hostility of their fellow agriculturalists.²⁶

In 1866, just one year after the provincial zemstvo’s first convocation, the Ekaterinoslav *guberniia* assembly voted down deputy Korf’s proposal to earmark zemstvo funds for the establishment of a teacher training academy. Addressing the assembled delegates, A. M. Korolenko, one of the project’s opponents, went so far as to reject the notion that the zemstvo should concern itself with education at all, offering as arguments for this view the observation that “for this purpose we have a Ministry of Public Instruction” and that public education “scarcely falls within the zemstvo’s competence; it may happen, after all, that in this or that assembly the majority is composed of peasants, peo-

²⁶This section draws heavily from the chapter in Veselovskii (1909/1911, v. 4) on the Ekaterinoslav zemstvo from its first convocation in 1865 to 1906.

ple lacking in any education whatsoever.” Another assemblyman expressed his hostility to tax-funded rural schools more prosaically: “We’ll all be paying, but only peasants will attend.” Two years later, by a vote of 13 to 11, the delegates blackballed Korf’s nomination as chair of the provincial executive board (*uprava*) and he subsequently resigned from the assembly.

In the wake of this defeat, Korf retreated to Aleksandrovsk, where in 1866 he had been elected to the district school board (*uchilishchnyi sovet*). Together with a few like-minded colleagues, for the next six years Korf worked to implement his reform program in the district. In his absence, the provincial school board effectively ceased to function, with zemstvo assemblyman A. N. Pol reporting in 1872 that the board had not met even once in the past three years. The situation was apparently similar in most of the districts: in 1889, for instance, the Pavlograd district zemstvo turned over its entire rural school network to the Holy Synod in order to reduce the tax burden on private lands. Ultimately, dissatisfaction with Korf’s perceived fiscal profligacy took hold of the Aleksandrovsk nobility as well, and in 1872 he failed to win reelection to the district zemstvo from the landowners’ curia. Although promptly elected to a seat by peasant voters, Korf, devastated and in poor health, declined to serve and instead retired with his family to Switzerland, returning to Russia only in 1880.

How successful were the efforts of Korf and his proteges to promote rural education in Ekaterinoslav? The available data pertaining to local government budget allocations suggest that, at least in the short run, Korf’s campaign was ineffectual. Consider Figure 4, which displays the Ekaterinoslav zemstvo’s budgeted expenditure on public education (*narodnoe obrazovanie*) between 1871 and 1911, in rubles per capita.²⁷ Unfortunately, only after 1885 do the data allow us to distinguish between district and provincial allocations. Still, for the initial period following emancipation the picture is clear enough: provincial and district authorities combined spent about 3 kopeks per capita on public schools.²⁸ Per capita expenditure doubled from this modest base during the

²⁷1871 is the earliest year for which expenditure data are available in published reports of the Department of Direct Taxes. Reports for 1891 and 1892, years of severe famine throughout much of the blacksoil belt, were compiled but never published, possibly because of the difficulties encountered in obtaining data from some districts.

²⁸There are 100 kopeks in a ruble. For comparison, average per capita income in the Russian Empire

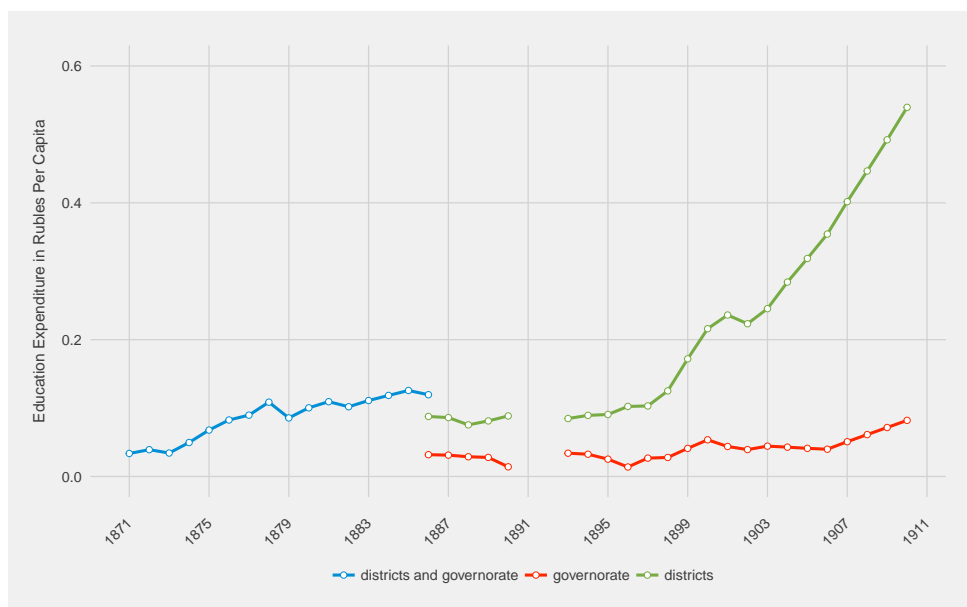


Figure 4: Ekaterinoslav zemstvo expenditure on public education, 1871–1911

late 1870s, shortly after Korf’s departure from the provincial political scene, but it then stagnated for the better part of two decades. Intriguingly, almost all of the rapid growth in education expenditure that occurred over the fifteen years leading up to the First World War was driven by the eight districts, with per capita spending by district authorities increasing from 12.5 kopeks in 1898 to 83.2 in 1911. It is unlikely, though, that this rapid development of human capital-promoting institutions can be attributed to the favorable attitudes towards rural education fostered by Baron Korf, as distinct from the appearance of new sources of public finance and the state’s increasingly ambitious efforts to subsidize local government investment in public goods.

in 1900 was about 100 rubles (Gregory, 1994). Total zemstvo expenditure on public education amounted to 3,5 kopeks per capita in 1871, 9.9 kopeks in 1880, and 18.7 kopeks in 1898.

7 Instrumenting for peasant obligations

In this section I develop an instrumental variables empirical strategy that aims to overcome two threats to validity left over from section 5: contamination of OLS estimates by unobserved heterogeneity and attenuation bias owing to error in the measurement of serf obligations. Part 7.1 states and then defends the assumptions undergirding my instrumental variables approach. Part 7.2 reports 2SLS estimates of quitrent effects on my main human capital outcomes. Finally, section 8 probes the integrity of the exclusion restriction.

7.1 Identification using cereal suitability

I exploit two sources of exogenous variation in the prevalence of quitrent obligations around 1858: first, geographic variation in the environmental suitability for cereal cultivation, wheat farming in particular; and second, the date of a district's incorporation into the Russian Empire.

With respect to the first source, the intuition is that, by the 1780s at the latest, the serf economy had evolved a clear interregional division of labor, with demesne agriculture concentrated in the highly productive blacksoil belt – stretching across Ukraine, the Central Agricultural region, and the Middle Volga – and cottage industries worked by serfs on quitrent dominating in areas where conditions for wheat cultivation were less favorable, mainly the Central Industrial and Lakes regions. Consequently, in the 1858 cross-section a district's environmental suitability for wheat cultivation should be negatively correlated with the prevalence of rents among that district's serfs.²⁹ The geographic distribution of serf obligations apparent from figure 1a implies that this is plausible. It should be possible, then, to identify the local average effect of serf obligations on human capital from cross-district variation in the environmental suitability for cereals. As for date of incorporation, the key distinction is between territories acquired before the mid-18th century and the Polish-Lithuanian lands annexed in the successive

²⁹I use wheat because, unlike the peasant's staple crop, rye, it was produced mainly for market. Results are similar when either rye or barley suitability is substituted for wheat suitability.

partitions of 1772, 1793, and 1795. Serfs in the former Polish provinces continued to enjoy superior legal protections after annexation, a fact that might shape the calculations of estate proprietors regarding the optimal utilization of serf labor.³⁰ As such, my estimations take into account the possibility that a different relationship between suitability and obligation regimes obtains in the Polish provinces.

I estimate instrumental variables specifications using a simple 2SLS equation for the first stage:

$$R_i = \alpha_j + \beta W_i + \gamma P_i + \delta W_i P_i + \lambda X_i + \varepsilon_i \quad (2)$$

where P_i is an indicator set to 1 if a district was annexed to Russia in one of the three partitions. \hat{R}_i replaces the excluded instrument W_i , which represents a district's estimated environmental suitability for wheat farming, in the second stage. I constructed district-level cereal suitability estimates using the Global Agro-Ecological Zones dataset created by the United Nations Food and Agriculture Organization.³¹ The FAO's methodology integrates factors such as soil type, moisture, climate variability, elevation, terrain ruggedness, and aspect into a crop growth model that produces an estimate of the maximum agro-climatically attainable yield for a given crop.

Suitability data are stored as a 5-by-5 arc-minute grid-cell. I aggregate these grid-cell estimates to the 1911 district boundaries, thereby producing estimates of each district's mean environmental suitability for wheat.³² Theoretically, this variable ranges between zero and 100, with larger values signifying more favorable environmental conditions for cereal production. Figure 1b displays the resulting estimates of wheat suitability across 45 provinces of European Russia.

³⁰For instance, according to Blum (1961), the obligations which serfs owed to their master were regulated by a contract, labor services owed were minimal for cotters and landless peasants, and field serfs could not be converted into household servants.

³¹Wheat suitability is estimated using 1961–1990 climate averages with rain-fed conditions and low-level inputs. The Global Agro-Ecological Zones (version 3.0) dataset can be accessed at <http://gaez.fao.org/Main.html>.

³²I implemented this raster-to-polygon spatial join using tools in the raster package for R version 3.1.0. Weights corresponding to the proportion of the cell that is enclosed by the district polygon are used for grid-cells which straddle district boundaries.

In the presence of heterogeneous treatment effects, identification using instrumental variables rests on four core assumptions: (1) ignorability of the instrument; (2) the exclusion restriction; (3) monotonicity of the instrument, and (4) no interference across experimental units (for a recent review, see [Sovey and Green, 2011](#)). Non-interference and monotonicity I take to be unproblematic. The remainder of this section briefly defends the two other identification assumptions.

7.1.1 Ignorability of the instrument

Ignorability implies that the instrument W_i is uncorrelated with the first-stage disturbance term ε_i . In other words, the instrument is “as good as” randomly assigned, perhaps conditional on some set of covariates X_i ; or formally, $E[W_i \varepsilon_i | X_i] = 0$. Ignorability of the instrument in specification (2) could be violated if my measure of environmental suitability partially reflects observed yields and is therefore endogenous to some omitted district-level characteristic such as the level of technology or agricultural productivity. However, because the crop growth model used to estimate suitability is based on the concept of a maximum agro-climatically attainable yield, as opposed to an actual or feasible yield given some specific production technology, this form of endogeneity should not be present.

7.1.2 Exclusion restriction

As is often the case, the exclusion restriction is probably the instrumental variables assumption most subject to reasonable doubt. For independence to hold, a district’s environmental suitability for cereal cultivation must have no effect on its human capital outcomes of interest net of the indirect effect through serf obligations. The exclusion restriction implies that the instrument W_i is uncorrelated with the second-stage error term ξ_i (again, perhaps conditional on covariates X_i): $E[W_i \xi_i | X_i] = 0$. Independence might be violated if, for example, districts with more favorable environmental conditions for cereal cultivation are less urbanized on average, and urbanization in turn is positively correlated with literacy and other human capital outcomes.

As emphasized in section 1.1, because of the historical contingency of the relation-

ship between serf obligation systems and cereal suitability, as well as the latitude enjoyed by serf-owners in setting obligations, we should not necessarily expect serf obligations to be correlated with other potentially relevant features of the agrarian political economy, such as household structure (Dennison, 2011). Still, I use two strategies to counter potential breaches of the exclusion restriction. First, I control for the geographic and economic covariates described in sections 4 and 5 in order to block possible back-door pathways between suitability and human capital. Second, although the exclusion restriction cannot be tested directly, falsification tests may serve to evaluate its plausibility. Using a placebo experiment of this type, in part 8 I am unable to falsify the independence condition on which the validity of my 2SLS estimates rests.

7.2 2SLS estimates of serf obligation effects

Table 4 reports the estimated 2SLS first stage as well as the reduced-form relationship between the instrument, suitability for wheat farming, and eight outcomes of interest: (1) male and (2) female rural elementary enrollment rates; (3) male and (4) rural literacy rates; (5) per capita and (6) per pupil public expenditure on rural schools, and (7) per capita and (8) per pupil school expenditure from local property taxes. As anticipated, the estimated first-stage relationship is negative, significant, and substantively large. As the first two columns in table 4 indicate, changes in the composition of the conditioning set do not materially affect the estimated first-stage relationship.

The first-stage estimates implies that, in areas which were incorporated into the Russian Empire before 1772, a one standard deviation increase in a district's environmental suitability for wheat – representing an increase of 19.5 percentage points – reduces the proportion of serfs obligated for quitrents exclusively by 14.4%. In the former Polish provinces (encompassing 90 out of 443 districts represented in my dataset) the relationship between suitability and quitrent obligations appears to be considerably weaker: the same standard deviation increase in suitability reduces the proportion of serfs obligated for rents by only 5.6%. In both specifications, the F -statistic from a joint test of the instrument's main effect and its interaction with the partition indicator is well above 10, the usual rule of thumb for identifying a weak instrument (Staiger and Stock, 1997).

	First Stage				Reduced Form			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Wheat suitability	-0.007*** (0.002)	-0.007*** (0.002)	-0.001** (0.001)	-0.001** (0.001)	-0.005*** (0.002)	-0.057*** (0.025)	-0.002 (0.001)	-0.009 (0.018)
Polish provinces	-0.417* (0.226)	-0.362* (0.206)	-0.251** (0.124)	-0.197** (0.083)	-0.459 (0.283)	0.539 (2.381)	-0.171 (0.115)	-0.188 (1.695)
Suitability × Polish provinces	0.005** (0.003)	0.004* (0.002)	0.002* (0.001)	0.002* (0.001)	0.004 (0.003)	-0.019 (0.032)	0.001 (0.002)	-0.010 (0.026)
Rural primary schools, 1856	0.112*** (0.042)	0.107** (0.047)	0.041** (0.018)	0.033** (0.015)	0.021 (0.052)	-0.722 (0.523)	-0.030 (0.039)	-1.019** (0.517)
Proportion serf	0.257** (0.114)	0.281** (0.118)	0.106** (0.046)	0.053* (0.030)	0.049 (0.112)	-1.287 (1.064)	-0.095 (0.063)	-2.279*** (0.795)
First stage <i>F</i> -statistic	26.272*** (df = 2, 430)	27.374*** (df = 2, 425)						
Adj. <i>R</i> ²	0.465	0.478	0.253	0.340	0.407	0.428	0.343	0.389
Outcome mean	0.255	0.255	0.454	0.184	0.597	12.311	0.214	4.423
Geographic covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Economic covariates	No	Yes	No	No	No	No	No	No

Notes: Outcome variables in columns (1)–(8) are as follows: (1) the male elementary enrollment rate; (2) the female elementary enrollment rate; (3) the male rural literacy rate; (4) the female rural literacy rate; (5) per capita and (6) per pupil public expenditure on rural primary schools, and (7) per capita and (8) per pupil local public expenditure on rural schools. Standard errors clustered by province in parentheses. Geographic covariates include access to ports, access to navigable waterways, administrative center dummies, log district area, terrain ruggedness, latitude, longitude, and their squared terms. Economic covariates include horses per capita, cattle per capita, rural population density, urbanization, and log urban market potential. *** denotes $p < 0.01$, ** denotes $p < 0.05$, and * denotes $p < 0.1$.

Table 4: 2SLS first stage and reduced-form estimates of serf obligation effects on human capital

The reduced-form estimates in table 4 yield a mixed picture. Effects of environmental suitability, with the expected sign, are discernable in the case of female literacy, male school enrollments, and per capita as well as per pupil public expenditure on rural primary schools. However, in contrast to OLS results reported in section 5, the coefficient on suitability does not reach conventional levels of significance in the four remaining estimations.

These results carry over only partially to 2SLS estimations reported in table 5. Here, with the exception of the elementary enrollment rate for boys and local per pupil school expenditure, quitrent effects are always statistically significant at the 5% level. These effects are substantively meaningful: my 2SLS estimates imply that a one standard deviation shift in the proportion of serfs obligated for quitrents exclusively increases the rural elementary enrollment rate, on average, by 4.7% for females, and the rural literacy rate by 8.1% for males and 4.5% for females. Effects on expenditure are similarly large: a standard deviation increase in the prevalence of quitrents translates into 18.4 additional kopeks of school expenditure per capita, and 2.65 additional rubles per pupil; the same shift corresponds to 8.1 additional kopeks of per capita expenditure from local taxes. Although the Polish provinces perform poorly on nearly all dimensions of human capital accumulation in 1911, there is no indication that the relationship between obligation systems and human capital differs in these areas from the relationship in other parts of Russia. In sum, then, the 2SLS results generally support the hypothesis of a causal relationship between the prevalence of quitrents among a district's serfs in 1858 and that district's subsequent propensity to invest in human capital formation.

8 Testing the exclusion restriction

Of course, the exclusion restriction is impossible to test directly. Still, its plausibility can be evaluated using a placebo test motivated by [Nunn and Wantchekon \(2011\)](#). Under the assumption that a district's environmental suitability for wheat farming affects its human capital outcomes only indirectly, through the relative predominance of quitrents and labor services, we should expect to find no direct effect of wheat suitability on hu-

	Enrollments		Literacy		Public Expenditure		Local Expenditure	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Quitrent	0.102 (0.076)	0.155** (0.065)	0.268*** (0.065)	0.148** (0.065)	0.613*** (0.200)	8.781*** (2.840)	0.265** (0.116)	2.219 (1.637)
Polish provinces	-0.068** (0.034)	-0.070*** (0.018)	-0.053** (0.025)	-0.014 (0.032)	-0.177*** (0.053)	-0.852 (1.062)	-0.095*** (0.027)	-1.116** (0.486)
Quitrent × Polish provinces	-1.604 (1.167)	-0.818 (0.594)	1.181 (1.158)	2.108 (1.673)	-1.219 (1.406)	44.207 (44.452)	-0.032 (0.795)	13.958 (17.196)
Rural primary schools, 1856	0.037* (0.019)	0.020 (0.016)	0.007 (0.017)	-0.006 (0.016)	-0.043 (0.070)	-1.960** (0.779)	-0.062 (0.042)	-1.385*** (0.520)
Proportion serf	0.066 (0.044)	0.014 (0.034)	-0.002 (0.031)	-0.027 (0.031)	-0.086 (0.126)	-3.036** (1.431)	-0.130** (0.066)	-2.545*** (0.859)
Adj. R^2	0.000	0.249	-0.195	-0.953	0.392	-0.012	0.323	0.286
Outcome mean	0.454	0.184	0.274	0.076	0.597	12.311	0.214	4.423
Geographic covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Economic covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Outcome variables in columns (1)–(8) are as follows: (1) the male elementary enrollment rate; (2) the female elementary enrollment rate; (3) the male rural literacy rate; (4) the female rural literacy rate; (5) per capita and (6) per pupil public expenditure on rural primary schools, and (7) per capita and (8) per pupil local public expenditure on rural schools. Standard errors clustered by province in parentheses. Geographic covariates include access to ports, access to navigable waterways, administrative center dummies, log district area, terrain ruggedness, latitude, longitude, and their squared terms. Economic covariates include horses per capita, cattle per capita, rural population density, urbanization, and log urban market potential. ***, ***, **, * denotes $p < 0.01$, $p < 0.05$, and $p < 0.1$.

Table 5: 2SLS estimates of serf obligation effects on human capital

man capital accumulation in areas where serfdom had never been present or had been abolished long before. I test this conjecture by estimating the reduced-form relationship between environmental suitability and human capital accumulation in the Russian Empire's three Baltic provinces – Estland, Lifland, and Courland – where serfdom was abolished and the serfs emancipated without land between 1816 and 1819.

For several reasons, this placebo experiment represents a hard, albeit indirect test of the exclusion restriction. Crucially, because serfdom was present in the Baltics in the fairly recent past, just four decades before its abolition in the other 47 provinces of European Russia, my placebo specifications will find a null direct effect of environmental suitability only if, first, the exclusion restriction holds, and second, suitability's indirect effect through serf obligations fades out substantially between 1819 and the outcome period. In the light of microeconomic evidence that human capital stocks are remarkably persistent, the second condition seems far from trivial. Using 1880, 1900, 1920, and 1940 U.S. Census microdata, for instance, [Sacerdote \(2005\)](#) finds that American slavery's adverse effect on the educational attainment of slave descendants lasts for two generations. The institutional bases of human capital accumulation, schools and teachers, are arguably even more persistent. Indeed, when I pool data from the Baltic region and Arkhangel province, where serfdom failed to take root because the tsars never attempted to settle their servitors in the region, I find a strong negative relationship, significant at the 1% level, between a district's suitability for wheat farming and the number of rural primary schools per 10,000 people in 1856.³³ This is consistent with a gradual decay of suitability's indirect effect through serf obligation systems.

The main limitation of the placebo experiment is the study's small size: 31 districts spanning the three Baltic provinces and Arkhangel (23 in the Baltics alone). This means, first, that I can control only for the baseline geographic covariates listed in section 4, as well as rural schools in 1856. Due to very substantial changes to district boundaries after 1861, in any case, it would be difficult to incorporate additional economic and demographic covariates into the analysis. Second, while the statistical power of models fit in this section is limited, it seems unlikely that increasing the sample size would substan-

³³The coefficient loses its significance when Arkhangel is dropped from the dataset.

tively alter my reduced-form estimates of direct suitability effects. In placebo specifications reported below, as well as estimations using data from the Baltic provinces alone (not reported here), the coefficient on wheat suitability is close to a precisely estimated zero, and quite distinct from, for instance, an imprecisely estimated, potentially large, and perhaps incorrectly signed effect.

My motivation for including Arkhangel in some specifications is related to the unusual reason for serfdom's absence from this northern land. If my crop suitability estimates are to be believed, conditions for cereal cultivation in the Northern Dvina basin are no worse than in neighboring provinces, including St. Petersburg, Vologda, and Estland, where labor coercion flourished. Thus serfdom's absence cannot be explained solely by the extreme poverty of the soil. Military considerations played a more important role: Muscovy's rulers originally granted landed estates (*pomest'ia*) to their servitors on the empire's southern frontiers, with the aim of settling their core military forces close to the front and thereby creating a buffer between Moscow and the nomadic peoples inhabiting the southern steppe. Because Arkhangel was so far removed from the front, the tsars never attempted to settle military servitors in the region (Hellie, 1971). As such, it seems reasonable to extend the analysis to Arkhangel as well as the Baltics.³⁴

Table 6 reports the results of placebo specifications for my eight outcomes: (1) male and (2) female rural elementary enrollment rates; (3) male and (4) female rural literacy rates in 1897; (5) per capita and (6) per pupil public expenditure on rural schools, and (7) per capita and (8) per pupil school expenditure from local taxes, all in 1911.³⁵ The coefficient on wheat suitability fails to reach conventional levels of statistical significance in six of eight models. Suitability's relationship with the male elementary enrollment rate is significant at the 10% level, but the coefficient is "incorrectly" signed: favorable conditions for wheat cultivation are associated with higher, not lower, enrollments. There

³⁴On the other hand, dropping Arkhangel may increase the internal validity of the placebo experiment by restricting the analysis to districts with nonzero wheat suitability. My estimates of direct suitability effects are substantively identical, though, regardless of whether or not Arkhangel is excluded.

³⁵Differences in the structure of public finance – the *zemskie sbory i povinnosti* described in part 3.2 – mean that direct comparisons between local school expenditure in Arkhangel and in the Baltic provinces are not very informative. In particular, *zemskie sbory* were a marginal component of public revenues in the Baltic region. As such, columns (7) and (8) include interactions between wheat suitability and an indicator for districts in Arkhangel province.

	Enrollments		Literacy		Public Expenditure		Local Expenditure	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Wheat suitability	0.004*	0.001	0.000	-0.002	-0.006	-0.139*	0.000	0.012
	(0.002)	(0.002)	(0.003)	(0.005)	(0.006)	(0.080)	(0.002)	(0.038)
Arkhangel							-0.107	-2.766
							(0.182)	(4.271)
Suitability × Arkhangel							0.006	0.121
							(0.005)	(0.128)
Rural primary schools, 1856	0.008**	0.009***	0.003	0.007	-0.001	-0.177	0.000	0.007
	(0.004)	(0.002)	(0.004)	(0.006)	(0.011)	(0.142)	(0.002)	(0.044)
Adj. R^2	0.145	0.666	0.865	0.898	0.298	0.742	0.910	0.909
Outcome mean	0.447	0.306	0.637	0.579	0.767	14.274	0.059	1.350
Geographic covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Heteroskedasticity consistent standard errors in parentheses. Geographic covariates include access to ports, access to navigable waterways, administrative center dummies, log district area, terrain ruggedness, latitude, longitude, and their squared terms. *** denotes $p < 0.01$, ** denotes $p < 0.05$, and * denotes $p < 0.1$.

Table 6: Direct effects of wheat suitability on human capital outcomes

is also a marginally significant relationship, with the expected sign, between cereal suitability and per pupil public expenditure on rural schools. All other estimates are non-significant and relatively small in magnitude. In sum, the placebo experiments in this section indicate that the independence condition on which validity of my instrumental variables estimates rests is plausible.

9 Conclusion

Do agrarian institutions intervene in the relationship between land inequality and human capital accumulation? I find substantial evidence that, in the case of Russia during the second half of the 19th century, the local institutional structure inherited from the pre-industrial agrarian economy continued to shape both mass and especially elite incentives to adopt human capital-promoting policies and institutions. More specifically, *obrok* districts in which landlords lacked direct control over the labor and work organization of the peasantry, but had devised effective institutions for regulating peasant labor mobility, proved to be a more hospitable environment for human capital accumulation after 1861 than their principal alternative, *barshchina* districts in which estate

economies continued to depend on high land rents and low agricultural wages. Results from a variety of identification strategies suggest that the effect of quitrents on subsequent human capital accumulation – including rural literacy rates, elementary enrollment rates, and public school expenditure – is both substantively large and most likely causal. These findings, I believe, underscore the usefulness of a more class structural view of the relationship between land inequality and development: researchers should be attentive not only to the consequences of land inequality for human capital formation, but also to the ways in which “surplus extraction relations” and related institutions mediate this relationship.

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