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Abstract

We study the effect of improvements in peasants' land tenure, launched by the Stolypin reform, on agricultural productivity in late imperial Russia. The reform allowed peasants to obtain land titles and consolidate plots. We find that land consolidations increased productivity. We argue that changes in peasant de facto land usage rights caused this effect. In contrast, the titling component of the reform was associated with a decrease in land productivity. We present evidence that this negative effect was driven by transaction costs to exit the commune and the outflow of labor from the countryside.

1. Introduction.

The 1906 Stolypin reform, one of the largest property rights reforms in Russian history, dramatically changed peasants' land tenure. Politically, the reform aimed to construct a class of small landowners in the countryside who would provide support for the government in the wake of the peasant unrests during the 1905 revolution. Economically, the reform attacked poverty and inefficiency of Russian agriculture, offering peasants an alternative set of institutional arrangements to improve productivity. The reform granted peasants a choice to exit the commune – the institution that dominated Russian agricultural landscape after the emancipation of serfs. Exiting meant a switch from communal to individual land ownership for a single household. In addition to exiting, a household could consolidate its land from several scattered strips of land into one allotment. Over the nine years of reform implementation (1907-1915), nearly 2.5 million peasant households decided to exit the commune and over 1.2 million households managed to consolidate their plots, or about 20 and 10 per cent of 12.3 million households correspondingly (Dubrovskij 1963; Davydov 2010).

The Stolypin reform has received a huge amount of attention in the historical literature because it represented the last attempt of the tsarist regime to reform the Russian economy and society before the 1917 Revolution. The conventional view is that the reform failed due to peasants' unwillingness to participate. Moreover, the reform intensified tensions and conflicts in the Russian village, contributing to rather than preventing the revolution (Anfimov 1980, Koval'chenko 1991, Pallot 1999). In contrast, the reform supporters underline its positive impact on peasants' incentives that should have led to the rapid economic development of Russian agriculture during the years before the First World War. They argue that the low take-up of the reform was limited by the supply of the reform rather than the demand (Tukavkin 2001, Williamson 2006, Davydov 2010).

This paper undertakes an econometric approach to this debate. We use province level data, regularly published by imperial authorities, to evaluate the effect of changes in land tenure initiated by the reform – both exits and consolidations - onto agricultural productivity. We also

investigate a criticism of the reform -- that it increased tensions and conflicts in the Russian village -- to explore whether conflicts limited the positive effect of the reform.

Peasants' decisions to exit and to consolidate were voluntary. As such, the variables of interest that track the impact of the reform are potentially endogenous. We take advantage of the bureaucratic red tape associated with the reform and the limited supply of land survey engineers necessary for land consolidation as sources of exogenous variation in the take-up of the reform. We find that the consolidation component of the reform indeed caused an increase in land productivity, as supporters of the reform argued. At the same time, we find that the net effect of exits from the commune, represented by land title conversions from communal to individual tenure, onto land productivity was negative, as reform skeptics believed.

Beyond the historical interpretation of the Stolypin reform, our paper contributes to the economics literature on property rights and the literature on institutions and development. The historical peculiarities of the Stolypin reform allow us to disentangle the effect of changes in transfer and exclusion rights from the effect of changes in usage rights. Both exiting and land consolidations offer similar levels of tenure security but only land consolidations alleviate restrictions on control rights due to the interdependencies of production in the commune. Restrictions on usage rights in communal farm production are extremely common. Using modern plot-level data for commune farm production in Vietnam, Markussen et al. (2011) show that this type of restriction on use is indeed binding and results in inefficiencies. Our findings suggest that the usage rights effect, since it is the only one associated with the consolidation of peasant allotments, is more important, at least in the short-run.

To provide further evidence of an effect of usage rights, we take advantage of a peculiarity of the reform that permitted individual households to apply for land consolidation even if the rest of the commune did not, which we refer to as singular individual land consolidations as opposed to the more ideal form of individual land consolidations which occurred village-wide. Both types of individual consolidations will relax restrictions on use but de facto restrictions are more likely to persist for singular consolidations. In addition, conflicts over reform implementation, which

can be interpreted as de facto restrictions on use, are also more likely to persist for singular consolidations. To bolster our claim that we identify an effect of changes in usage rights, we verify whether an expansion in usage rights corresponds to changes in production techniques or crop production. We find that land consolidations in the previous year predict the inflow of agricultural machines and that land consolidations lead to greater specialization in crop production, suggesting that farmers indeed have altered their production.

We explore three alternative interpretations of our main result for land consolidations. First, land consolidations could have improved economies of scale. We show that the results are not sensitive to the average size of consolidated plots. Second, land consolidations decreased transportation costs. If it were merely transportation costs, then we would expect to find a positive effect for singular individual consolidations, which we do not. Thirdly, there is the possibility that the reform, and its uneven implementation, undermined the institution of commune and its role in maintaining public order, leading to widespread conflict and unrest in the countryside. If communes that participated in village-wide land consolidations suffered less from the breakdown in order, we may not be observing the effects of better usage rights. After controlling for various measures of violent conflict, the magnitude and sign of the effect of consolidations remains stable. Finally, we should mention that the modern emphasis of formal property rights and access to credit is not really a mediating factor in our case. Few peasant farms actually used land as collateral to obtain credit.

The positive effect on land consolidations that we observe is conditional on a household exiting the commune. But what was the effect of exiting and obtaining a land title on productivity if the household did not manage to consolidate? The evidence overwhelmingly supports a negative effect on land productivity. Unfortunately, due to data limitations, we are not able to present conclusive evidence about the channel of influence. That said, we find evidence that is consistent with 1) the average negative effect being driven by provinces that experienced less permanent outmigration (to resettle in the Asian part of the empire) and had better off-farm opportunities, which reduced land productivity with the implementation of the reform, 2) the

presence of transaction costs, which decreased land productivity due to imperfect credit markets, and 3) reform-related conflicts which limited the implementation of land consolidations and led to a relative decrease in land productivity. Clearly, less aggregated data would provide a clearer picture but this evidence is an important step in trying to understand the effects of the Stolypin reforms and to what degree it was a success.

The importance of usage rights highlights an underemphasized role of institutions in economic growth – to coordinate production plans and, in particular, changes in production plans. Too often the debate about whether institutions matter for economic growth focuses solely on incentives and neglects this coordinating role. Coordination occurs in both a static and dynamic sense (Lachmann 1971). Property rights that are perfectly secure but perfectly inflexible may coordinate production plans very well in a static sense but inhibit growth and distort factor markets because they fail to provide enough flexibility for economic agents aiming to coordinate changes in production plans. Thus, the focus on incentives misses an important part of the picture, a part that the Stolypin reform illuminates very well. Contrary to the literature on similar historical phenomena from British history – the enclosure – which argues that open fields system did not prevent coordination and limit agricultural development (Allen 1982), we find that legislative intervention made it possible to circumvent bargaining costs and relaxed institutional constraints, which had inhibited efficiency improvements in the organization of agricultural production.

The outline of the paper is as follows: first, we provide the necessary details of the reform and Russian agriculture during the time of the reform; second, we discuss the hypotheses in greater detail; third, we describe the data and our estimation approach; fourth, we present the results and then we conclude.

2. Russian pre-revolutionary agriculture and the Stolypin reform: an overview.

2.1. Institutional settings of Russian agriculture after the emancipation: the commune.

The peasant commune was the main institution in the Russian village after the abolishment of serfdom in 1861. With the exception of three Baltic provinces (Lifliandia, Estliandia,

Kurliandia), all peasants in provinces of the European part of the empire had to belong to a particular commune. Usually, there was one commune per rural settlement. The emancipation reform empowered communes with broad decision-making authority over local issues, both political and economic ones, in order to replace the serf-owner as the source of power in the village. In the economic sphere, in particular, the commune regulated the majority of peasants' agricultural activities under the system of open fields. Each household cultivated a number of separate and scattered narrow strips, requiring peasants to coordinate production plans with their neighbors, and the commune instituted various restrictions on usage rights to facilitate this coordination. In particular, an individual peasant could hardly make an independent decision on what to cultivate, when to seed, harvest etc. In addition, the narrowness of strips limited introduction of agricultural machines and sparseness of strips implied extra transportations costs.

Peasants' transfer and exclusion rights in land varied with the commune type. Reparation (*peredel'naya*) communes were strongly represented in the majority of Russian provinces with the exception of the western, former Polish, provinces of the empire. All communes in Vilno, Kovno, Grodno, Minsk, Podolia and Volin' provinces (*podvornaya*) were hereditary ones³.

In repartition communes, which represented eighty percent of all communes, both rights to exclude and transfer were limited by periodical redistributions of allotments between commune members to match equally land recourses to household working capacity, undertaken by a majority decision. Peasants could not sell, lease, mortgage or transfer legally their strips under communal tenure. A peasant household also could not exit without the consent of the commune and, if consent is granted, would exit with no compensation for the household's allotment. Hence, household ownership of private property in land did not exist in repartition communes; land belonged to the commune. Obviously, this affected negatively peasants' incentives to invest

³ Also repartition communes represented less than a half of the peasants in Kiev, Poltava, and Bessarabiya provinces (Durbrovskij 1963, pp. 570–573). In addition, repartition communes in Cossack communities in Don, Kuban', Orenburg, and Terek provinces existed under different tenure regimes. Cossack communities enjoyed privileged status in the empire, possessing extensive land estates at the expense of extended military duty for males. Finally, there were no communes in the Baltic (Lifliandia, Estliandia, Kurliandia) provinces.

in land as well as their access to credit (an allotment could not be used as a collateral). There are anecdotal evidences that the commune tried to limit these effects by introducing compensation for land improvements in case of repartition or allowing informal renting within the commune (Gregory 1994; Nafziger 2008). About one third of all repartition communes in the early XXth century did not conduct any repartition of land since the emancipation. Their number was larger in the Black Earth provinces because of the higher profitability of agriculture. Rich peasants did not want to lose their land and lobbied against repartitions, which would have produced a more equal distribution of land within the commune (Ziryanov 1992).

In hereditary (*podvornaya*) communes, ownership passed down within the family. There were no repartitions and peasants enjoyed full exclusion rights in land. Peasants also had better land transfer rights but these were still limited. A transfer in the hereditary commune required an individual either inside or outside the commune willing to take the land allotment and related obligations. The transfer might include compensation for land, i.e., the quasi-selling of plots was possible there.

In addition, the commune (of both types) regulated peasant mobility, and accordingly the supply of labor, because of the mutual responsibility for tax payments. Seasonal workers and all peasants who wished to temporarily leave their native areas had to get passports from local communal authorities. Even if they moved to urban areas, they remained responsible for paying commune taxes. In the repartition commune, such a migrant could not exit the commune legally without its consent. In practice, communes did not like to give permissions to exit exactly because of fiscal reasons, while they had more willingness to issue temporary travel passports to improve the land to labor ratio. This additional financial burden that potential urban migrants faced reduced rural-urban migration and could have led to labor overinvestment in agriculture. The peasants' legal right to equal access to land in the repartition commune worked in the same direction.

There is a long discussion in historical and economic literatures on the economic consequences of the institution of the commune and the existence of the 'agrarian crises' in the

post-emancipation Russian Empire (e.g. Anfimov 1980). The standard argument, ascending to Vladimir Lenin (1899) and Alexander Gerschenkron (1963), is that the free-rider problem caused by collective responsibility and poor property rights created disincentives for peasants to invest in land and reduced their access to credit; the strip system and the consequent limited usage rights locked peasants into backward agricultural techniques and a failure to adopt modern machinery; finally, restrictions on land sales and peasants' mobility froze the development of factor markets, forced peasants to overinvest in agriculture, producing inefficient allocation of land and labor. Taken together, these restrictions negatively impacted the productivity of land, which was almost three times lower in Russian in 1913 than in England (Anfimov 1980 p. 80), and plunged Russian agriculture into crisis. Questioning this view, estimates of the national income of the Russian Empire by Paul Gregory (1982) fail to reveal stagnating agricultural productivity; on the contrary, his estimates show rapid growth of peasants' incomes during the late XIX – early XX centuries. His macro reconstructions suggest that the commune was a more flexible institution than historians traditionally thought. More recent analysis at the micro-level by Stephen Nafziger (2008, 2010) support this new complicated picture. Nafziger argues that repartitions themselves were not exogenous for peasants and could substitute for undeveloped factor markets and observes a negative correlation between the number of repartitions and agricultural productivity in Moscow province.

2.2. The Stolypin reform.

2.2.1. Legal Framework.

While there was a lot of discussion in the government on chosen institutional organization of the Russian countryside after emancipation and its potential impact onto peasants' welfare (see for example Commission on Peasant Welfare 1901), little had been done policy-wise before the 1905 revolution. Peasant unrest triggered the Stolypin reform (1906) that was aimed to secure political support to the government and address poverty in the countryside.

The reform enabled the peasant to choose among different agrarian organizations of property rights. In repartition communes, under the 09.11.1906 decree, individual peasants could

exit the commune and appeal for conversion of their arable land title from communal to personal property, i.e. hereditary tenure.⁴ If an applicant failed to reach a consensus with his commune on the precise conditions of exit, a local land captain (*zemskii nachalnik*) was empowered to solve such disputes and to arrange exit even without commune's consent. The final exit decisions had to be approved by local peasant courts (*uezdnij krestyanskii sezd*). An exit from the repartition commune and title conversion meant a substantial improvement in exclusion and transfer rights for an individual household as well as access to credit. After the exit, the household's land was protected against possible future repartitions; the household could sell their strips to other peasants (selling land to non-peasants was still prohibited; there were also restrictions how much former commune land one peasant household could possess), to lease it legally or to mortgage in the Peasant Bank (but not to other banks). Similarly, in hereditary communes, the reform granted peasants legal rights to sell, to lease or to mortgage their plots in the Peasant Bank. The scale of changes was obviously smaller there, because hereditary peasants enjoyed many of these rights *de facto*.

The initial conditions of the Stolypin reform on exits were slightly modified by the 14.06.1910 law. The law simplified exit procedures for households in communes for which there had been no repartitions since the emancipation. Such households could apply for a titling certificate (*udostoveritel'nii akt*) for lands in their possession and could automatically get it without any discussion with the commune on the precise conditions of exit.

The 1906 Stolypin reform also opened an opportunity for peasants to consolidate their strips into joint allotments (*khutora* and *otruba*). By a two-thirds majority, a commune – both repartition and hereditary ones - could vote for general redistribution into separate, consolidated allotments (village-wide consolidation). In either type of commune, an individual household could demand for the consolidation of its strips (singular consolidation). The commune could try to block an individual request if consolidation was 'impossible or inconvenient' and instead buy

⁴ To be precise it was hereditary tenure with personal ownership. Standard hereditary tenure supposed family ownership existed. In hereditary communes heads of households could also convert titles of their allotments from family to personal ownership.

off the demand with money. Again local authorities (local land works commissions – *zemleustroitelnie komissii*) were in charge of resolving disputes and could override a commune's discontent. Under 1906 law, completing the exiting procedure was a pre-requisite for a singular consolidation in the repartition commune, but the 29.05.1911 law removed this requirement.⁵ Land consolidations were free for peasants and the government paid for them. On top of that, the government launched an additional subsidy and loan program for separators, including subsidies in kind (wood). The maximum subsidy was 150 rubles per household (Klimin 2002).

The consolidation changed greatly the usage rights of the household. An exit alone did not make an individual household independent from the commune. Since the commune's land still surrounded the strips of such a household, it was forced to follow the rotation of crops established by the commune (Chief Administration of Agriculture and Land Works 1912); only after consolidation did the commune have much less influence on an individual household's cultivation decision, specifically on whether to plant a particular crop or use a particular technique. In contrast, a household that consolidated its land could immediately shift to a new crop or agricultural technique after the event. In particular, a consolidated household could take advantage of technological economies of scale, for example, by adopting agricultural machines. Improvements in the usage rights were more pronounced in village-wide land consolidations. In the case of singular consolidation a separator continued to live in the commune environment and had to deal with his commune neighbors on a daily basis. Land consolidations also likely improved transfer rights, since it is easier to sell a larger plot than separated strips.

Finally, the Stolypin reform granted peasants opportunities to implement other types of land improvements at the expense of the government. In particular, if two communes in neighboring villages or a commune and a neighboring landlord did not have precisely determined titles on allotments that they cultivated jointly, peasants could apply for land title specification. The government also started a set of agricultural help programs that were supposed

⁵ A village-wide consolidation without abolishment of the commune was possible under 1906. But the demand for that was negligible (Chief Administration of Agriculture and Land Works 1913).

to improve peasants' agricultural techniques. But their scale was not large; in 1908 – 1910, for which we have data, expenditures varied between 171 and 2064 thousand rubles (Chief Administration on Agriculture and Land Works 1911).

2.2.2. The Stolypin reform in action.

Figure 1 presents annual dynamic of exits under both the 1906 decree and the 1910 law. Under the 1906 decree, about one and a half hundred thousand households left the commune in an average year with a spike of seven hundred thousand during the first two years after the reform. In total, by January 1st, 1916, there were 2, 008, 432 exits with privatized land of 14, 122, 798 *desiatinas* or 15 429 157 hectares. In addition, 469, 792 households acquired titling certificates under the 14.06.1910 law, or about 80,000 annually (Dubrovskij 1963). All in all, 20% of households privatized 10% of communal land over nine years of the implementation of the reform.

Figure 1 somewhere here.

In terms of geography the number of exits per province increased from the North to South with the exception of West where there was either no or few repartition communes (the only other two exceptions were Don populated by Cossacks and Astrakhan). Figure 2 maps the number of exits summed up over all years of the reform per province. It is easy to conclude from this map that exits were correlated with soil quality and land per capita; both were increasing from the North to the South. Another correlate is climate, which was obviously changing along the longitude parallel. However, it is unlikely that weather shocks determined the geography of exits and the reform in general. Droughts – the main shock for Russian agriculture – normally affected the larger part of European Russia when they happened.

Figure 2 somewhere here.

Historians of the reform (Zyryanov 1992) pointed out that households possessing 'extra' land allotments, which they would have likely lost under the next repartition, were among those who tried to exit the commune first. Conflicts and tensions with the rest of the commune were an inevitable outcome in such cases. Only a quarter of exiting households managed to reach an

agreement with the commune on the precise conditions of their exits during one month, the amount of time given by law to resolve any disputes, following the application (Williamson 2006 p. 149). Better options outside agriculture was another factor promoting exits from the commune; in this case, peasants took advantage of the reform in order to sell their allotment, a source of funds that they would not have had access to under the old rules.

Figure 3 presents the consolidations dynamics. The number of households that consolidated their plots both individually and village-wide was steadily increasing by 1910 and remained roughly at the same level afterwards. In 1912, there was a temporary decline in consolidations. Singular consolidations constituted a majority of all consolidations. After 1910, there were about 100,000 singular consolidations per year and 60,000 households consolidated their allotments under village-wide consolidations. The government promoted consolidations in various ways. Some historians argued that local authorities actually forced peasants to consolidate using administrative measures (Kovalchenko 1991, Pallot 1999). However, special investigations on that conducted by local self-governments, *zemstvos*, counted only between two and fifteen percent of “forced” involuntary consolidations (Klimin 2002).

Figure 3 somewhere here.

The geography of consolidations mirrored the geography of exits to some extent as figure 4 demonstrates. There were fewer consolidations in the North and their number per province increased moving to the South. The main differences relative to exits were consolidations in the west (there were no exits because of the absence of repartition commune) and their substantial number in Saint Petersburg and the surrounding Northwest provinces. Figure 5 shows that these difference were mainly driven by village-wide consolidations. There were many of them in the Southwest, Belorussian provinces and provinces around Saint Petersburg. With an exception of Orenburg, there were few village-wide consolidations in the Southeast, the East and the North. In contrast singular consolidations dominated in the belt of Black Earth provinces (figure 6). There were few of them in the North but in the West as well.

Figure 4 somewhere here.

Figure 5 somewhere here.

Figure 6 somewhere here.

Village-wide consolidations required a two-thirds majority and, accordingly, were less likely to occur in the communes with high level of tensions and conflicts. Singular consolidations themselves represented a threat to the peasant way of life that had been so dominated by the institution of the commune and could have caused conflicts between separators and the commune. Some historians claim that local authorities chose the best land to offer as a consolidated plot to promote the reform take-up, which could have deepened protests and tensions (Pallot 1999). However, conflicts rarely were openly violent; the government was quite effective in preventing such type of clashes. Communes usually tried to sabotage singular consolidations and then prevent the normal operations of separators. The most powerful weapon available was to block access to commune pasture and forest, which were not subject to consolidation by law. These blockades would have been illegal but many communes organized them in practice. The other anti-enclosure actions included pasturing livestock on enclosure's crops and arson (Pallot 1999; Klimin 2002).

Despite these within-commune tensions and conflicts, the demand for the reform was much higher than the supply. The number of applications both to exit and to consolidate was substantially larger than the actual number of applications to exit approved by local courts and the number of consolidations undertaken in practice. The consolidation procedure could have caused bottlenecks. If a peasant wished to consolidate his strips, he had to apply to the local land works commission. The commission then regulated disputes with the commune if they existed and finally set a time when a land engineer would conduct actual land works. However, there was a significant lack of land survey engineers, slowing down the consolidation procedure. By late 1915 around two million households consolidated their plots although more than six million had applied for consolidations (Volkov 1999; Davydov 2010).

The lack of land engineers was an old problem for Russia. The shortage of land engineers limited both of the two previous land cadastre reforms: the construction of general cadastre for

European Russian in the late XVIII – early XIX century (*Generalnoe mezhevanie*) and the emancipation of the serfs. This was not the least reason why adjoining communes that held joint land titles still existed or why the emancipation proceeded under communal tenure instead of individual (Davydov 2010, Khristoforov 2011). By the beginning of the reform, there was only one institute and five schools that produced land engineers and their assistants in the whole country. In 1906, for the whole of Russia, there were only 600 land engineers (Volkov 1999). While the government opened a number of new schools and extended enrollment into the old ones, the demand still outpaced the supply. In 1914, the number of land engineers was about 3300, plus about 7000 of their assistants (Volkov 1999). The lack of land engineers led to average times of consolidation of up to two years; the procedure was a bit faster for village-wide consolidations that were free of within commune conflicts (Tukavkin 2001).

In addition, there was a lot of bureaucratic red tape in the work of land captains and the approval process of title conversion. As we have argued elsewhere (Chernina et al. 2013), the main determinants of this specific type of bureaucratic efficiency were largely independent of the Stolypin reform. First, local officials were poorly educated and poorly prepared for this job; they were overburdened with other responsibilities. Land captains were appointed to their positions during the previous decade when the state policy was instead pro-commune rather than anti-commune. Candidates for this position were very limited in supply. Initially, the government planned to hire only local gentry for these positions, but it had to extend the pool of candidates to retired military officers, graduates of Orthodox divinity schools, and other non-gentry, middle-class citizens with exclusion of peasants themselves (B.Zh., 1898). Few land captains were added after the reform (2615 in 1913 vs. 2604 in 1906, Central Statistical Committee of the Ministry of Interior Affairs, 1907, 1914). The government tried to improve the quality of current officials and offered two-month courses for them in 1908, but their education levels remained low (Dubrovskij, 1963, p. 167). Second, the approval process relied on local land records on previous repartitions and poor documentation extended the procedure (Maksimov, 1999, p. 95). Usually, exactly the same local land captains who oversaw the reform were in charge of creating

this paperwork in the 1890s and early 1900s. The central government acknowledged the slow exit procedure and tried to improve it, but without success (see, for example, decree of the Ministry of Internal Affairs issued December 30, 1909, and June 14, 1910 Ministry of Internal Affairs 1910, Vol. 1, p. 15; 1912, Vol. 3, p. 106).⁶

There are anecdotal evidences that agricultural productivity increased as a result of the reform. Klimin (2002 pp. 229-230) provides examples of higher yields in the farms of separators in comparison to their commune neighbors. He argues that the difference was about 20-25 percent, reaching two or even three hundred percent in some places.

3. Hypotheses.

In this section, we discuss our main hypotheses concerning the effects of the complex set of reforms. Figure 7 summarizes the main effects of the reform on agricultural productivity for the two main components of the reform - exits and consolidations. The effect of the right to exit the commune and obtain an individual land title is familiar. Improvements in exclusion and transfer rights should improve dramatically peasants' incentives to increase land productivity. However, we argue that time was needed to observe the benefits of this mechanism. The Stolypin reform was in operation for less than a decade only, so we can not verify the hypothesis of a long-run effect of changes in property rights initiated by the reform. In the short-run, it is more difficult to predict the effect of exiting onto agricultural productivity and there are quite a few channels through which one might find a negative or little effect of exits.

First, a title conversion without consolidation hardly affected the usage rights and did not shifted to better agricultural technologies and techniques. In particular, it meant little in terms of incentives to invest in mechanization to explore scale effect because strips of the Russian peasant were often too narrow – sometimes even several meters – and intermixed with other peasants'

⁶ The government also attempted to employ career incentives for local officials using their performance in reform implementation as criteria, though again without success. A number of provincial governors were openly against the central government in that question. In the end, the government failed to fire officials from noble families or with connections (Dubrovskij, 1963, pp. 167–174). Maksimov (1999, p. 96) gives other examples how the government tried to speed up the approval procedure.

plots, placing restrictions (even formal rules about use) on usage rights after exiting the commune. In such a situation, individual farmers had to continue to coordinate their decisions about what to cultivate, when to sow, etc., with the commune. Second, better land liquidity caused by title conversion and better transfer rights changed household's opportunity costs and eased financial constraints; peasants could explore other economic activities without losing income from land. Indeed, Chernina et al. (2013) find a positive impact of the Stolypin reform onto internal migration. If there were overinvestment of labor into agriculture, as many historians argue (Allen 2003), and inefficient allocation of inputs, the titling reform could result in a reallocation of labor, increasing the marginal productivity of labor but decreasing land productivity. In addition, institutional limitations on property rights remained even after the reform; in particular, peasants could not sell their allotments to non-peasants and there were limits on how much former commune land a peasant household could accumulate. Hence, there should be less of an effect from the reallocation of land to the more productive individuals. Third, in the short-run, land may actually remain idle since labor no longer needs to be allocated to land to maintain tenure security and can be reallocated to other activities while peasants hold the land as a safety-net. Fourth, exits and land privatization were costly and could have negatively impacted agricultural productivity temporarily because of the strain on peasants' budgets. As we discuss in the previous section, the exiting procedure was not automatic and could have involved significant transaction costs. Fifth, an exit without consolidation did not remove transportation costs of travelling between strips. Sixth, exits and land privatization may have produced conflicts and these conflicts could affect productivity negatively. Finally, there could be adverse selection in the beginning of the reform. Negative mortality shocks, widespread in such a poor country as the Russian Empire in early 20 C., created temporal advantages in land allocation for particular households. These households could rush to take advantage of the reform and to privatize land, which they would lose otherwise. If these households were also in lack of labor because of the mortality shock, this could lead to negative selection.

The second major component of the reform was land consolidation. The direct benefits of consolidation due to economic effects were twofold. First, consolidations could increase productivity because of a scale effect. Second, consolidations should reduce transportation costs. The many scattered strips of land that peasant households cultivated before the reform required significant travel time, which was extremely costly in the short growing season and all the more so if peasants were lugging heavy machinery from plot to plot. All these benefits could result in greater incentives to invest into agricultural capital but may have needed some time to take effect. In addition to these two economic effects, there is an institutional one. Before the reform, the commune regulated agricultural activities of individual households, but this regulation could persist even after the household has exited the commune. If a peasant household consolidated its plots after exiting, the influence of the commune, in theory, was greatly diminished. We would expect that changes in land usage rights caused by consolidation were positive and we actually view these changes in usage rights as the most important effects of the reform.

The short-run effects of consolidations are not all positive. First, consolidations also could improve the liquidity of land and hence the second reason for a negative effect of exits onto land productivity also applies. Second, the fourth reason from the exit list – the transaction costs - could be also applied to consolidations; however, we do not expect that this was an important channel because larger part of consolidation costs – expenditures on land works – were covered by the state. Third, the fragmented portfolio of plots that households farmed before the reform could have served as crop insurance and consolidation would have made farming more risky, possibly pushing households to favor less risky production activities at the expense of expected output (Klimin 2002 p.135 provides an example that some peasants indeed considering such type of reasoning). Fourth, peasants that remained in the commune resented households that managed to consolidate their plots. Not only could have the consolidation process generated conflicts among specific households but the consolidated households themselves could have been ostracized or even interfered with directly by their commune neighbors. Given the nature of our data, we will interpret any conflicts stemming from a

household consolidating that interfere with production activities as dampening the usage rights effect. However, we will be able to distinguish openly violent conflicts in order to investigate direct effects of conflict that do not run through changes in usage rights. Finally, given the particularities of the reform, selection into different consolidation procedures may give rise to apparent negative (or positive) effects of the reform.

Given that selection is an econometric as well as an economic issue, we will discuss how we examine this hypothesis in the next section. For the remaining channels of influence, we will attempt to disentangle these effects with the following subsidiary hypotheses. For exits, we will explore three hypotheses on possible negative effects concerning labor overinvestment, transaction costs, and conflicts. For labor overinvestment, we will interact rural density with the exits variable. We address the transaction costs hypothesis in two ways. First, this should be a temporary effect and hence only contemporary exits should negatively affect productivity. Second, we take advantage of the changes in the reform rules that essentially drive the transaction costs of exiting towards zero after 1910. Finally, for conflicts, one would expect that effect to be less pronounced in repartition communes where no actual repartitions occurred because there were no temporary winners and losers.

For consolidations, we will explore the usage rights, transportation costs, scale economies and conflicts hypotheses. We would expect that the usage effect to be more pronounced for village-wide consolidations, which occurred in the communes with better collective decision-making and where the reform was less likely generate to new tensions around land usage. In contrast, the effect of transportation costs should be the same of village-wide consolidations and singular ones. For economies of scale, we introduce the average area of a consolidated plot and argue that this effect should be stronger for plots with greater area. Conflicts will be handled similarly as with exits.

4. Data and Methods

We construct a provincial level dataset on agricultural output, exits and consolidations in the early XXth C. Russian Empire before and during the Stolypin agrarian reform. Using the

variation in the participation in the reform across provinces and over time, we estimate the impact of the two components of the reform that should have affected productivity.

4.1. Data Description.

We combine several official sources published by imperial authorities in the early XXth C. and figures extracted from the archives by previous generations of historians. First, we use data on the titling component of the reform from the journal of the Ministry of Internal Affairs (*Izvestiya Zemskogo otdela MVD*) and Dubrovskij (1963). Second, we employ data on consolidations from annual reports of the Chief Administration of Agriculture and Land Engineering (various titles and years). We use these reports to extract data on subsidies and loans granted to peasants to implement consolidations as well. Official annual statistical volumes of the Russian Empire are our sources for data on grain yields, livestock, rural and urban population; official annual volumes of the Ministry of Agriculture are the source on agricultural wages. We borrow data on railway deliveries of agricultural machines from Davydov (2010) and data on violent conflicts from Grave and Dubrovskij (1926) and Dubrovskij (1956, 1963). Table A1 of the appendix provides a full list of our sources.

Data availability determines the number of observations in our dataset. We have roughly complete information for forty-seven European provinces of the empire out of fifty-four⁷. We have average annual data on these provinces for eight, two before and six after the reform: 1905, 1906, 1907, 1908-1909, 1910-1911, 1912, 1913 and 1914. The availability of exit statistics, published irregularly, determines the reform periods.⁸

Table 1 presents summary statistics of our data. We report variables characterizing the implementation of the Stolypin reform in per peasant grain hectare because we are mainly looking at land productivity. Almost seven households per thousand hectares exited repartition

⁷ The imperial “core” 50 European provinces plus four provinces in the North Caucasus (Kuban, Terek, Stavropol and Chernomosrk). We do not have either exit figures or controls for Arkhangelsk, Chernigov, Chernomosrk, Estlyandiya, Kherson, Olonetz and Yaroslavl.

⁸ Due to the same reason of data availability we have to use data on exits from the commune since November, 6 1906 (the date when the government issued the reform decree) till January, 31 1908 for the 1907 period and since February, 1 1908 till December 31 1909 for the 1908-1909 period.

communes in an average province in an average year during the period under consideration (under the 1906 decree); in addition one and half households per thousand hectares exited in communes where there were no actual reparations since the emancipation (under the 1910 law). The number of consolidations was substantially smaller. Only about two and a half households per thousand hectares consolidated its allotment in an average province in an average year between 1905 and 1913. Almost two of them did this via village-wide consolidations, when all the land in a village was redistributed into consolidated plots at once; and a bit more than another half did this via singular consolidations. The average size of a consolidated plot was about five hectares. Those who consolidated got grants and subsidies from the government; their magnitude was small, only 33 kopeks per cultivated hectare in an average province in an average year. The variation in reform implementation between provinces was substantial.

We construct exit confirmation rate (actual exits to the stock of applications to exit ratio) and consolidation implementation rate (actual consolidations to current applications to consolidate ratio⁹) to measure reform realization relative to demand for the reform. As described in the historical section, the supply of the reform was binding because of red tape and shortage of land survey engineers. Average exits to applications to exit ratio was only about fifteen percent and consolidations to applications to consolidate ratio was about twenty percent.

The other variables characterizing implementation of the reform are the share of complaints on consolidations and the number of violent conflicts in a province, before 1905 and during the period under study. The former characterizes tensions related to land consolidations; peasant could complain to authorities on consolidation decisions. The conflicts variable is an aggregate measure of all types of open protests in the countryside with protests against landlords as the dominant type, i.e. conflicts of peasants with outsiders. Because of the 1905 Russian

⁹ We do not use actual consolidations to the stock applications to consolidate ratio, as in the exit confirmation index, because of a weak instrument problem. If peasants withdrew more applications than they submitted during a year, current applications to consolidate variable could be negative. Because of that consolidation implementation index could be negative as well. The implementation index could be also larger than one if there were more actual consolidations than applications to consolidate during a year, i.e. applications from previous years were realized in a scale larger than the new demand for consolidations.

Revolution there was a lot of violence in the countryside, about fifty-five cases in an average province. Before the reform the scale of violence was much less, only eight and a half conflicts per province¹⁰.

The share of repartition communes without actual repartitions measures the strength of the repartition commune. These repartition communes could not solve collective action problems. By its nature this variable is stable over time but it varies a lot over space from zero (in provinces where there were no repartition communes) to almost ninety percent in Kaluga province where the repartition commune basically did not function.

Land productivity in Russian European provinces on peasants land was about eight hundred kilograms of grain per hectare (grain is defined as a sum of four main crops (both winter and summer) – rye, wheat, barley and oats). It increased from about seven and a half hundred per hectare in 1905 to almost a ton in 1913. We construct the grain area Herfindahl index to account for regional specialization in production of particular grain crop. We cannot estimate labor productivity or TFP in the agrarian sector, since we do not have precise measures of labor or capital in the Russian village. Instead we employ area under grain crops to measure land input, rural population figures as a proxy for labor and livestock (cows and horses) as proxies for capital. We do not have a good measure on the stock of agricultural machines in a province, only on the inflow, namely total weight of machines delivered to a particular province by railroads; so we do not control for agricultural machines in our basic estimations, but use these data on inflow of the machines to explore the mechanism of the reform. There was an average density of forty-five rural citizens per square kilometer, less than one cow and half a horse per hectare of arable land in an average Russian province. In addition, we use the amount of credit which peasants received under the small loans program launched by the central government. This variable is a proxy of peasants' access to credit more generally because they basically did not have any other

¹⁰ Unfortunately, being extracted from secondary works (Anfimov 1998, Grave and Dubrovskij 1926, Dubrovskij 1956 and 1963) our conflicts measures do not vary over time. We know only total number of conflicts in a province in 1901-1904 and in 1905-1914.

options (Korelin 1988). As one could see access to credit was very limited indeed, about one ruble per a thousand of hectares only.

Rural wages during harvest season, share of urban population and migration to the Asian part of the empire represent controls for the three main options available to peasants at that time: to become a hired worker either in agriculture or in a city, or migrate to Southern Siberia where the government provided land. Rural wages during the harvest peak time were about 97 kopeks per day, i.e. up to thirty rubles per month or about a quarter of 1913 GDP per capita (Markevich and Harrison 2011). Urban settlements were growing very fast but their average share was only about twelve and a half percent. The level of migration to Siberia was high (about 3 mln people over ten years) but much less impressive in relative terms; roughly one household per ten thousand hectares migrated to Siberia annually.

Finally, we have data on two other important characteristics of Russian European provinces, the presence of the repartition commune and the presence of local self-governance (*zemstvo*) in a province. We consider a province as a province with repartition communes if at least five percent of peasants belonged to them before the reform (in thirty-two out of thirty-five of our repartition provinces, the actual share was more than a half). By construction, this dummy does not vary over time. We view the *zemstvo* dummy as a very important determinant of agricultural productivity in a province because *zemstvo* initiated various programs aimed to develop peasant agriculture. In particular, they invested a lot into the disseminating of advanced knowledge and techniques as well as basic education among rural citizens. Local self-governments were introduced by the 1864 law but only in about half of all provinces. There were several expansions of number of provinces with *zemstvo* later, including one such expansion in 1911. Accordingly, this variable almost does not vary over time.

4.2. Econometric Specification.

To test our hypotheses on the impact of the Stolypin reform on peasant agriculture, we will use panel data techniques. Our main dependent variable is grain yield per hectare. We prefer to estimate the effect of the reform onto land productivity and not onto labor productivity or TFP

because the former is the most precisely measured. However, we will provide estimates of the reform effect on a pseudo-TFP measure, described below. Our main explanatory variables track the implementation of the land titling and consolidation components of the Stolypin reform, namely number of title conversions, a formal exit from the repartition commune, and the number of land consolidations. We normalize these variables and our (non-categorical) variable controls by lagged area under grain crops. We do not use contemporary area under grain crops because it is possible the reform impacts area under crops. We use a regression model in first differences with linear regional (group of provinces), repartition province and zemstvo trends, and year effects. The main disadvantage to this specification is that one of our important variables, zemstvo dummy, almost does not vary over time and therefore we do not estimate this effect. We employ current reform implementation variables because we are interested in a short-term effect of the reform.

To be precise, we estimate the following equation:

$$\Delta Yieldph_{it} = \alpha + \beta * \Delta Exits_{it} + \Omega * \Delta (Consolidations_{it}) + \Theta * \Delta (Controls_{it}) + (Region_t) + (Year_i) + (Repartition_t) + (Zemstvo_t) + \varepsilon_{it} \quad (1)$$

where subscripts i and t index provinces and years, respectively. *Yieldph* is the output of grain per hectare of area under grain crops; *Exits* and *Consolidations* are measures of the reform implementation. In different specifications, *Consolidations* is either the total number of households that consolidated their plots (per hectare), or contains both types of consolidations separately, singular consolidations and village-wide. We also use as a control variable, the number of consolidations (per hectare) for which the consolidation process requires a household's land to be first separated from an adjacent village or commune (land title specification works).

As controls, we employ rural density per hectare of arable land, number of cows and horses to account for labor and capital inputs. We use rural wages to take into account supply and demand for labor in a province. We also use amount of credit per hectare of area under grain crops and share of urban population to control for industrial markets, accordingly. We control for

zemstvo trends because of its discussed role in agriculture promotion. Further, since exits were unnecessary in provinces without repartition communes, we add a separate linear trend for these provinces. Finally, we control for year fixed effects, $Year_i$, and employ twelve regional linear trends, $Region_t$. Year effects take into account any time trends, such as macroeconomic shocks; regional trends should account for unobserved regional characteristics that change over time, such as climate or different responses of the reform to quality of land.

To construct TFP proxy, we take a reduced-form approach. First, we regress in first differences $\log(\text{yield})$ on $\log(\text{area under crops})$, $\log(\text{rural population})$, $\log(\text{cows})$, $\log(\text{horses})$, $\log(\text{rural wage})$, regional trends, repartition province and zemstvo trends and period dummies. We then regress the residuals (pseudo Solow residuals) on the differenced reform variables (in per capita terms because the household is the decision-making unit), repartition province trend and period effects.

The primary concern with (1) is potential endogeneity because of selection of various types. We address this problem by taking advantage of the constrained supply of the reform due to red tape and the shortage of land survey engineers. We employ 2SLS approach, instrumenting either for number of exits or consolidations with exit confirmation rate and consolidation implementation rate, correspondingly. These instrumental variables estimates should take care of any selection into the reform, based on contemporary unobservable factors.

5. Results and Analysis

Table 2 reports our baseline results based on the specification in (1). While these baseline results suffer from endogeneity concerns, they provide a useful starting point. We first report the results for the pseudo-TFP measure in columns 1-3 since these are the most intuitive (although, as discussed above, the least precise given our data). The coefficient on share of exits is not statistically different from zero in columns 1-3. The coefficient on the share of individual consolidations is positive but not significant at the ten percent level. However, in column 3, when we separate individual consolidations into singular and village-wide, we see a very different story. The coefficient on village-wide consolidations is positive while the coefficient on

singular consolidations is negative and both are statistically significant. This is consistent with an unambiguous improvement in usage rights for village-wide consolidations as well as increased conflict and tensions in communes with singular consolidations. An alternative explanation is that selection drives the different effects: in provinces with lower productivity, the collective action problem involved in village-wide consolidations is more difficult to solve. We will return to this explanation when we discuss the IV estimates in Table 4.

In columns 4-6, we change from the pseudo-TFP measure to the direct measure of total land productivity. As expected, with more precise measurement, the effects are better estimated. The overall changes in land productivity associated with the reform were substantial; according to column 5, one standard deviation increase in exits was associated with a 2.2 percent decrease in land productivity and one standard deviation increase in consolidations with 6.2 percent increase in land productivity. These numbers suggest that if one percent of households exited and then consolidated, there would be an increase in grain yield per hectare of about 4 percent. In column 6, we again separate consolidations into singular consolidations and village-wide consolidations. As discussed in section 3, we expect that the effect of better usage rights should be stronger for village-wide consolidations. Indeed, we see that the coefficient is larger than for the total effect. The coefficient on singular consolidations is negative but insignificant. In column 7 of table 2, we include the total amount of subsidies and grants that households received from the government as a part of the reform. The authorities used these as an incentive at the margin to influence individual households to participate in the reform; therefore, if de facto usage rights were driving the results, then one would expect a negative effect from these subsidies. The coefficient is indeed negative, however, statistically insignificant; that might be because of incomplete data on subsidies for which we have less observations.

Most of our other controls have intuitive signs. The coefficient of rural density, i.e. proxy for labor input, is always positive and significant at the 1% level but relatively large in magnitude (one standard deviation in rural density (roughly a quarter of a person per hectare) results in an increase in nearly 0.18 tons per hectare, or roughly two-thirds of a standard

deviation in land productivity), which would be in conflict with large amounts of surplus labor in the Russian commune. The coefficients on rural wage and cows are positive and statistically significant (with the exception of the coefficient on cows in the specification accounting for subsidies), which confirms the importance of the scarcity of both labor and fertilizer in grain production. The coefficient on horses is negative, a seemingly puzzling result; however, this negative relationship is easily justified by the historical accounts of peasants overinvesting in horses due to market imperfections; each peasant household tended to own a horse to cultivate land.

We address endogeneity and selection concerns using an instrumental variables approach. In table 3, we report the first stage for each reform variable. The coefficients of the instrumental variables suggest that there is enough explanatory power to run the second stage regression. In table 4, we report the second stage results. The first three columns instrument for exits and land consolidations separately and then together. The last three columns instrument for singular and village-wide consolidations separately and then all together with exits in the final column. The effect of exits remains negative and significant and even increases in magnitude, suggesting that it is unlikely that negative selection drives the results. If anything, it appears that more productive provinces were more likely to exit and were better insulated from the negative impacts of exiting, which would be consistent with the conflicts, labor overinvestment and transaction costs explanations. In column 6, with each reform variable as an instrumented variable, an increase of one standard deviation in exits per hectare leads to a decrease in 0.048 tons per hectare, almost one-fifth of a standard deviation. The effect of consolidations, again looking at column 6, separately for singular and village-wide, shows again evidence of positive selection. Those communes that were worse off had more trouble consolidating as a village. Once selection is taken into account, the coefficient is now positive for singular consolidations although insignificant and the coefficient on village-wide consolidations remains positive and significant. The IV results allow us to rule out the transportation costs explanation since both the effects of village-wide and singular consolidations should not differ in this case.

Thus, the results require a more nuanced explanation than the common assertion that improvements in property rights lead to higher productivity. They support the hypothesis that in the short-run changes in the usage right were more important than changes in exclusion and transfer rights.

5.1 Channels of Influence.

In table 5, we attempt to trace the effects of changes in usage rights through the two channels of altering production techniques and adjusting crop choice. In columns 1 and 2, we see that lagged village-wide consolidations explain inflow of agricultural machines. For crop choice, we construct a concentration index over the four main grains and correlate this crop specialization measure with the reform variables in columns 3 and 4. We see a positive association with village-wide consolidations and the grain area Herfindahl index, although the coefficient does not quite reach statistical significance. However, if we allow for the effect to vary by the scale of the consolidate plot (column 5), village-wide consolidations lead to higher Herfindahl indices for provinces with larger consolidated plots, suggesting that better usage rights lead to more specialization when the benefits of specialization are higher.

In table 6, we explore three hypotheses. First, we look at scale effects of consolidations. Second, we investigate the labor overinvestment hypothesis and, third, we use the peculiarities of the reform to see whether transaction costs played a role in the negative effect. In columns 1 and 2 of table 6, we see that there are no scale effects. The coefficients on average consolidated plots are both insignificantly different from zero and the interaction term is even negative. In column 3, we add migrants and interact this with exits. In regions with low levels of resettlement migration, exiting the commune has a stronger negative association with land productivity in terms of the point estimate but this estimate is imprecisely estimated. Since permanent migration releases labor from the densely populated European part of Russia, if this outflow of labor is accompanied by a shift in production away from marginal lands, then this could be evidence for labor overinvestment. We do not have a measure of rural-urban migration, which consisted of both permanent and temporary migration. Instead, we proxy for this movement using the

variable urban population share based on the assumption that higher urban share indicates better off-farm opportunities. In column 4, we see that exits were more negatively associated with productivity in the more urbanized provinces, where peasants had better prospects outside agriculture. But, again, the effect is imprecisely estimated. However, in the first case, most migration is permanent, leading to a withdrawal of whole households and their land, of which the best plots were transferred to other households and the worst left idle, raising overall land productivity. In the second case, most migration is temporary, withdrawing labor from the farm but not necessarily land, which could result in a decrease in overall land productivity. After making a back of the envelope calculation, we can establish a generous estimate of the impact of withdrawing labor from agricultural production in European Russian due to exits of 0.8 mln tones. We get this figure assuming that 20 percent of those who exited quit self-employment in agriculture (Dubrovsky 1963 p. 359) and all of their lands were then withdrawn from cultivation. Since we cannot observe labor inputs this is the best method to approximate the overinvestment hypothesis; this approximation does not count land that remained in production but received less labor. We estimate that the total negative effect of exits is between 2.6-3.1 mln tones, i.e. this characterization of the overinvestment hypothesis does not explain the total effect.

Exits and land privatization were costly and could have negatively impacted agricultural productivity temporarily because of the strain on peasants' budgets. The exiting procedure involved several steps and could have incurred non-negligible transaction costs. In the last three columns of table 6, we investigate the hypothesis that transaction costs explain the negative relationship between exits and land productivity. First, in addition to the exits under the 1906 decree we control for exits in repartition communes who have not had a repartition since the emancipation; the latter became possible only after the 1910 law under a different exiting procedure. Transaction costs could be lower in repartition communes without any actual repartitions since there were no land transfers within the commune to complicate the tracing of claims to land. Column 5 shows that 1906 exits variable has a negative coefficient and the no repartition exits variable has a positive but both are insignificant, generally consistent with the

transaction costs explanation. However, this evidence would also be consistent with the conflict hypothesis. We take advantage of historical peculiarities of the reform to distinguish between these two interpretations. The reform had another built in feature, which created variation in the transaction costs of exiting. After the 1910 decree, transaction costs decreased for all types of exits in the commune, both with and without actual repartitions, so we can test the hypothesis that transaction costs explains the negative effect of exits under 1906 decree by focusing on exits before 1910. Column 6 reports that exits before 1910 fully explain the negative effect that we observe. In column 7, we include lagged exits to see if the negative effect is merely temporary. The coefficient on the lagged share of exits is positive but insignificant. To summarize, we cannot reject the hypothesis that transaction costs explain the negative effect. However, the particular timing of the change in transaction costs corresponds to the timing of two alternative explanations for the pre-1910 negative effect, labor overinvestment and conflicts related to the consolidation procedure.

In table 7, we start with our two measures of rural violence, one pre-reform and one post, and interact these measures with exits (columns 1 and 2); the interaction terms in both columns do not significantly differ from zero. In column 2, in areas with no post-reform violence, the effect of exits is not significantly different than zero although it is still negative, but there is weak evidence that greater unrest post-reform is associated with a more negative relationship between exits and productivity. This gives weak evidence for the conflicts hypothesis. Next, we include a measure of internal conflicts based on the share of complaints about the consolidation process. Interacting each of these variables, in columns 3 and 4, gives little statistical relationship. These results seem unsupportive of the basic conflict story. Finally, in column 5, we allow village-wide and singular consolidations to have different effects for repartition province. The results indicate that there is no significant difference for village-wide consolidations, although the coefficient is negative. For singular consolidations, the effect is actually less negative for repartition provinces and close to zero. In short, the selection story, together with transaction costs and labor overinvestment, seem to explain the observed negative effects.

Moreover, the standard characterization is that consolidations created more controversy in the countryside than exits did but we only observe (net) negative effects for exits.

6. Conclusion.

We find a large positive effect of land consolidations on agricultural productivity. We argue that this effect is primarily driven by changes in de facto usage rights, allowing peasant farmers greater independence to make changes in production decisions. Thus, we reestablish a pessimistic view on the impact of the commune on agricultural productivity. Importantly, this view does not claim that the institution of the commune was inflexible in adjusting to economic changes and peasants' demands *within* a particular crop-production activity. Indeed, studies have shown that the commune had substitutes for factor markets and peasants were able to respond to explicit and implicit prices (Gregory 1980, Nafziger 2010, Castañeda Dower and Markevich 2013). However, our results demonstrate that the restrictive land rights imposed by the commune severely limited the rural households' production function in general. The institution of the commune did not provide enough flexibility to allow farmers to coordinate their production plans once more intensive, specialized or alternative methods of production became profitable.

These results are not only important for understanding the institution of the commune and Russian agriculture in the late imperial period, they also inform the currently fashionable view of enclosure, referring to both the privatization of commonly-held pasture land and the consolidation of fragmented plots -- that it did little to improve agricultural productivity. Incorporating the Russian Empire into this discussion enriches our understanding of how these institutions affected economic development. Since land consolidation had such a large impact on land productivity, a comparative analysis for why we encounter these discrepancies would be valuable.

Finally, we can speculate about a widespread criticism of the reform that, by increasing the level of conflicts, it led the Russian countryside on a path towards revolution. Our results suggest that explanations based on the worsening of peasants' living conditions as a result of reform-induced conflicts seem unlikely. However, the reform's interference with the commune and the

expectation of equal distribution of resources in the countryside could have sown the seeds of revolution. Anecdotal evidence suggests that conflicts induced by the reform played exactly along these lines. Undoubtedly, a more complete understanding of the reform as a cause of the revolution demands further research.

References.

Allen, Robert C. (2003). *Farm to Factory. A Reinterpretation of the Soviet Industrial Revolution*. Princeton: Princeton University Press.

Allen, Robert C. (1992). *Enclosure and the Yeoman: The Agricultural Development of the South Midlands 1450-1850*. Oxford: Clarendon Press.

Anfimov, Andrei M. (1980). *Krest'yanskoe khozyajstvo Evropejskoj Rossii, 1881-1904* [Peasant household in European Russia, 1881 - 1904]. Moscow: Nauka.

Anfimov, Andrei M. (ed.) (1998). *Krest'yanskoe dvizhenie v Rossii v 1901–1904 gg.* [Peasant movement in Russia in 1901–1904]. Moscow: Nauka.

Castaneda Dower, Paul and Andrei Markevich (2013). 'Labor Surplus and Mass Mobilization: Russian Agriculture during the Great War'. *Working paper* available at SSRN: <http://ssrn.com/abstract=2239084>.

Central Statistical Committee of the Ministry of Interior Affairs (1905-1916). *Statisticheskij ezhegodnik Rossii v ... godu* [Statistical yearbook of Russia in ... year]. Annual volumes for 1904 – 1915. Saint-Petersburg.

Central Statistical Committee of the Ministry of Interior Affairs (1902). *Statisticheskij vremennik Rosijskoj imperii* [Statistical periodic of Russian Empire]. Vol. 54. *Urozhaj 1902 goda* [Crop Yield in 1902]. Saint-Petersburg.

Chief Administration of Agriculture and Land Engineering (1908–1912). *Obzor deyatelnosti zemleustroitel'nikh komissij v ...* [Review of Land-Engineering Commissions in ...]. Annual volumes for 1907–1911. Saint-Petersburg.

Chernina, Eugenia, Paul Castaneda Dower and Andrei Markevich (2013). Property Rights, Land Liquidity and Internal Migration. *Journal of Development Economics*, forthcoming.

Commission on Peasant Welfare (1901). *Materialy komissii dlya viyasneniya voprosa o blagosostoyanii krest'yan s 1861 g.* [Materials of the commission on peasant wealth since 1861]. Saint-Petersburg.

Davydov, Mikhail A. (2010). *Vserossijskij rynok v kontse 19 – nachale 20 vv. i zheleznodorozhnaya statistika* [All-Russian market in the late XIXth – early XXth centuries and railway traffic statistics]. Saint-Petersburg: Aleteya.

Dubrovskij, S.M. (1956). *Krest'yanskoe dvizhenie v revolutsii 1905-1907 godov* [Peasants' movement in the 1905-1907 revolution]. Moscow: Izdatel'stvo Akademii Nauk.

Dubrovskij, S.M. (1963). *Stolypinskaya zemel'naya reforma* [The Stolypin land reform]. Moscow: Izdatel'stvo Akademii Nauk.

Gerschenkron, Alexander (1965). 'Agrarian Policies and Industrialization of Russia 1861-1917' in *The Cambridge Economic History of Europe* vol. VI., part II, Cambridge: Cambridge University Press.

Grave, B. and S.M. Dubrovskij (1926). *Krest'yanskoe dvizhenie nakanune revolutsii 1905 goda* [Peasants' movement on the eve of the 1905 revolution]. In *1905 god* [The year 1905]. Vol. 1. Moscow, Leningrad: Gosizdat.

Gregory, Paul (1982). *Russian National Income 1885-1913*. Cambridge: Cambridge University Press.

Gregory, Paul (1980). 'Grain Marketing and Peasant Consumption, Russia 1885-1913,' *Explorations in Economic History* 17(2): 135-164.

Gregory, Paul (1994). *Before Command: The Russian Economy from Emancipation to Stalin*. Princeton: Princeton University Press.

Klimin, I.I. (2002). *Stolypinskaya agrarnaya reforma i stanovlenie krest'yan sobstvennikov v Rossii* [Stolypin agrarian reform and establishment of a class of peasants-landowners in Russia]. Saint-Petersburg: Klio.

Korelin, A.P. (1988). *Sel'sko-khozyastvennij kredit v Rossii v kontse XIX – nachale XX veka* [Agricultural credit in Russia in the late XIXth – early XXth century]. Moscow: Nauka.

Koval'chenko, I.D. (1991). Stolypinskaya agrarnaya reforma (mifi i real'nost') [The Stolypin agrarian reform (myths and reality)], *Istoriya SSSR*, 1991 (2): 52-72.

Khristoforov, I.I. (2011). Ot Speranskogo do Stolypina: krest'yanskaya reforma i problemi zemleustrojstva [From Speransky to Stolypin: peasant reform and land works]. *Rossijskaya istroiya*, 2011 (4): 27-43.

Lachmann, L. M. (1971). *The Legacy of Max Weber*. Berkeley: Glendessary Press.

Lenin, Vladimir (1899). *Razvitie kapitalizma v Rossii* [Development of capitalism in Russia]. Saint-Petersburg.

Markevich, Andrei and Mark Harrison (2011), 'Great War, Civil War, and Recovery: Russia's National Income, 1913 to 1928', *The Journal of Economic History*, 71(3): 672-703.

Markevich, Andrei (2013), 'Economic Development of Late Russian Empire in Regional Perspective', *Mimeo*.

Markussen, Thomas, Finn Tarp and Katleen van der Broek (2011). 'Forgotten Property Rights: Evidence of Land Use Rights in Vietnam', *World Development*, 39(5): 839-850.

Ministry of Interior Affairs (1908-1915) *Novosti Zemskogo Otdela* [The News of Zemskij Department]. Vol. 2, 1908; Vol. 3, 1910; Vol. 3, 1912; Vol. 6, 1914, Vol 7, 1915.

Ministry of Agriculture. Department of agricultural economics and statistics (1906-1914). *Sbornik po selskomu khozyastvuza ... god* [Annual agricultural volume for .. year] Annual volumes for 1906-1914, Saint-Petersburg.

Ministry of internal affairs. (1908-1914). *Izvestia zemskogo otdela MVD*. [News of provincial department of the Ministry of internal affairs]. Monthly volumes for 1908-1914, Saint-Petersburg.

Nafziger, Steven, (2008). 'Communal Institutions, Resource Allocation, and Russian Economic Development: 1861–1905', *The Journal of Economic History*, 68(2): 570-575.

Nafziger, Steven (2010). 'Peasant Communes and Factor Markets in Late Nineteenth-century Russia', *Explorations in Economic History*, 47(4): 381–402.

Pallot, Judith (1999). *Land Reform in Russia, 1906-1917. Peasant Response to Stolypin's Project of Rural Transformation*. Oxford: Clarendon press.

Tukavkin, V.G. (2001). *Velikorusskoe krest'yanstvo i Stolypinskaya agrarnaya reforma*. [Great Russian peasants and the Stolypin agrarian reform] Moscow: Pamyatniki istoricheskoy mysli.

Turchaninov, N. (1910). *Itogi pereselencheskogo dela* [The results of resettlement movement] Vol. 1. Saint-Petersburg.

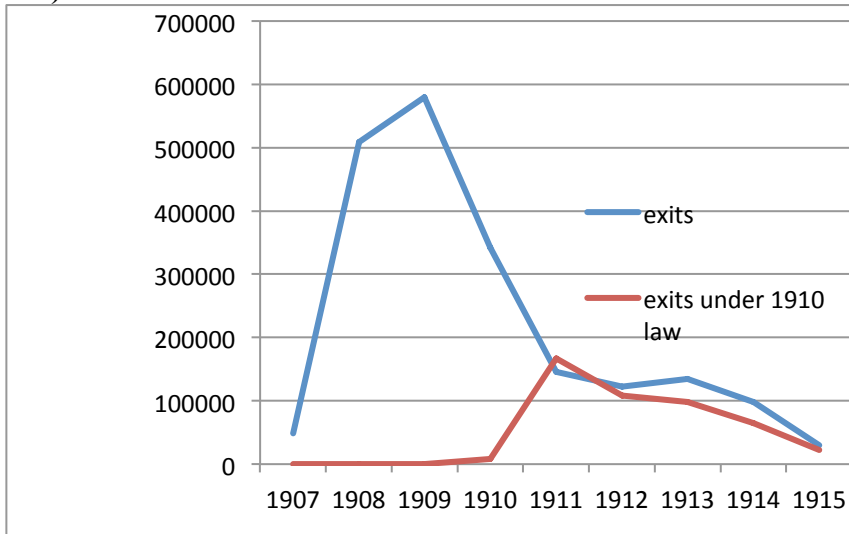
Turchaninov, N. (1915). *Itogi pereselencheskogo dela* [The results of resettlement movement] Vol. 2. Saint-Petersburg.

Volkov, S.N. (1999). *Ot zemlemernoj shkoli do universiteta: ocherki istorii gosudarstvennogo universiteta po zemleustrojstvu za 1779-1999* [From land engineering school to university: a history of the State University of land engineering in 1779-1999] Moscow: Kolos.

Williams, Stephen F. (2006). *Liberal Reform in an Illiberal Regime. The Creation of Private Property in Russia, 1906 - 1915*, Stanford: Hoover Institution Press.

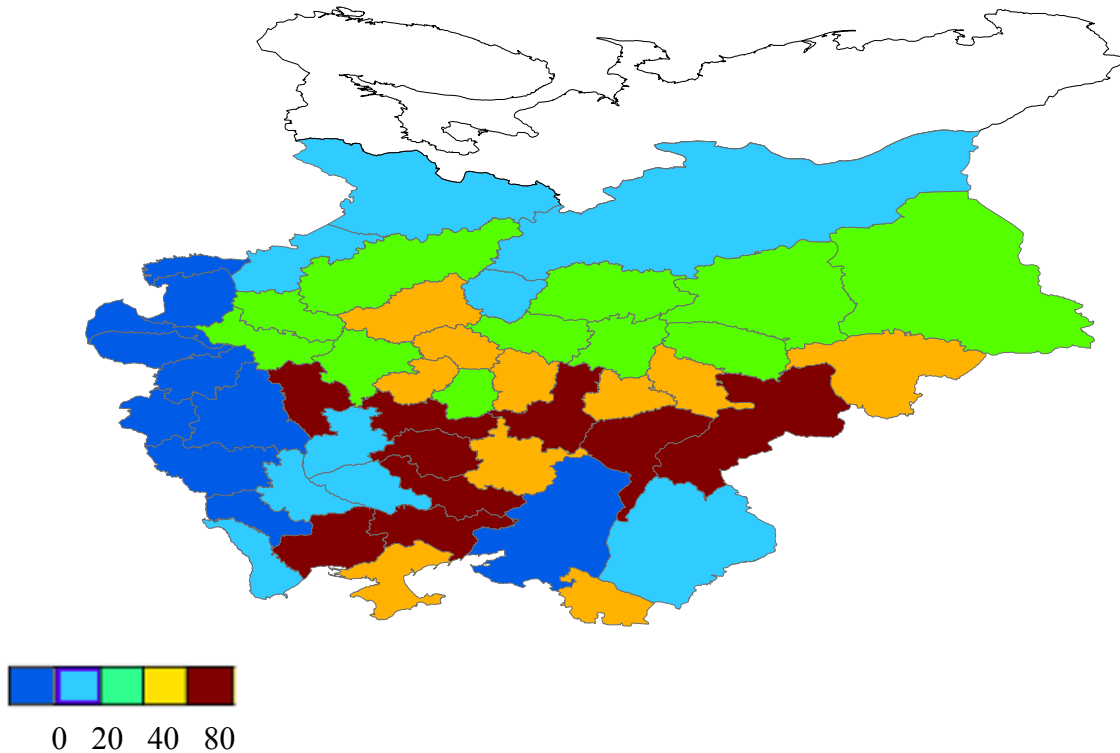
Zyrianov, P. (1992). *Krest'yanskaya obshchina v Evropeiskoi Rossii v 1907 – 1914 gg.* [Peasant commune in European Russia in 1907-1914], Moscow: Nauka.

Figure 1. Exits and exits in repartition communes without actual repartitions (under 1910 law).



Source. *Dubrovksy (1963)*.

Figure 2. Exits (000) over space.

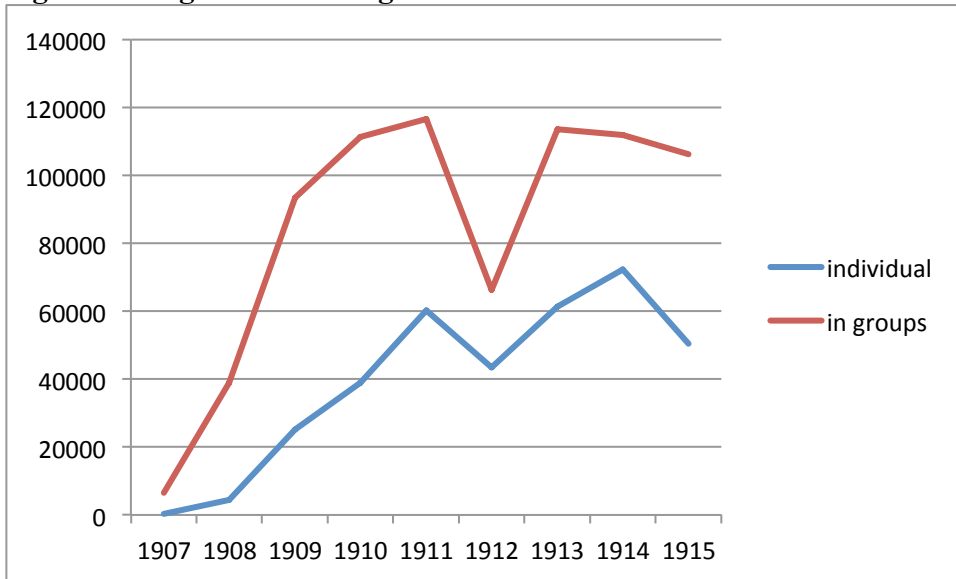


Note: Exits are in thousands of households.

Dark blue provinces are provinces with zero exits from repartition commune. There were either no communes there (3 Baltic provinces), either all peasants belonged to hereditary communes (all provinces in the West) or Cossacks land tenure dominated (Don).

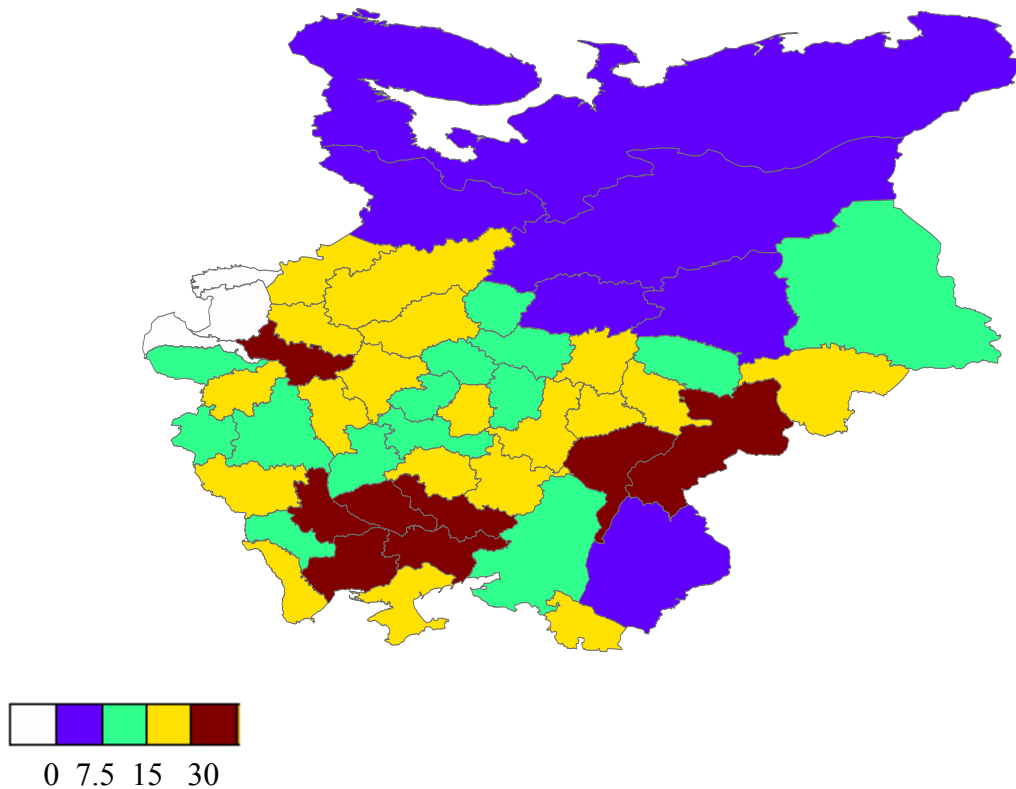
No data for Archangelsk province in the North that is left blank.

Figure 3. Singular and village-wide consolidations.



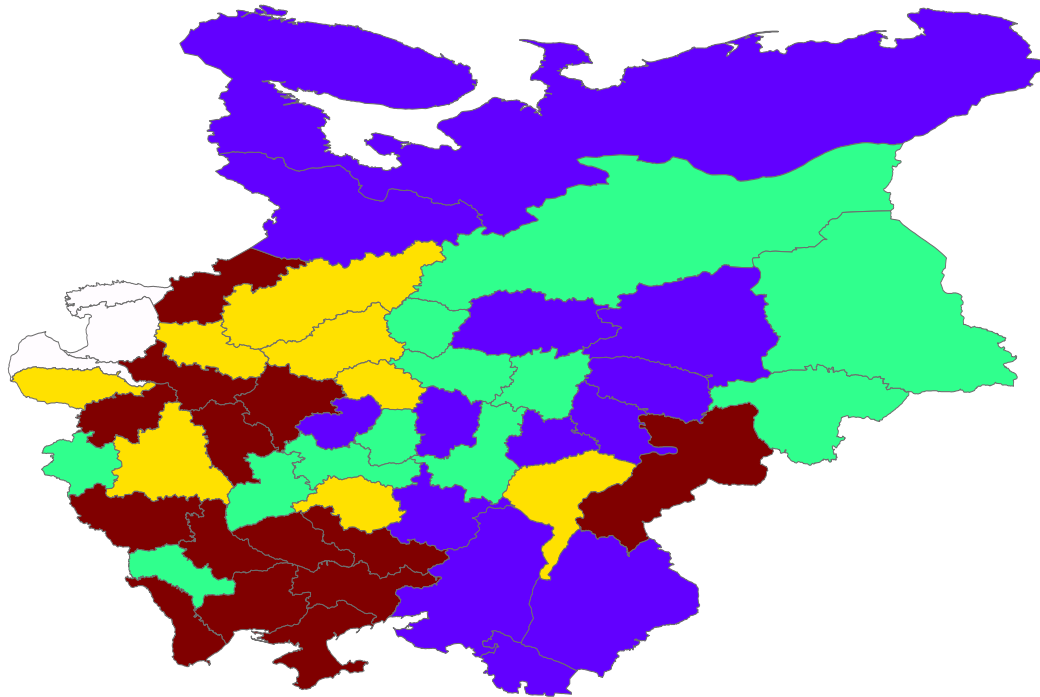
Sources: Annual reports of the chief administration of agriculture and land engineering.

Figure 4. Consolidations, all types (000), over space.



Note: Consolidations are in thousands of households.

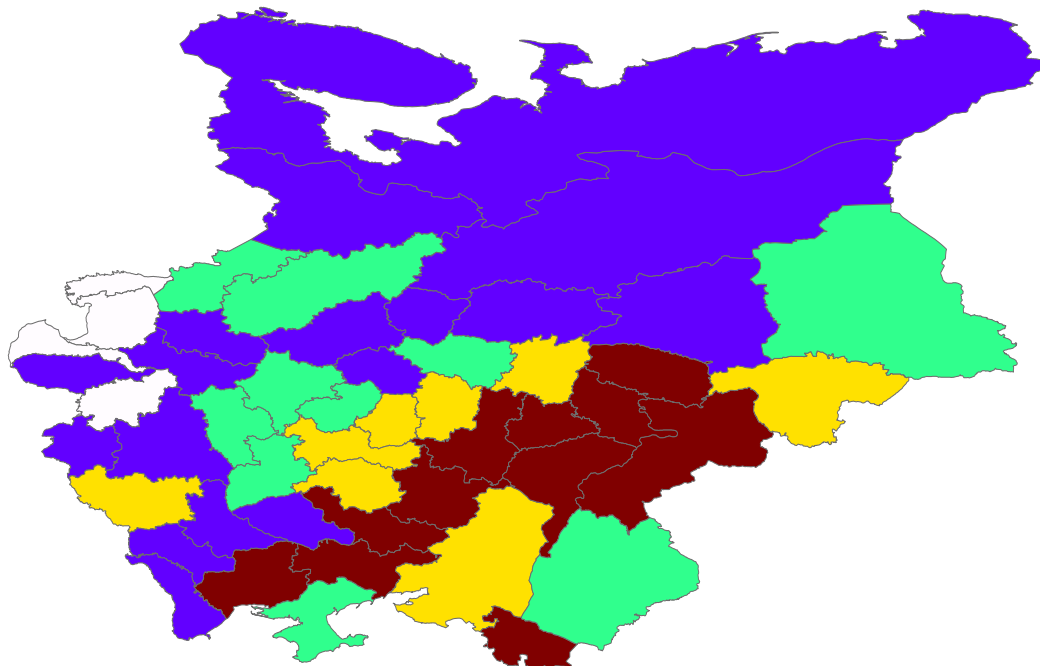
Figure 5. Village-wide consolidations (000) over space.



0 5 10 20

Note: Consolidations are in thousands of households.

Figure 6. Singular consolidations (000) over space.



0 2.5 5 10

Note: Consolidations are in thousands of households.

Figure 7. Summary of the effects of the two components of the Stolypin reforms onto agricultural productivity.

	Exit	Exit and Consolidation
Exclusion right	+	+
Transfer right	+	+
Usage right	~	+
Scale effect	~	+
Eased mobility restrictions	-/+	-/+
Transaction costs	-	-/~
Transportation costs	~	+
Conflicts	-	-
Insurance	~	-

Table 1. Summary statistics.

Variable	Mean	Std. Dev.	Min	Max	N
Number of hhs exited per hectare	0.0067	0.0187	0	0.2636	374
Number of hhs exited per hectare in no repartition communes	0.0015	0.0043	0	0.0422	340
Number of hhs consolidated land per hectare (total)	0.0026	0.0040	-0.0018	0.0262	376
Number of hhs consolidated land per hectare (village-wide)	0.0018	0.0034	-0.0018	0.0229	376
Number of hhs consolidated land per hectare (singular)	0.0007	0.0012	0	0.006	376
Reform subsidies and grants per hectare (in rubles)	0.3268	0.6334	0	5.0076	393
Share of complaints on consolidations (all)	0.0208	0.0282	0	0.1421	376
Average size of consolidated plot	4.983	6.297	-5.499	30.895	423
Exit confirmation rate (exits to stock of applications ratio)	0.1421	0.2098	0	0.980	421
Consolidation (all) implementation rate (all consolidations to current all applications ratio)	0.2019	0.2724	-0.152	2.432	423
Consolidation (village-wide) implementation rate (village-wide consolidations to current village-wide applications ratio)	0.2286	0.3741	-0.273	3.597	423
Consolidation (singular) implementation rate (singular consolidations to current singular applications ratio)	0.1472	0.2371	0	1.293	423
Pre-reform conflicts	8.64	10.06	1	44	45
Number of openly violent conflicts	55.47	54.43	1	212	43
Share of repartition communes without actual repartitions since the emancipation in 1905	0.3673	0.31	0	0.884	46
Peasant grain yield, tons per hectare	0.7919	0.2776	0.0689	1.6103	423
Peasant area under grain crops, hectares	981000	772000	174000	5430000	423
Grain area Herfindahl index	0.45	0.11	0.268	0.913	423
Total Population ('000s)	2400.76	883.33	708.70	4663.6	376
Rural density per sq km	44.83	22.28	4.55	114.03	376
Number of cows per hectare	0.9441	0.5965	0.1501	5.2969	376
Number of horses per hectare	0.5588	0.2207	0.0598	1.9972	376
Amount of small credit loans per hectare (rubles)	0.0013	0.0028	0	0.0221	420
Rural daily wage in harvest season (kopeks)	97.02	32.96	45	234	368
Urban share	0.1257	0.1160	0.0059	0.7425	376
Migrants per hectare	0.0009	0.0017	0	0.0193	415
Local self-government dummy (zemstvo)	0.7021	0.4579	0	1	376
Repartition province dummy	0.77	0.43	0	1	47

Table 2. The effect of exits and consolidations on agricultural grain productivity.

Dependent Variable=	Pseudo-TFP Pooled OLS			Grain Yield per Hectare First Differences			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Exits per capita	-0.000	-0.000	-0.001				
	[0.003]	[0.003]	[0.003]				
Consolidation per capita		0.014					
		[0.010]					
Consolidation per capita (village-wide)			0.040**				
			[0.017]				
Consolidation per capita (singular)			-0.048**				
			[0.022]				
Exits per hectare				-0.640	-0.921**	-1.041**	-1.127**
				[0.421]	[0.384]	[0.394]	[0.449]
Consolidations per hectare					11.471***		
					[4.228]		
Consolidations per hectare (village-wide)						16.180***	17.734***
						[5.304]	[5.865]
Consolidation per hectare (singular)						-23.391	-23.284
						[15.527]	[16.279]
Rural Density				0.006***	0.008***	0.008***	0.009***
				[0.002]	[0.002]	[0.002]	[0.002]
Small credit loans per hectare				0.042	-1.314	-2.956	-6.498
				[5.047]	[5.275]	[4.156]	[4.156]
Cows (hundreds per hectare)				0.047***	0.049***	0.048***	-0.004
				[0.017]	[0.017]	[0.018]	[0.128]
Horses (hundreds per hectare)				-0.105*	-0.117**	-0.114**	-0.026
				[0.054]	[0.052]	[0.053]	[0.202]
Rural wage				0.003***	0.003***	0.003***	0.003***
				[0.001]	[0.001]	[0.001]	[0.001]
Urban Share				0.688	0.488	0.610	0.859
				[1.136]	[1.150]	[1.137]	[1.278]
Subsidies and grants per hectare							-0.018
							[0.021]
Regional Trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Repartition Province and Zemstvo Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.004	-0.007	-0.009	0.050	0.053	0.047	0.165***
	[0.044]	[0.049]	[0.049]	[0.056]	[0.054]	[0.052]	[0.045]
Observations							
R-squared	306	306	306	306	306	306	282

The dependent variable in columns 1-3 is a pseudo measure of TFP. See the text for a description about how this variable is constructed. For columns 4-7, the dependent variable is peasant grain one of the reform variables, exits or consolidations per hectare. The estimation is performed using first differences. The basic set of control variables contains rural population density, the number of credit cooperatives per hectare, cows (hundreds per hectare), horses (hundreds per hectare), and urban share of the population. Clustered-robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table 3. First-stage Results

Dependent Variable=	Exits Per hectare	Individual Consolidations per hectare	Individual (village-wide) Consolidations per hectare	Individual (singular) Consolidations per hectare
	(1)	(2)	(3)	(4)
Exits confirmation rate	0.079*** [0.023]			
Consolidation implementation rate		0.005*** [0.001]		
Consolidation implementation rate (village-wide)			0.001*** [0.000]	
Consolidation implementation rate (singular)				0.002*** [0.001]
Exits per hectare		0.028*** [0.008]	0.026*** [0.007]	0.001 [0.001]
Consolidations per hectare	2.012 [1.877]			
Consolidations per hectare (village- wide)				0.005 [0.018]
Consolidation per hectare (singular)			-0.024 [0.181]	
Controls	Yes	Yes	Yes	Yes
Regional Trends	Yes	Yes	Yes	Yes
Repatriation Province and Zemstvo Trend	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes
Constant	-0.004 [0.004]	-0.000 [0.000]	-0.002*** [0.000]	-0.000 [0.000]
Observations	305	306	306	306
R-squared	0.520	0.601	0.460	0.456

The dependent variable is one of the reform variables, exits or consolidations per hectare. The estimation is performed using first differences. The basic set of control variables contains rural population density, the number of credit cooperatives per hectare, cows (hundreds per hectare), horses (hundreds per hectare), and urban share of the population. Clustered-robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table 4. IV Estimates of the effect of exits and consolidations on agricultural grain productivity.

Dependent Variable=	Grain yield per hectare					
	First Differences					
	(1)	(2)	(3)	(4)	(5)	(6)
Exits per hectare	-1.783** [0.904]	-1.359*** [0.422]	-2.080** [0.979]	-2.072*** [0.667]	-1.032*** [0.347]	-2.591** [1.168]
Consolidations per hectare	13.618*** [5.003]	28.532** [12.752]	28.061** [12.607]			
Consolidations per hectare (village-wide)				56.447** [22.387]	15.823*** [4.885]	52.878** [22.398]
Consolidation per hectare (singular)				-26.911* [14.299]	11.607 [26.944]	3.375 [30.210]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Regional Trends	Yes	Yes	Yes	Yes	Yes	Yes
Repartition Province and Zemstvo Trend	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.195*** [0.039]	-0.182*** [0.041]	-0.185*** [0.041]	-0.147*** [0.053]	-0.188*** [0.041]	-0.156*** [0.053]
Observations	305	306	305	306	306	305
R-squared	0.400	0.380	0.376	0.293	0.408	0.303

The dependent variable is peasant grain yield per hectare. The estimation is two-stage least squares performed using first differences. The basic set of control variables contains rural population density, the number of credit cooperatives per hectare, cows (hundreds per hectare), horses (hundreds per hectare), and urban share of the population. Clustered-robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table 5. Land consolidations and changes in usage rights.

Dependent Variable=	Inflow of Agricultural Machines per Hectare		Grain Area Herfindahl Index		
	First		First		First
	Differences	IVFD	Differences	IVFD	Differences
	(1)	(2)	(3)	(4)	(5)
Lagged Exits per hectare	-0.008 [0.005]	0.003 [0.013]			
Lagged Consolidation per hectare (village-wide)	0.316*** [0.096]	0.564*** [0.216]			
Lagged Consolidation per hectare (singular)	-0.020 [0.199]	-0.224 [0.387]			
Exits per hectare			0.146*** [0.029]	-0.032 [0.160]	0.117*** [0.026]
Consolidations per hectare (village-wide)			0.426 [0.332]	7.608 [5.849]	-1.345 [0.815]
Consolidation per hectare (singular)			0.672 [0.996]	0.751 [2.980]	-2.201 [2.186]
Scale*Consolidations per hectare (village-wide)					0.215** [0.101]
Scale*Consolidation per hectare (singular)					0.265 [0.237]
Scale of consolidated plot					-0.000 [0.000]
Controls	Yes	Yes	Yes	Yes	Yes
Regional Trends	No	No	No	No	No
Repartition Province and Zemstvo Trend	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes
Lagged Ag. Machines	Yes	Yes	No	No	No
Constant	0.001* [0.000]	0.001 [0.001]	-0.001 [0.009]	-0.007* [0.004]	
Observations	0.001*	0.001	-0.001	0.004	0.000
R-squared	[0.000]	[0.001]	[0.008]	[0.009]	[0.004]

The dependent variable in columns 1 and 2 is the inflow of agricultural machines by railways per hectare. In columns 3 and 4, the dependent variable is a Herfindahl index, computed using the share of area under grain crops by grain crop. The estimation is performed using first differences. The basic set of control variables contains rural population density, the number of credit cooperatives per hectare, cows (hundreds per hectare), horses (hundreds per hectare), and urban share of the population. Clustered-robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table 6. Economies of scale, labor overinvestment and transaction costs.

Dependent Variable=	Grain yield per hectare						
	First Differences						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Exits per hectare	-0.922** [0.386]	-0.944** [0.397]	-2.495** [1.016]	-0.859* [0.484]	-0.508 [0.465]		-0.852*** [0.291]
Consolidations per hectare	11.498** [4.387]	10.026 [8.872]	11.424** [4.263]	11.473*** [4.240]	6.068 [4.022]	11.163** [4.532]	12.820*** [4.748]
Avg. size of consolidated plot	-0.000 [0.004]	-0.000 [0.003]					
Avg. Size*Consolidations per hectare		0.175 [0.813]					
Migrants*Exits per hectare			0.630 [0.387]				
Urban Share*Exits per hectare				-0.687 [3.029]			
Exits per hectare in no repartition communes					5.299 [3.673]		
Exits per hectare post-1910						0.020 [2.667]	
Exits per hectare pre-1910						-0.914** [0.390]	
Lagged Exits per hectare							0.358 [0.469]
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regional Trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Repartition Province and Zemstvo Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.079** [0.033]	0.078** [0.033]	-0.001 [0.052]	0.053 [0.054]	0.056 [0.098]	0.054 [0.053]	0.037 [0.053]
Observations	306	306	302	306	238	306	259
R-squared	0.407	0.407	0.416	0.407	0.447	0.407	0.436

The dependent variable is peasant grain yield per hectare. The estimation is performed using first differences. The basic set of control variables contains rural population density, the number of credit cooperatives per hectare, cows (hundreds per hectare), horses (hundreds per hectare), and urban share of the population. Clustered-robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table 7. The effect of reform-induced conflict on agricultural productivity.

Dependent Variable=	Grain Yield per hectare				
	First Differences				
	(1)	(2)	(3)	(4)	(5)
Exits per hectare	-1.418*** [0.524]	-1.059 [1.123]	-0.774* [0.413]	-0.878** [0.420]	-1.029** [0.388]
Consolidations per hectare	13.796*** [4.998]	15.403** [6.354]	7.287 [5.266]		
Consolidations per hectare (village-wide)				13.366** [6.286]	16.358* [8.289]
Consolidation per hectare (singular)				-40.784 [27.004]	-345.229** [166.582]
Pre-reform Conflicts*Exits per hectare	0.052 [0.072]				
Regional Violence*Exits per hectare		-0.001 [0.016]			
Share of complaints*Consolidations per hectare			76.594 [79.277]		
Share of complaints*Consolidations per hectare (village-wide)				43.125 [73.223]	
Share of complaints*Consolidation per hectare (singular)				412.808 [499.615]	
Share of complaints			0.369 [0.477]	0.216 [0.408]	
Repartition Province*Consolidations per hectare (village-wide)					-0.306 [8.865]
Repartition Province*Consolidations per hectare (singular)					322.328* [170.194]
Controls	Yes	Yes	Yes	Yes	Yes
Regional Trends	Yes	Yes	Yes	Yes	Yes
Repartition Province and Zemstvo Trends	Yes	Yes	Yes	Yes	Yes
Period Effects	Yes	Yes	Yes	Yes	Yes
Constant	0.111** [0.044]	0.019 [0.043]	0.052 [0.053]	0.043 [0.053]	0.046 [0.051]
Observations	253	200	306	306	306
R-squared	0.433	0.256	0.410	0.423	0.421

The dependent variable is peasant grain yield per hectare. The estimation is performed using first differences. The basic set of control variables contains rural population density, the number of credit cooperatives per hectare, cows per hectare, horses per hectare, and urban share of the population. Clustered-robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table A1. Data sources.

Variable name	Variable definition	Source
Exits	Number of households exited the commune under 1906 decree	Ministry of Internal Affairs (1908-1914)
Exits in no repartition communes	Number of households exited the commune under 1910 law (in communes without actual repartitions)	
Consolidations	Number of households that consolidated land	Chief Administration of Agriculture and Land Engineering (1908-1914)
Consolidations (singular)	Number of households consolidated land individually	
Consolidations (village-wide)	Number of households that consolidated land at once as a village.	
Subsidies and loan	Amount of subsidies and loans provided to peasants that consolidated land	
Average size of consolidated plot	Average size of individually consolidated plot	
Complaints on consolidations	The share of complaints that were appealed by peasants.	
Exit confirmation rate	Exit confirmation rate (ratio of exits confirmed by local courts to all applications to exit)	
Consolidations implementation rate	Consolidation implementation rate (ratio of all implemented consolidations to all applications to consolidated)	Chief Administration of Agriculture and Land Engineering (1908-1914).
Pre-reform conflicts	Number of openly violent peasant unrests in a province during 1901–1904	Anfimov (1998)
Regional violence	Number of outright violent conflicts	Grave and Dubrovskij (1926); Dubrovskij (1956, 1963)
Grain yield	Grain (rye, wheat, barley and oats) yield in tons per hectare	Central Statistical Agency of the USSR(1928)
Grain area	Area under four main grain crops – rye, wheat, barley and oats	
Population	Population in thousands on January, 1 st of each year	Central Statistical Committee of the Ministry of Interior Affairs (1905–1916)
Rural density	Rural population per square kilometer on January, 1 st of each year	
Urban share	Share of urban population	
Horses	Number of horses in hundreds per hectare	
Cows	Number of cows hundreds per hectare	
Zemstvo province	Zemstvo dummy for provinces with elected local governments (zemstvos)	
Repartition province	Repartition province dummy for provinces with at least five percent of repartition communes	Durbrovskii (1963)
Inflow of agricultural machines	Agricultural machines in tons supplied to a province by railroads	Davydov (2010)
Rural wage	Daily earnings of rural workers in harvest season	Ministry of Agriculture (1906-1914)
Rural credit supply	Amount of small credit loans	Department of Small Credit (1905-1915)
Migrants	Number of migrant families passed through Syzran and Chelyabinsk registration centers per 1000 rural citizens	Turchaninov N. (1910, 1915)

References.

Anfimov, Andrei M. (ed.) (1998). *Krest'yanskoe dvizhenie v Rossii v 1901–1904 gg.* [Peasant movement in Russia in 1901–1904]. Moscow: Nauka.

Central Statistical Agency of the USSR (1928). *Svod urozhajnikh svedenij za godi 1883-1915* [Yields in 1883-1915] Moscow: TsSU press.

Central Statistical Committee of the Ministry of Interior Affairs (1905-1916). *Statisticheskij ezhegodnik Rossii v ... godu* [Statistical yearbook of Russia in ... year]. Annual volumes for 1904 – 1915. Saint-Petersburg.

Central Statistical Committee of the Ministry of Interior Affairs (1902). *Statisticheskij vremennik Rosijskoj imperii* [Statistical periodic of Russian Empire]. Vol. 54. *Urozhaj 1902 goda* [Crop Yield in 1902]. Saint-Petersburg.

Chief Administration of Agriculture and Land Engineering (1908–1912). *Obzor deyatelnosti zemleustroitel'nikh komissij v ...* [Review of Land-Engineering Commissions in ...]. Annual volumes for 1907–1911. Saint-Petersburg.

Chief Administration of Agriculture and Land Engineering (1911). *Zemleustrojstvo (1907–1910)* [Land-Engineering (1907–1910)]. Saint-Petersburg.

Chief Administration of Agriculture and Land Engineering (1913–1915). *Otchenie svedeniya o deyatelnosti zemleustroitel'nikh komissij na ...* [Report of Land-Engineering Commissions in...]. Annual volumes for 1912–1914. Saint-Petersburg.

Davydov, Mikhail A. (2010). *Vserossijskij rinoz v kotze 19 – nachale 20 vv. I zhelezodorozhnaya statistika* [All-Russian market in the late XIXth –early XXth centuries and railway traffic statistics]. Saint-Petersburg: Aleteya.

Department of Small Loans (1905-1915). *Otchet po melkomu kreditu za ... g.* [Report on small loans in ... year]. Annual volumes for 1905-1915. Saint-Petersburg.

Dubrovskij, S.M. (1956). *Krest'yanskoe dvizhenie v revolutsii 1905-1907 godov* [Peasants' movement in the 1905-1907 revolution]. Moscow: Izdatel'stvo Akademii Nauk.

Dubrovskij, S.M. (1963). *Stolypinskaya zemel'naya reforma* [The Stolypin land reform]. Moscow: Izdatel'stvo Akademii Nauk.

Grave, B. and S.M. Dubrovskij (1926). *Krest'yanskoe dvizhenie nakanune revolutsii 1905 goda* [Peasants' movement on the eve of the 1905 revolution]. In *1905 god* [The year 1905]. Vol. 1. Moscow, Leningrad: Gosizdat.

Ministry of Interior Affairs (1908-1915) *Novosti Zemskogo Otdela* [The News of Zemskij Department]. Vol. 2, 1908; Vol. 3, 1910; Vol. 3, 1912; Vol. 6, 1914, Vol 7, 1915.

Ministry of Agriculture. Department of agricultural economics and statistics (1906-1914). *Sbornik po selskomu khozyastvuza ... god* [Annual agricultural volume for .. year] Annual volumes for 1906-1914, Saint-Petersburg.

Ministry of Internal Affairs. (1908-1914). *Izvestia zemskogo otdela MVD*. [News of provincial department of the Ministry of internal affairs]. Monthly volumes for 1908-1914, Saint-Petersburg.

Ministry of Justice. (1907–1915). *Statisticheskie sborniki Ministerstva Yustitzii* [Statistical Volumes of Ministry of Justice]. Annual volumes. Saint-Petersburg.

Turchaninov N. (1910). *Itogi pereselencheskogo dela* [The results of resettlement movement] Vol. 1. Saint-Petersburg.

Turchaninov N. (1915). *Itogi pereselencheskogo dela* [The results of resettlement movement] Vol. 2. Saint-Petersburg.