Property Rights, Land Liquidity and Internal Migration — **Source link**

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Property Rights and Internal Migration: The Case of the Stolypin Agrarian Reform in the Russian Empire

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"Property Rights and Internal Migration:

The Case of the Stolypin Agrarian Reform in the

Russian Empire"[1]

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Abstract

While economists have little question about the potential for liquidity constraints to influence the migration decision, the relative importance of these constraints has resisted empirical verification. The unique nature of the Stolypin agrarian reform in Russia provides a natural experiment with exogenous variation in liquidity constraints. The reform gives peasants the right to withdraw from the commune and to sell one's share of land. Previously liquidity constrained households could then take this opportunity to migrate to less populated areas. Some communes were not affected by the reform, permitting difference-in-differences analysis. Using a panel of historical data from 1901-1914 on regional migration, we find a strong positive correlation between the reform and migration. We employ instrumental variables to address the possible endogeneity due to omitted factors that might drive both commune exit and migration.

JEL Codes: J61, N33, N53, O12, O13

1. Introduction

Internal migration is a central feature of economic development. Indeed, industrialization and the settlement of the frontier are the two major stories of development in the modern era. The forces that influence internal migration have been well discussed by economists (Lucas 1997; Greenwood 1997). However, strong empirical evidence for the importance of the various forces has been elusive. Moreover, there is a clear need for such evidence given the debates about internal migration in the contemporary policy discourse. For example, a recent report by the World Bank (World Bank 2010) argues that Russians should be moving around within the country more than they are, considering the economic costs and benefits. One explanation for why Russians do not migrate is the liquidity constraint many face. This explanation also fits the situation in China after the financial crisis of 2008-2009 when many Chinese migrants who had moved to urban areas for work returned to their rural homes (Hsu et al 2010). Nevertheless, economists have had difficulty in showing empirically the importance of liquidity constraints in the migration decision. This paper takes advantage of a natural experiment that provides a source of exogenous variation in liquidity constraints faced by potential migrants. Specifically, this paper investigates the impact of 1906 Stolypin agrarian reform, occurring in the European part of the Russian Empire, on migration to Siberia - an attractive destination for Russian peasants[2] - in the late XIXth and early XXth centuries.

The Stolypin reform represented a set of policies aimed to attack poverty and low productivity of Russian agriculture. The reform undermined the power of the peasant repartition commune, the key institution in the majority of provinces (*guberniya*s) of the empire. For our purposes, the reform can be viewed as restructuring peasants' claims to land under the commune to claims with greater individual rights in the regions with repartition communes. Giving peasants greater individual control meant they could more easily sell their plots and have greater liquidity; hence, the opportunity to sell individual claims to property eases the economic burden of migration.

We construct a panel dataset on regional migration to Siberia, before and after the reform. We can then apply difference-in-differences analysis to the regions affected and those unaffected by the reform in order to analyze the link between the reform and migration. To unpack the mechanism of

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[2] Both contemporary surveys and interviews with former migrants from the 1950s and 1960s state increasing welfare of migrants relative to their living standards at the regions of out-migration (Tukavkin 2001). The stereotype about Siberia as a region unsuitable for living, which influenced strongly by the Gulag archipelago and Stalin's forced migration, is correct only for the Northern part of Siberia. Climate in the South Siberia is very similar to climate of the great plains of Canada and the northern part of the US.

this link, we investigate the relation between the number of title conversions, resulting in an exit from the commune, and migration to Siberia. We also employ an instrumental variables approach to deal with the potential endogeneity problem. We find that the reform, through the channel of exiting the commune, has a positive and significant effect on migration to Siberia. These are our baseline results. With them, we contribute to the empirical literature on migration showing directly for the first time that the relaxing of liquidity constraints increases migration.

Second, we take advantage of historical peculiarities of the reform to compare effects of different mechanisms to ease liquidity constrains. We are able to separate the impact of the land titling aspects of the Stolypin agrarian reform from the government's migration policy. The latter largely existed independently of the reform and changed considerably during the years leading up to the reform and concurrently with the reform, evolving from a restrictive policy to a promoting one. Large-scale spending on resettlement administration, developing new lands, providing credit and benefits to settlers all were implemented during the time of the Stolypin reform. However, both before and after the reform, only approved migrants could take advantage of the generous migration policies of the government. We study subsidized (who were approved) and unsubsidized (those who did not seek approval) migration flows to separate the effect of shifts in governmental policy towards migration from the effect of the titling reform.

Our third contribution is to the literature on land titling and individual decisions. The previous authors have stressed the indirect effects of improved tenure security onto migration (Field 2007, Do and Iyer 2008, De la Rupelle et. al. 2009), while we demonstrate that there might be a direct effect working via the eased liquidity constraint. In general, this direct effect might not be present because land titling reforms usually decrease the attractiveness of migration by improving living standards in the regions of potential out-migration. That is to say, the institutional reform is designed to address the poverty trap in rural areas by improving access to credit, incentives to invest, and dispute resolution concerning property. Again, we take advantage of uniqueness of the Stolypin reform to show that the pure economic effect of the titling reform might be larger than the institutional effect.

Finally, we contribute to a better understanding of the nature and design of the Stolypin agrarian policy demonstrating that its two major components, namely the land titling reform and encouragement of migration, were consistent with each other. Previous economic historical literature tended to overlook this connection (Dubrovsky 1963, Zyryanov 1992, Williams 2006 etc. but with an important exclusion of Tukavkin 2001).

The structure of this paper is the following: Firstly, we describe the previous literature and provide a historical review of the Stolypin reform. Next, we establish a simple model of the

migration decision and discuss the economic arguments for which outcomes we might expect. Then, we introduce and summarize the data and present the empirical results. Finally, we make some conclusions about the empirical relation between titling reform, liquidity constraints and internal migration based on the Stolypin reform.

2. Literature Review

The modern migration literature starts with the classical paper by Lewis (1954) which models rural-urban movements as a shift of "surplus" labor from the countryside to cities, caused by a structural change in economic organization related to the rise of modern industry. A belief on behalf of the potential migrants in rural areas that their resources are not being put to their most valued use underlies their decisions to migrate in this model and in many later migration models (e.g. Todaro 1969). The transportation costs, transaction costs and liquidity constraints are other factors that are usually accounted for in migration models (see Stark 1991 for a review).

Although gravity or wage differential models can easily incorporate a liquidity constraint, to our knowledge, the literature has underemphasized the role of liquidity constraints as a main factor in determining migration patterns. One notable exception is the literature on illegal migration since illegality can foster the use of cheap labor as collateral (Friebel and Guriev 2006, Assunçao, J. J., and Carvalho, L. S. 2009). This theory does not work for internal migration for which illegality can not be used as a credible commitment to work at below market wages. The underemphasis in the empirical literature is likely due to the difficulty in separating one's opportunities at place of origin and the liquidity constraint. Some studies provide evidence of a liquidity constraint (Hatton and Williamson 1994, Andrienko and Guriev 2004; Halliday 2006) but these studies must resort to testing whether or not there is a positive correlation between income or wealth and migration below some threshold. In this case, the observed relationship between wealth or income and liquidity constraints is still likely to be biased. For example, in poorer areas, the extent of household production may induce nonlinearities in household size and the number of migrants, quite apart from liquidity constraints, and household size might correlate positively with wealth. Indeed, there are many possible stories since wealth tends to be endogenous to many economic processes. McKenzie and Yang (2010) call for more experiments, both natural and controlled, to help understand the causes and effects of migration given the empirical difficulties associated with selection and

endogeneity.[3] Our research fills this gap and helps answer more generally the effect of liquidity constraints on household behavior.

Our work also relates to the literature on titling reforms and their impact on the allocation of resources and individual behavior. Field (2007) shows how obtaining a formal individual property right encourages individuals to leave for urban areas. Individuals choose to supply urban labor because of greater tenure security while they are away from their property. De la Rupelle et. al. (2009) make the connection between tenure security and migration by showing that land tenure insecurity is a major cause of return migration. Do and Iyer (2008) show that individual land titles increase labor devoted to non-farm activities, possibly leading indirectly to migration.

Economists have been paying greater attention to the political and institutional constraints that prevent both emigration and internal migration. Clemens (2010) takes advantage of a natural experiment on the issuance of work visas to more accurately relate the decision to emigrate to economic outcomes. Galor, Moav and Vollhter (2009) argue that the agricultural elite suppressed the education of rural labor, resulting in delays in industrialization, i.e. movement from rural areas to urban industrial centers. Similarly, Domar (1970) argues that the existence of a frontier may hinder economic development by creating perverse incentives for the landed aristocrats to restrict labor movement. In short, political or other institutional constraints may matter at least as much as economic ones. The Stolypin reform provides a unique opportunity to understand the relative importance of these different influences on migration, improving our knowledge of historical and contemporary migration patterns and migration policy.

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[3] To illustrate the absence of empirical evidence on the importance of liquidity constraints, the review paper must resort to discuss an unfinished, ongoing randomized experiment that attempts to address the importance of financial constraints for the migration decision (Beam et al 2010). The authors describe the plans of the experiment to randomly allocate loans to households who have expressed an interest to migrate internationally. Even when this study is completed and the results are known, this type of experiment can not identify the same effect that we are able to identify with the Stolypin reform as a natural experiment. This type of experiment will still suffer from a selection problem, no matter if the randomly chosen households were aware of the loan program or not when they decided to apply for an international job. Of course, their project can identify effects of interest that we are unable to identify.

3. Historical review of the Stolypin reform.[4]

The main component of the Stolypin agrarian reform was the titling reform initiated by the 6th of Novermber, 1906 decree. The decree introduced an opportunity for peasants in repartition communes in the European part of the Russian Empire to exit the commune and to convert their land titles from communal to individual ones. From the perspective of migration to Siberia, the titling reform introduced an easing of peasants' financial constraints. Peasants obtained access to an additional source to finance their move, since they could privatize and then either sell or lease their allotments. Although possession of a land title might increase the household's wealth, in terms of the opportunity cost of migration, the easing of liquidity constraints was a more important immediate feature of title conversion (much similar to the modern movement to title land discussed in de Soto 2000). A title could improve land productivity through improved incentives, better access to credit or land consolidation. Consequently, one would expect to see an increase in the peasants' valuations of their future income stream derived from not migrating. However, in the technological and institutional framework of early XX century Russian agriculture, this effect required time to take effect. In the short-run, a land title's contribution to the value of not migrating meant little if the peasant simply continued the same production activities.

The Stolypin titling reform affected the European part of the Russian Empire unevenly because repartition communes existed only in thirty-eight of fifty European provinces. There were no communes in the Baltic (Lifliandia, Estliandia, Kurliandia provinces) and the Cossack (Don, Kuban, Terskaya provinces) regions. All communes in Grodno, Kovno, Vilno, Minsk, Podolia and Volin' provinces were hereditary ones. The hereditary (*podvornaya)* commune assumed individual land ownership passing down within the family, in contrast to the repartition (*peredel'naya*) commune where there was no private property in land because of periodical redistribution of land between households. Before the reform, peasants could not exit the repartition commune without its consent and did not get any compensation for leaving one's allotment to the commune.[5] An exit was

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[4] For more details on the history of the reform, imperial agriculture and migration to Siberia in the late 19th – early 20th century see the long version of this paper: Eugenia Chernina, Paul Castañeda Dower and Andrei Markevich "The Stolypin Agrarian Reform and Peasant Migration", mimeo 2010.

[5] The 1904 temporary rules for the first time eased the prohibition on receiving compensation for leaving one's allotment. They introduced an opportunity for peasant migrants to Siberia to ask for compensation from the commune but without a right to sell the allotment (Shilovskii 2006). In practice, however, not many potential migrants enjoyed this opportunity because of the 1904- 1905

much easier in communes with hereditary tenure and could include compensation; the hereditary commune required that a peasant wishing to exit find an individual either inside or outside the commune who was willing to take the land allotment and related obligations with possible monetary transfer between the parties. The Stolypin titling reform left peasant exit opportunities almost unaffected in hereditary communes, but changed dramatically the whole exit procedure in repartition communes, introducing free exit and the right to sell plots.

Figure 1 presents the dynamics of tilting conversion under the 1906 decree. On average, one and a half hundred thousand households left the commune annually with a spike of seven hundred thousand during the first two years after the reform. In total, by January 1st, 1916 there had been 2 008 432 exits creating privatized land of 14 122 798 *desiatina*. All in all, 22% of households privatized 14% of communal land over nine years of the implementation of the reform. The price of average privatized allotment was 893 rubles. It was sufficiently more than the minimum amount recommended by the government for a peasant family to have after arrival at the place of destination in order to start a farm successfully (Voskresenskii 1909).

Figure 1 somewhere here.

Another important component of the new agrarian policy was an encouragement of migration to Siberia. The 10.03.1906 decree, issued half a year before the start of the titling reform, substantially enlarged existed subsidized for migrants and established new ones. The decree introduced interest-free loans for migrants who had 'socially valued' projects (like construction of churches, hospitals, schools, roads, canals, wells, mills, etc) and started special governmental programs on land research, demarcation and improvement and development of public health. The decree increased the upper limit of start-up loans from 100 to 125 rubles. The limit was increased further to 165 rubles in 1908 and to 250 rubles in 1912. The total number of governmental spending on migration tremendously increased from just below 5 million rubles in 1906 till almost 30 million in 1914 (Trekhsvyatskii 1918). Finally, starting from 1906, the government initiated a wide

Russian-Japanese War that cut migration flows dramatically, thus there were no subsidized migrants during these years at all (Tukavkin 2001, Shilovskii 2006). Also, in practice, it was difficult for peasants to obtain compensation during these years; Tukavkin (2001) provides an example of Kharvokvskaya province where only about 3.5 percent of all migrants managed to sell their plots, contrast to 83 percent in 1910. As a robustness check we allow the reform to occur in 1904 instead of 1906, the results (see the long version of this paper Eugenia Chernina, Paul Castañeda Dower and Andrei Markevich "The Stolypin Agrarian Reform and Peasant Migration", mimeo 2010) do not support the hypotheis that 1904 rules already eased budget constraints.

information campaign on migration to Siberia. In 1907 alone, the government published six and a half million of brochures and leaflets, one hundred and thirty thousands hand-books and four hundred thousands of clarifications on the subject (Sklyarov 1962).

Both before and after the Stolypin reform only authorized migrants could apply for governmental subsidies. The Ministry of Internal Affairs and the Ministry of State Property were responsible for granting such official permits (*prokhodnoe svidetelstvo*). The permit specified the new place of settlement where a migrant would get a land allotment, leased to him for rent by the government. Unauthorized migrants could get land in Siberia as well but they were the last in line for allotments, meaning they would get land of the poorest quality and without any tax reductions. (Voshchinin 1915). Almost all authorized migrants applied for and got subsidies in the amount close to the upper limit; thus, in 1907-1908 ninety percent of authorized migrants got startup loans with an average loan of 125 rubles (Trekhsvyatskii 1918). To capture this difference between peasants with and without official permits, we will refer to them as subsidized and unsubsidized migrants below.

The 10.03.1906 decree simplified the procedure to get official permits to migrate; for example, the government ceased to consider the wealth of a potential delegate migrant when issuing such permits (Sklyarov 1962). Formally, after the reform, everybody willing to migrate could get a permit (Voshchinin 1915). In practice, however, the government continued to grant permits conditionally on applicant's welfare (the minimum welfare requirements varied between 125 and 300 rubles of assets per family and an additional condition that the household had no tax arrears) and on the availability of land in the place of destination. For example, as a result of the large migration spurt during the first year after the Stolypin reform, the government encountered a shortage of plots prepared for allocation and had to introduce temporarily provincial limits on the number and time of granting permits. Current regional conditions, such as famines, affected these limits. In 1911, all restrictions based on land availability were removed (Sklayrov 1962, Simonova 1965, Shilovskii 2003, 2006). Obviously, unauthorized unsubsidized migrants, by definition, did not face with any of these limitations.

The migration to Siberia substantially increased after the reform. Figure 2 presents its dynamics between 1896 and 1914 extracted from Turchaninov (1910, 1915). Before 1906, the annual number of migrating families was fifteen thousand and never exceeded thirty thousand in a single year. After the reform, migration quickly reached a new level of forty thousand families per year with a peak of eighty to one hundred thousand in the first three years (1907-1909) after the reform.

Figure 2 somewhere here

4. Hypotheses

We argue that an increase in migration after the Stolypin agrarian reform was not just a coincidence. In particular, our main hypothesis is that the new opportunity to leave the commune and become an individual owner of one's land allotment influenced the decision to migrate. As discussed, individual ownership should ease the liquidity constraint by both economic and institutional means. The alternative hypothesis is that the titling reform influenced the migration process through the effect of increasing productivity. Peasants who exited the commune anticipate higher yields for their individually owned land allotments.[6] In this case, the reform would have a negative impact on migration. Another possible hypothesis is that the titling reform had relatively little influence because the budget constraint had been totally eliminated by increased government subsidies. In order to understand how these three hypotheses could result, we employ a simple model.

4.1. A simple model of migration at the provincial level

The standard emigration function (EM) approach relates the difference between home and destination wages to emigration rates. A relative rise in the home wage should reduce emigrant flows. Shocks to the emigration function such as technological change may shift the EM also impacting emigration rates. For example, when industrialization takes place in a poor country, real wages rise and previously constrained emigrants can finance migration. One would then observe a simultaneous rise in emigration and the real wage, a phenomenon many considered the puzzle of European migration at the end of XIX century (Hatton and Williamson 1994).[7]

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[6] Assunçao and Carvalho. (forthcoming) offer another possibility: they show that relaxing liquidity constraints reduces inequality in place of origin. Since reducing inequality (without redistribution) has a positive effect on growth, the Stolypin reform could have an additional negative effect on the desire to migrate. This effect is probably not so relevant for early twentieth century Russia.

[7] One might argue by analogy in favor of a similar explanation for peasant migration to Siberia in the Russian Empire in the late XIXth - beginning of the XXth centuries. We observe an increase in migration together with growing real wages and real income of both peasants and industrial workers (Borodkin and Valetov 2002, Gregory 1980, b, Kiryanov 1979, Mironov 2010). The analogy is limited, however. Unlike the European case, industrialization alone cannot explain a shift in the EM and the hump-like dynamics of migration to Siberia at the beginning of XXth century (see figure 2). Hatton and Williamson (2002) speak about long-term persistent changes; in contrast, we consider a

Unfortunately, we cannot use this approach empirically. With our data, it is impossible to track migrants from their origin to their place of destination. Instead of using the EM approach, we choose to model the liquidity constraint faced by potential migrants explicitly focus. This allows us to focus the comparative statics on changes in the liquidity constraint rather than changes in wages at the origin. While wages at the origin are important, they are not the main variable that is changing due to the Stolypin reform. In the simplest terms, households in the early twentieth century had one destination in mind for internal rural-rural migration -- Siberia. In addition, many of them did not have accurate expectations of what this region would bring them.[8] Consequently, predicting where migrants will go is of limited economic interest. Without this dimension, it is simple to control for wage differentials at the origin without the use of a gravity model. The advantage of our approach is that both the costs of migration and the liquidity constraint are in the forefront of the decision on whether to migrate or not.

The main alternative to migrating for peasant households is to continue farming one's allotment in the commune. Within the commune, a complex system of obligations developed which translated into very different household claims on future income streams. Importantly, the households' allotments and obligations are the key variables in judging the relative value of migrating to Siberia. The nature of the commune put a redistributive pressure on claims to fixed assets, while taking into account obligations, arrears and performance. But due to imperfect sharing, the asset structure that determined the income stream also varied. Some households had a large proportion of illiquid fixed assets while others were able to accumulate a significant amount of liquid assets even though actual allotments were not that different. This within province variation is important in explaining migration but we will be unable to exploit this variation since we only have data at the provincial level. However, provinces did differ in restrictions on leaving the commune, opening the door for differences across provinces in the liquidity constraint and, more importantly, in the effect of the reform on these liquidity constraints.

We model peasant households' decision to migrate in the following way. Each household, i, in province, p, receives a draw, x_{ip}, from the following distribution, $F(x; \mu, \sigma)$, where μ and σ are location and scale parameters. For the moment, assume μ and σ are fixed but we will consider the
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much shorter period of time for which we suppose migration is an immediate response to policy innovations.

[8] Isaev (1891) writes: "Many from the poor majority do not have right expectations…Some of them do not have any: it's hard to live at home, so poor peasants resettle to Siberia with a confidence it is not going to be worse…"

case when these change over time. In the long-run, one might expect the reform to influence these parameters. For each household, x_{ip} summarizes its wealth determined by the size and quality of allotments, obligations, arrears and other assets that the household possesses. We can also think of x_{ip} as an integral variable of the opportunity cost of migrating to Siberia that depended on parameters like urban employment opportunities or population density in a province. The key friction in the model is a liquidity constraint on household wealth, λ. Given this constraint, only a fraction of wealth, $(1 - \lambda_{ip})x_{ip}$, is transferable if one exits the commune and hence available to fund migration or other activities. The costs of migration, C_p, include transportation costs and start-up funds. Again, these are not small. Subsidies, S_{ip}, available through the government's migration policy partially offset the cost of migration.

We summarize the expected benefit of migrating to Siberia with the variable, v_{Mig}. As the discussion above makes clear, this value, in comparison to x, may not be sufficient to understand the individual migration decision. The fact that we must use data on migration aggregated at the provincial level lessens the concern that the benefit of migrating is the same for all households. We also motivate this assumption with the fact that the relative informational disadvantage households had when faced with the decision to migrate to the unknown land of Siberia probably did not vary by province. Although there are significant direct migration costs, we have in mind political and subsidized restrictions on migration that impose a cost on migration in the form of a liquidity constraint. For example, political restrictions can cause those who migrate to forfeit rights to land affecting λ. Those whose liquid wealth is below the cost of migration (net of subsidies) cannot migrate, i.e. such households will find it beneficial to migrate but cannot. We can then interpret $\xi_{ip} = (C_p - S_{ip})/(1 - \lambda_{ip})$ broadly as a budget constraint. Both the migration policy and the Stolypin property rights reform influence this budget constraint. An increase in subsidies (an increase in S) and a decrease in the fraction of wealth that is illiquid (a decrease in λ) both slacken this constraint. Now we can determine the share of the population that migrates, given by $F(v_{Mig} > x \geq \xi; \mu, \sigma)$.

Although provinces differ by productivity as well as cost of migration, there are several important groups of provinces that will lead to different budget constraints. Given the details outlined in the historical section, we have the following budget constraints to consider: ξ_{Spre} for subsidized migrants before the Stolypin reform; ξ_{Spost}, for subsidized migrants after the Stolypin reform but were not affected by the titling reform; $\xi_{Spost+AR}$, for subsidized migrants after the Stolypin reform who were affected by the reform; ξ, for unsubsidized migrants before the Stolypin reform and after for those who were not affected by the agrarian titling reform; and finally, ξ_{AR}, for unsubsidized migrants who were affected by the Stolypin reform. We have then $v_{Mig} > \xi$ by

assumption supported by historical evidence. By the nature of the agrarian reform and migration policy, we know $\xi > \xi_{Spre} > \xi_{Spost} \geq \xi_{Spost+AR}$ and $\xi \geq \xi_{AR} > \xi_{Spost+AR}$. What we do not know is the impact of the agrarian reform on the liquidity constraint and hence the relative impact of the agrarian titling reform on migration.

4.2 The econometric model

Since some of the provinces were relatively unaffected by the agrarian reform, the ones without repartition communes, the most natural approach is to obtain a difference-in-differences estimate of the effect of the reform. The validity of our control group is discussed in more detail in subsection 5.3. With the treatment and control groups defined, the model can be formulated by the following equation:

$$Migration_{it} = \alpha + \beta * Reform_{it} + d * Post_{it} + \gamma * Reform * Post_{it} + \tau_t + \varepsilon_{it} \qquad (1)$$

where by *Reform* we mean a dummy indicating those provinces affected by the reform and *Post* tracks the date of implementation. τ_t is a time period dummy for years before and after the reform implementation and ε_{it}, is a random disturbance. The coefficient γ is the effect of interest and we expect it to be positive. We can easily modify (1) to account for control variables as well as regional or provincial heterogeneity.

Since historians argue that the success of the reform depended on several measurable characteristics, we include a set of controls to hold these factors constant, including both demographic and economic variables. For population characteristics, we use the size of population in a province, the share of urban citizens and rural density. The size of the province in terms of population obviously influenced both the number of exists and migrants. We need the urbanization rate variable to partially control for availability of outside option in a province. We also control for the unskilled wage rate in a province to condition on the attractiveness of this outside option. This wage rate should also account for the outside option of non-farm activities in rural areas if this wage is in equilibrium. Rural density reflects the severity of land scarcity in a province, an important determinant of migration according to all scholars. Accordingly, we also include the average privatized plot size. To control for the wealth level, we use livestock (namely the number of horses and cows) per one hundred peasants and seed yield per square versta to control for liquidity available to peasants and relative income. To account for potential regional heterogeneity we employ thirteen region dummies (described in the next section), among which fifty provinces of Russian are distributed, as well as both fixed and random effects at the province level.

Equation 1 is in levels whereas the percentage change may be of greater interest. The one difficulty with using logs while the main variable of interest is a dummy variable that changes over time is that the huge spike in migration from low levels before the reform may not accurately capture the magnitude of the effect. If the unit of measurement is fixed, the initial spike will necessarily reduce the magnitude in subsequent jumps.

4.3 Subsidized and unsubsidized migration

In the perfect experiment, the difference-in-difference estimates of treatment and control provinces before and after the reform should report the same effect of the agrarian reform for both the subsidized and unsubsidized migrants. See table 1 where B_{pre} and B_{post} stand for characteristics that affect the budget constraint that may change over time, M_{pre} and M_{post} reflect the government's migration policy and AR represents the agrarian reform.

There are at least three plausible reasons why this might not be the case: 1) the underlying distributions could be different for politically constrained and unconstrained; 2) even when they have the same underlying distribution, the relative impact of the reform may be very different for subsidized migrants than unsubsidized migrants; and 3) generous financial support after 1906 increased the pool of potential subsidized migrants and accordingly decreased the number of those peasants who could not hope to get official permits to migrate.

Under 1), the scale of the distribution of the treatment provinces may be compressed relative to the control provinces given that one role of the commune was to ensure minimum living conditions for all. At the extreme, we might envision a mass point at the bottom end of the distribution for the treatment group before the reform. In this case, it is possible that, only by working in conjunction with each other, migration policy and the agrarian titling reform could ease liquidity constraints and have an effect on migration. Under 2), it is possible that the additional impact of the reform once subsidies reduce the budget constraint is smaller than it would be if no subsidies were in place. Under 3), the effect of the titling reform for unsubsidized migrants had to be less pronounced if at all because the pool of potential unsubsidized migrants decreased.

Since the price of average privatized allotment was larger than the minimum of assets needed for start-up in Siberia, we do not expect that the titling reform and migration policy could work only in conjunction. Indeed the number of both subsidized and unsubsidized migrants from the provinces with repartition communes increased after the start of the reform. Obviously, both subsidies and an easing of the liquidity constraint will have substitution effect and income effects. While it seems reasonable that the substitution effect of the liquidity constraint is smaller for those with subsidies

than those without, it is less clear how the income effects work. Under liquidity constraints, at low levels of wealth, migration will not respond to small changes in wealth. As wealth increases, at some point, migration will respond dramatically in a positive way, and then gradually decrease in response and eventually become an inferior good. It is difficult to say at which point households are during this transition before and after the reform and changes in migration policy. However, we expect that the income effect is positive and smaller for the subsidized migrants. At the same time, given the limited number of subsidies relative to total peasant population, we do not expect that the pool of potential unsubsidized migrants shrank dramatically and the third effect was large. Finally, average subsidies per family were large enough both before and after reform (depending on the destination region between 15 and 75 percent of the governmentally approved minimum) to diminish the additional impact of the titling reform. To summarize, we expect that for subsidized migrants, the effect of the agrarian titling reform was conditional on the presence of subsidies, while, for unsubsidized migrants, the unconditional effect could be identified and it should be larger than the conditional effect for subsidized migrants. Thus, having data on both subsidized and unsubsidized migrants is crucial for our understanding about how robust our results are. To test the effects of unsubsidized and subsidized, we simply replace the outcome variable with either subsidized or unsubsidized migrants in (1).

4.4 Decision to exit the commune

If we do see a positive effect of the reform, particularly for the unsubsidized migrants, then ideally we want to test if the mechanism we have in mind is at work. Fortunately, we have data on the number of exits from the commune for the treatment provinces. Provinces unaffected by the reform have zero exits from the commune by construction. The intensity of exit should then predict migration from a treatment province. Then, using the following regression, we can more precisely identify the effect of interest, β.

$$Migration_{it} = \alpha + \beta*Number\ of\ exits_{it} + \tau_t + \varepsilon_{it} \tag{2}$$

Of course, we can modify (2) to account for control variables and regional heterogeneity. However, the primary concern with (2) is the problem of reverse causality. The difficulty here is that those who wanted to migrate (but did not face the budget constraint) anyway could have taken advantage of exit suggesting an upward bias in the β.

To address this issue, we instrument for the number of exits with the number of applications for exit that were later recalled and the proportion of disputes over title conversion that were decided in favor of the household (i.e. proportion of confirmed applications). We imagine that both signify

the presence of social pressure that discourages exit in a particular commune, the former related negatively to exit and the later related positively. This social pressure should have no correlation with actual economic outcomes since it is likely driven by cultural and ideological reasons (Nafziger 2007). Thus, we can run the following regression to control for the bias:

$$Number\ of\ exits_{1907\text{-}1914} = \alpha + \beta*[hhrecall,\ zemstvo\_confirm]_{1907\text{-}1914} + u_i \qquad (3a)$$

Since, some instruments are only available to us in totals, we must aggregate the number of exits and the number of migrants over the whole post reform period under consideration. Of course, we add controls to (3a) where appropriate. One of our instruments varies over time, so we can implement a dynamic instrumental variable. Thus we can reestimate (2) using 2SLS with the first stage as:

$$Number\ of\ exits_{it} = \alpha + \beta*[zemstvo\_confirm]_{it} + u_{it} \qquad (3b)$$

4.5 Short-run and long-run effects.

An additional issue is that the agrarian reform may also have an impact on the distribution of the value of not migrating relative to the value of migration. Since the agrarian reform is ultimately designed to address productivity, we might expect a rightwards shift of the distribution of the value of not migrating for those affected by the agrarian reform relative to v_{Mig}, ξ_{Mpre}, $\xi_{Mpost+AR}$, ξ_{Mpre}, ξ_{AR} and ξ. Naturally, this would reduce the share of those wanting to migrate. This shift in productivity may not occur immediately in contrast to the easing of political and legal constraints on migration which we imagine happens soon after their implementation. However, in terms of the model, it is unclear whether we should then assume $F(x;\ \mu_T,\ \sigma_T) \neq F(x;\ \mu_C,\ \sigma_C)$ before or after the reform or both. Perhaps the most sensible assumption is that before the reform productivity in the treatment group was on average below the control group, $\mu_T < \mu_C$, and, at some point afterwards, $\mu_T = \mu_C$. In the long-run the productivity effect will also show up in the value of migrating if peasants underestimated the effect of learning-by-doing for production and the increasing returns to scale associated with the number of settlers in Siberia, causing both μ_T and μ_C to shift to the left relative to v_{Mig}. Thus, the net effect of productivity on migration is ambiguous. We can easily modify (1) to account for time varying effects of the reform.

4.6 Selection

So far, we have not discussed selection. There could be unobservable ability that is correlated with the migration decision. This is an important issue because the productivity of previous migrants may have an effect on the relative value of migration for potential migrants. Under negative

selection, this relative value should diminish. Under positive selection, the opposite should occur. In the former case, we may underestimate the effect of the reform. In the latter case, we run the risk of misinterpreting positive selection as the effect of the reform. The historical anecdotes suggest that the most industrious tend to migrate, suggesting that positive selection may be a real concern (Tukavkin 2001).

We derive several empirical predictions that could be used to assess whether positive selection occurs. In all these predictions, we make the assumption that only positive selection explains the results; that is, there is no liquidity constraint. First, positive selection should be the same before and after the reform, especially considering the level of aggregation of the place of destination. Second, if this innate ability is uncorrelated with an ability to obtain migration subsidies, then there should be no difference between the effects of the migration policy on migration for subsidized and unsubsidized migrants. Third, if this innate ability is correlated with the ability to obtain subsidies, then we argue that this should be a positive correlation. Those with higher human capital are more likely to present projects that seem valuable to the authorities and hence get approval for migration. Under this assumption, positive selection should be stronger for subsidized migrants than unsubsidized migrants. We would then expect to see a stronger effect of the reform for subsidized migrants.

An additional selection issue is that subsidized and unsubsidized migrants may face different distributions of plot quality in both places of origin and destination. This becomes an issue because of changes in the migration policy during the reform. In fact, unsubsidized migrants had worse access to destination plots. If they also had worse access in place of origin but the distribution in Siberia was more compressed, our results may be driven by differences in relative valuations and not differences in liquidity constraints. Of course, since we have a control group, this is not a valid criticism unless the distribution of plots in place of origin is more compressed in the control group. However, a priori, one would expect the repartition communes to have more equally distributed plots.

4.7 Summary of hypotheses

Given the above discussion, we list the hypotheses that we would like to test as follows:

1) The reform should have a positive effect on migration for the treatment provinces.

2) This effect should run through the new opportunity to exit the commune to obtain individual land title.

3) The effect of both should be at least as large for unsubsidized migrants.

5. Data

We combine several sources to construct a panel dataset needed to estimate the effect of titling on migration empirically. The bulk of statistics that we use was gathered and published by official authorities, in particular by the Resettlement Administration and the Central Statistical Committee of Russian Empire. The former registered and surveyed both subsidized and unsubsidized migrants to Siberia when they passed through two key railway stations, namely Syzran and Chelyabinsk, on their way to destinations of settlement.[9] The 1896-1914 data on the number of migrant families with distribution by years and provinces of origin were published in Turchaninov (1910, 1915). The information on title conversions and exits from the commune as well as on the majority of controls, like population, urban share, rural density, size and cost of allotments, yield and livestock, are extracted from official statistical volumes (*Statisticheskii ezhegodnik Rossiiskoi imperii*) published annually by the Central Statistical Committee. We also use archival data on the implementation of the reform collected by previous generations of historians (Dubrovskii 1963, Zyryanov 1992).

Data availability determines the unit and the numbers of observations in our dataset. We use annually average regional data collected for six periods, one before and five after the reform: 1901-1906, 1907, 1908-1909, 1910-1911, 1912-1913 and 1914. In total there are three hundred province-in-a-period observations. Table A1 of the appendix provides details on our sources.

Table 2 presents summary statistics of our sample. There were on average nine and a half hundred migrants from a province per year between 1900 and 1914, a bit more than half of them got subsidies from the government. The province with the largest migration rate produced eight times more migrants than an average province and there were several provinces without any migrants at all. Migrants, summing over all fourteen years, composed about a half percent of the local population from an average province. Rural population density was quite high, 40 inhabitants per 1 square versta on average. The level of urbanization was very low, thirteen percent on average only. Yield and livestock variables reflect average income and assets available for migrants from different provinces. In an average province, one hundred peasants possessed fifty-six cows and horses. As a result of the Stolypin reform, over six and a half thousand peasants in an average province converted their titles and exited the commune per year. In the provinces which were among the leaders of the reform, these figures were about ten times higher during the peak years.

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[9] Only migrants traveled by ocean vessels from Odessa to Vladivistov via Indician and Pacific oceans were out of this registration procedure, but their number was negligible (Tukavkin 2001).

Table A2 of appendix provides summary statistics for provinces affected and not affected by the reform, separately. There is no significant variation in controls between provinces with and without the reform, although, variation in migration is large and it grows strongly after the reform. Table A3 of the appendix presents correlations between the variables. Moreover, the migration patterns leading up to the reform give no reason to question the parallel trends assumption used in the difference-in-difference analysis (see figure 3).

Figure 3 somewhere here.

6. Analysis: The effect of the reform on migration

Moving directly to the punch line, our estimates suggest that the Stolypin titling reform had a strong positive effect on migration and the effect is larger for unsubsidized migrants than for subsidies ones. We obtain per year, per province estimates between 526 and 668 households who migrate in response to the reform, meaning as many as 203,000 households migrated due to the Stolypin titling reform, i.e. 45% of all four and a half hundred thousand migrated households. We argue that a significant portion of this effect can be understood as a direct effect of households' greater ability to obtain individual title for their commune land allotments. Our estimates show that, on average, for each 1000 title conversions from communal tenure, about 40 to 60 households subsequently migrate. This proportion is around two to three times higher than the proportion of migrants to the population. This sudden jump in migration makes sense if households faced budget constraints. In sum, our estimates imply around 80,000 to 120,000 migrating households can be attributed to title conversion, 39 to 59 % of the total effect of the reform.

6.1 OLS and Diff-in-diff Estimates

We first discuss the difference-in-difference estimates in columns 1, 2 and 3 of table 3. If the treatment and control groups were randomly assigned, the estimates in the first three columns should not differ too much. The second and third columns include the controls discussed in the third section with the third column also including regional fixed effects. The estimate for the coefficient of interest decreases when we include the controls by around 18%. In column 2 (without fixed effects) all the variables have the right signs. Only one (rural population density) of the signs of the coefficients change when regional fixed effects are introduced but this is likely due to statistical insignificance suggesting that most of the variation in this control may be at the regional level.

Next, we allow for the effect of the reform to vary over time to analyze the effect of the reform in the short and middle run. Columns 4, 5 and 6 show a stronger effect for the period following the

reform. Between 700 and 1000 households per province migrated in response to the reform in the first year of the reform implementation and close to 1400 per year in the next two subsequent years, 1908-1909; in the further years the number of migrants decreased. This fits the above discussion on the effect of the titling reform over time; in the long run the reform contributed to growth of productivity of Russian agriculture that increased the opportunity cost of migration.

We also include regional fixed effects in column 5. Again, the effect of the reform is strong and positive. To exploit the panel structure, we run a random effects model that allows for province level heterogeneity. The advantage of using random effects is that some control variables may not vary much over the short time period. Column 6 reports the results.

A more direct measure of the mechanism discussed in section 4 is the number of households who converted communal rights to individual tenure. Without doing so, potential migrants did not necessarily ease their liquidity constraint. All the columns of table 4 show a positive and significant effect of the number of exits on migration to Siberia. The magnitude is consistent with the effects given by the reform dummies. For example, in 1908, there were close to 500,000 exits, predicting that 20,000 households should migrate in that year as a result of the reform. Column 1 and 2 confirm that the variation in number of exits within the provinces affected by the reform explains the effect of the number of exits. Interestingly, columns 5 and 6 of table 4 report an elasticity of .11-.13 which is very close to the historical household survey evidence that had 12.6% of households who sold their allotments migrating (1912 survey cited by Dubrovskii 1963).

The effect of the reform is positive and significant for unsubsidized migrants and positive but insignificant for subsidized migrants in tables 5. Importantly, this result gives further support that what we are identifying is the effect of the agrarian reform on migration and not simply the effect of the migration policy. Moreover, the insignificant coefficients on the "repartition_reform" and "reform" variables for subsidized migrants in column 1 suggests that they did not face liquidity constraints either before or after 1906 and neither the titling reform no more generous governmental subsidies substantially affected subsidized migrants flow. But those who migrated after the titling reform enjoyed its benefits as positive and significant coefficient on the number of exits variable for subsidized migrants (column 3) demonstrates.

In contrast, for unsubsidized migrants, the reform produced a significant effect. It is not possible to compare results for subsidized and unsubsidized migrants directly because the coefficients are not normalized. Taking elasticities in columns 4 and 8, we see that indeed the response is larger for the unsubsidized migrants. Again we find evidence that is consistent with the idea that the budget constraint matters not simply the wage differential. The larger response for

unsubsidized migrants also means that even if growing subsidies cut the pool of potential unsubsidized migrants, this cut was not large. Finally, the results suggest that there was no need to have both increased subsidies and the titling reform realized simultaneously to ease peasants' budget constraints; the titling reform alone was already sufficient.

The comparison of the results for subsidized and unsubsidized migrants also permits us to rule out the selection hypothesis as the only explanation of the increased migration after 1906. As discussed above, if the growing migration was the result of positive selection of the most industrious peasants that gradually increased relative value of migration for potential migrants, than we should observe either the same increase in the numbers of subsidized and unsubsidized migrants (if individual industriousness did not affect her chances to get subsidies) or larger increase for subsidized migrants (if it did). In fact, we observe that the reform produced positive and statistically significant effect only for unsubsidized migrants.

6.2 Instrumental Variables Estimates

As have been discussed above, we have to explore the potential endogeneity problem of the observed correlation between peasant migration to Siberia and exits from the commune. The nature of the Stolypin reform provides two potential candidates for instrumental variables, the percentage of applications ruled in favor of the exiting household by local authorities (zemstvo confirm) and the proportion of applications for title conversion that were recalled by the household (hh recall). The former instrument should be positively related to the number of exiting households and the latter should be negatively related. Importantly, both instruments should reflect social pressures existing within the commune as a result of the new opportunity to exit and not unobservable variables that affect the migration decision which can not be attributed to the agrarian reform. Peasants' attitude towards the reform varied across provinces as well as between peasants in the same province depending on their wealth and potential benefits from the reform. Zyryanov (1992) provided evidences that those peasants who opposed the reform often actively prevented other commune members to exit by threats or violence.

Only zemstvo_confirm is available for per year observations from 1907-1915. Thus, we can not run an overidentification test and exploit the panel structure of our data. The first stage results are presented in the first column of table 6. The F-statistic of 76.74 suggests that there is enough explanatory power to use zemstvo_confirm. In columns 2 and 3 of table 6, we present the basic specification for both all migrants and unsubsidized migrants, columns 4 and 5 use provincial fixed effects and columns 6 and 7 use random effects. We have not included year fixed effects since most

of the time variation is occurring in the migration and exits variables.[10] The results show that the coefficient on exits is positive and significant in all specifications. The size of the coefficient is larger in the instrumental variables estimates.

As discussed in the fourth section, in order to make use of both instruments, we focus on the period of 1914. The first stage regressions indicate that both variables appear to have enough explanatory power. The first column of table 7 shows that the coefficient on zemstvo_confirm is positive and significant and has a F statistic well above the weak instrument threshold. The hh_recall instrument does not have the expected sign and is on the border of the weak instrument threshold using the Stock-Yogo criteria. The positive sign could indicate that the instrument does not capture the intended relationship, rather higher exit flows may simply be correlated with higher recall flows.

The IV estimations in second column give qualitatively and quantitatively similar results as the pooled OLS regressions, suggesting that those would have migrated even if the reform had not taken place likely did not exit the commune. Using both instruments together allows us to test the exclusionary restrictions. The overidentification test reveals that we can not reject the hypothesis that we have valid instruments, although we caution against placing much weight on this result given that the hh_recall instrument is a weak predictor of the number of exits when it is used in conjunction with zemstvo_confirm and it has an unexpected sign.

6.3. Robustness checks

The first set of robustness checks that we employ is to modify our control group. We both reduce and augment the control group to address possible concerns about the parallel trends assumption. One issue may be that the Imperial policy did not treat all provinces equally, nor encourage all provinces to migrate to Siberia. We find two possible groups of provinces that might be subject to this criticism, the Baltic and the Cossack provinces. We first exclude the Baltic provinces (5 out of the original 12) and then exclude the Cossack provinces (3 out of the original 12). We rerun the basic specification for both all migrants and only the unsubsidized migrants. The results are presented in table 7, columns 1 and 2 for the Baltic exclusion and 3 and 4 for the Cossack exclusion. For the Baltic exclusion, the effect of the reform is diminished for both types of migrants.

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[10] Including year fixed effects does not substantially change the results. The coefficient on exits is positive and significant for both all migrants and unsubsidized migrants in all specifications except for provincial fixed effects in which the coefficient on exits remains positive but loses statistical significance at the 10% level for unsubsidized migrants.

The effect on unsubsidized migrants is still positive and significant while the effect on all migrants is no longer significant. The lack of significance is perhaps not surprising since we are reducing the sample size but the fact that the effect is still seen in the unsubsidized migrants gives further support that the reform effect works through the relaxation of the liquidity constraint. The Cossack exclusion is remarkably similar to the original control group, with the effect positive and significant for both types of migrants.

The next modification of the control group is to redefine the treatment group. Recall that the treatment group is constructed by including all those provinces with more than 5% repartition communes. To perform a sensitivity analysis, we modify the cutoff to more than 30% to extend the control group to a larger set of provinces (by 3 provinces). In columns 5 and 6 of table 7, we see the results. Again, the effect of the reform is positive but only significant for unsubsidized migrants.

Finally, we address the criticism of Bertrand et al (2004) that the difference-in-difference estimates suffer from serial correlation. We can deal with this criticism directly by appealing to our results that permit the effect of the reform to vary over time (see columns 4. 5 and 6 of table 3 and columns 6 of table 5). The effect of the reform is positive and significant when we would expect it to be if there were liquidity constraints. Since these estimates do not suffer from serial correlation, we do not need to correct the standard errors. We view this solution as superior to the general technique recommended by Bertrand et al (2004) since their solution is indirect and does not take full advantage of the data. Nevertheless, as a robustness check, we collapse our data into before and after periods to control for possible serial correlation in the difference-in-difference estimates. We find that the effect of the reform is even stronger and more precisely measured for both all migrants and the unsubsidized migrants.

6.4. Results in logs

Table 9 reports the results of our basic difference-in-difference model where the dependent variable enters in logs. The coefficients on the interaction between the reform provinces dummy and the reform periods are positive in all specifications, but mainly insignificant. That is possibly the result of having dummies for variables of interest. As discussed above, in such a case, the huge spike in migration, from low levels before the reform happening for all provinces, necessarily reduces the magnitude of effect of titling reform, and would explain our failure to capture it econometrically. When we change the variable of interest from dummy to the continuous variable – the number of exits – the coefficient becomes both positive and highly significant as table 9 demonstrates.

7. Conclusion.

We view the findings in this paper to contribute to three different literatures, the literature on migration and economic development, the literature on the effects of land titling and the historical literature on the Stolypin reform. First, the unique nature of the Stolypin reform permits the identification of an important factor in the migration decision, liquidity constraints. From an economic point of view, our main finding is that liquidity constraints matter for migration, and a simple analysis of wage differentials may miss an important determinant of migration. Although this is not a controversial statement, it nevertheless is difficult to test. The uniqueness of the Stolypin reform provides the necessary conditions to run such an experiment. Interestingly, the new economics of migration literature that also criticizes the naïve use of wage differentials focuses on imperfect markets as explanations for migration. A policy implication is to improve missing capital or insurance markets in the migrants' place of origin to decrease outflows (Stecklov et. al. 2005; Halliday 2006; Paulson 2003; Rosenzweig and Stark 1989). Improving local markets is, in fact, what the Stolypin reform did. Yet, in this case, as our results show, migration outflows increase by a lot, and market reforms explain about a half of internal migration to Siberia.

Second, we show that the introduction of individual land titles improves the allocation of resources by influencing the decision to migrate. The emphasis in the previous literature on land titling and individual decisions has been on the indirect effects of improved tenure security caused by institutional reforms. In contrast, we underline a possible direct economic effect of getting a land title which is realized through eased liquidity constraints. From the point of view of migration decisions, institutional and economic effects could work in opposite directions and their joint effect is ambiguous. Our empirical analysis of the Stolypin reform demonstrates that the direct economic effect of encouraging migration might be stronger than institutional ones that improve the option of not migrating.

Finally, our findings contribute to the economic history literature on the Stolypin reform. Traditionally, the primary aspects of the reform historians emphasize are the role of the reform in constructing private property and addressing land productivity. But the large effect of the reform on migration suggests that the dual aspects of the reform, migration and productivity, in fact, are quite consistent with each other. In addition, our estimates also suggest that the changes in migration policy and governmental subsides were less important than the titling reform for migration to Siberia. Therefore, the effect of the reform on migration may have been crucial for its rapid expansion during the years before the First World War.

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Figure 1. Titling conversion under the 1906 decree.

Source: Dubrovskii (1963).

Figure 2. Migration dynamics 1986-1914
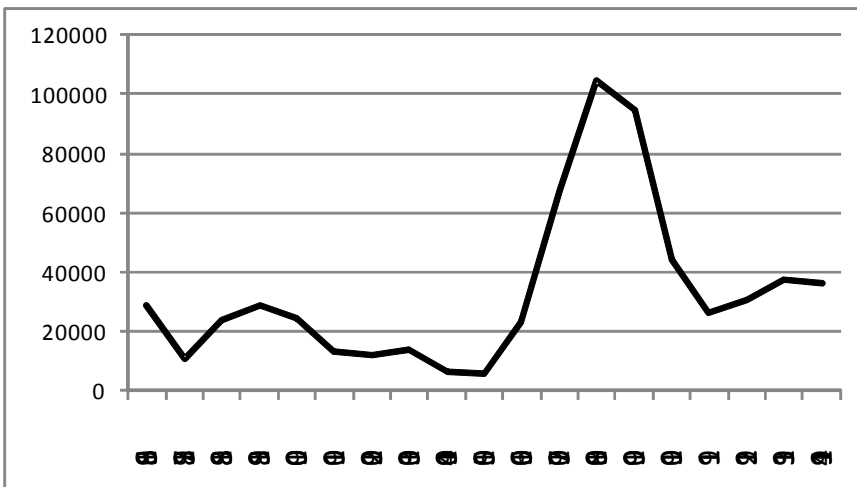
Source: Turchaninov(1910), (1915)

Figure 3. Migration dynamics 1897-1905 for Repartition and Non-repartition Provinces

Per Province Average Migration by Year
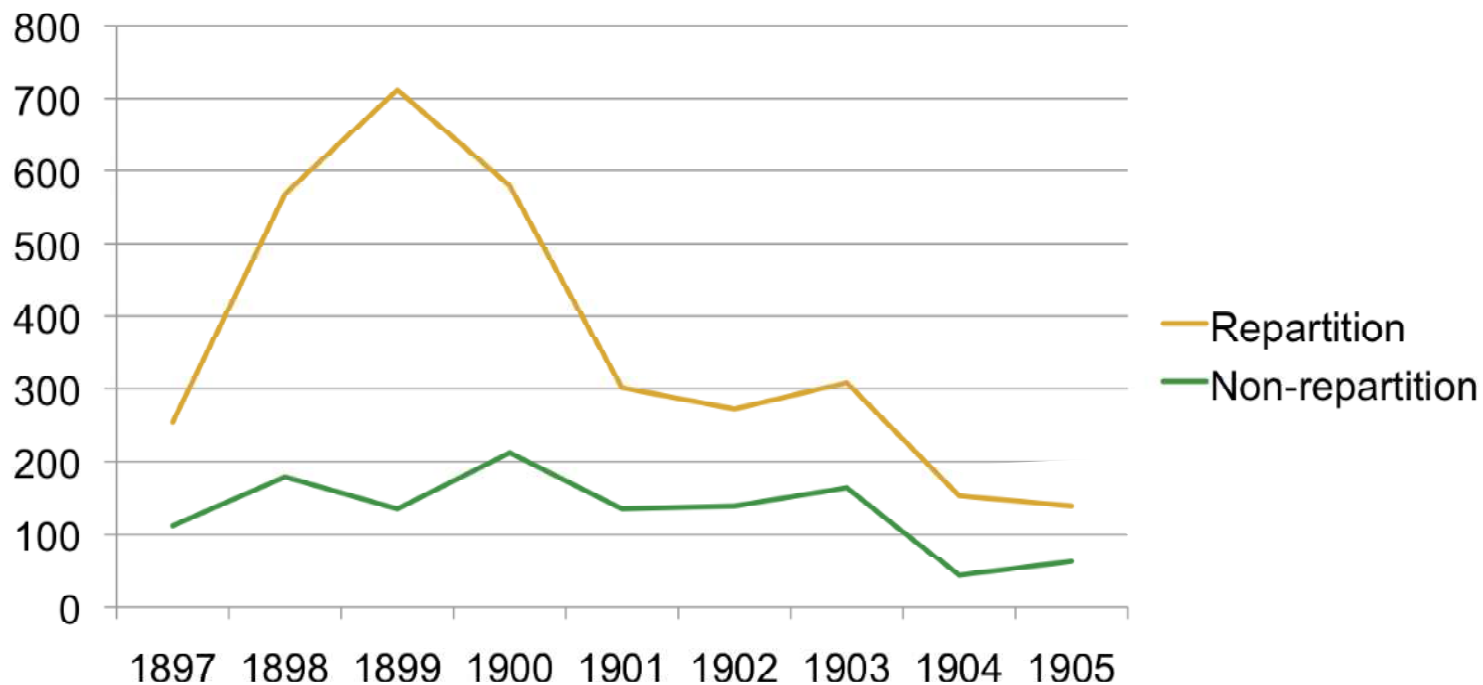
Source: Turchaninov(1910), (1915), calculations made by authors.

Table 1. Differential Impacts on the Peasants' Budget Constraints

Subsidized Migrants	*Before*	*After*	Unsubsidized Migrants	*Before*	*After*
Treatment	$B_{pre} + M_{pre}$	$B_{post} + M_{post} + AR$	*Treatment*	B_{pre}	$B_{post} + AR$
Control	$B_{pre} + M_{pre}$	$B_{post} + M_{post}$	*Control*	B_{pre}	B_{post}

Table 2. The Stolypin reform, migration to Siberia and provincial economic performance, 1896-1914.

Variable	Obs	Mean	Std,Dev,	Min	Max
Repartition_province	300	0,76	0,43	0	1
Reform	300	0,83	0,37	0	1
Repartition_reform	300	0,63	0,48	0	1
Exits	298	6583,80	12619,51	0	79298
zemstvo_confirm	297	0,31	0,23	0	0,98
hhrecall	50	0,06	0,06	0	0,36
Migrants	299	952,38	1409,21	0,00	8506,00
Smigrants	299	564,79	909,23	0,00	6486,00
Unsmigrants	299	387,59	704,44	0,00	5775,00
Popul (000)	300	2423,18	912,46	450,35	4890,25
Rdensity	300	40,13	19,59	4,13	101
Rwage (per harvest month in rubles)	296	29,99	9,17	15,8	65,22
Yield (per desyatina)	300	0,05	0,01	0,01	0,09
Livestock (cows and horses)	300	56,31	19,40	30,05	132,00
Ushare (%)	300	0,13	0,12	0,02	0,74
Uwage (per month in rubles)	285	17,97	6,88	5,5	37,41
Ruwage (per month in rubles)	297	19,71	4,61	9,33	31,29

Table 3. The effect of the reform on migration (levels)

VARIABLES	Diff-n-Diff			Pooled OLS	OLS with provincial FE	OLS with provincial RE
	(1)	(2)	(3)	(4)	(5)	(6)
repartition_reform	668.27***	526.03**	555.78**			
	[158.762]	[238.123]	[216.466]			
repartition_year1907				764.43**	978.45**	695.99*
				[341.949]	[424.866]	[382.069]
repartition_year190809				1,387.19***	1,481.13***	1,377.27***
				[358.650]	[392.314]	[403.058]
repartition_year191011				189.39	284.22	180.10
				[252.218]	[188.475]	[173.647]
repartition_year191213				528.95**	626.55***	511.79***
				[237.853]	[155.460]	[141.239]
repartition_year1914				413.61	551.46***	375.32**
				[266.051]	[161.945]	[167.292]
Reform	341.32***	460.08*	15.35			
	[92.665]	[237.086]	[222.731]			
year1907				223.58	-578.72	551.23**
				[269.164]	[372.031]	[257.754]
year190809				364.37	-232.41	605.78**
				[235.185]	[284.685]	[240.393]
year191011				-58.39	-654.53**	164.18
				[248.771]	[248.092]	[183.856]
year191213				-217.65	-729.06***	-56.02
				[239.900]	[247.857]	[196.799]
year1914				-259.64	-937.73**	-74.30
				[297.459]	[355.376]	[235.589]
repartition_province	151.81**	196.24	693.13*	444.51	0.00	-15.27
	[64.265]	[216.390]	[401.148]	[356.614]	[0.000]	[217.383]
popul		0.32***	0.58***	0.58***	0.57*	0.47***
		[0.071]	[0.103]	[0.092]	[0.309]	[0.112]
rdensity		26.61***	-5.19	0.15	-43.41*	20.75***
		[5.683]	[6.695]	[7.284]	[22.817]	[7.236]
livestock		17.89***	3.21	-0.34	-18.13	6.38
		[4.616]	[4.603]	[4.576]	[13.339]	[4.579]
yield		-7,493.96	-12,584.75*	-11,841.75	-17,167.12	-11,195.29
		[6,838.388]	[6,923.140]	[7,750.693]	[12,052.878]	[9,165.683]
rwage		-13.53**	-42.84***	-17.14*	-40.55**	-3.29
		[6.858]	[8.677]	[9.605]	[15.983]	[7.974]
ruwage		-41.15***	-37.39	9.41	84.17**	2.86
		[15.567]	[23.297]	[24.290]	[37.201]	[22.055]
Regional dummies	No	No	Yes	Yes	No	No
Constant	130.47***	-1,177.31*	160.80	-891.68	3,345.23**	-1,267.27
	[42.322]	[628.899]	[669.402]	[731.962]	[1,551.074]	[770.951]
Observations	299	292	292	292	292	292
R-squared	0.103	0.313	0.476	0.583	0.396	
Number of id					50	50

Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 4. The role of exit from the commune for migration (levels and logs)

VARIABLES	Pooled OLS (levels)			Pooled OLS (Logs)	
	(1)	(2)	(3)	(4)	(5)
Exits	0.04***	0.04***	0.04***		
	[0.009]	[0.009]	[0.008]		
repartition_province		305.71*			
		[156.971]			
logexits				0.13***	0.11***
				[0.024]	[0.027]
popul	0.33***	0.33***	0.35***	0.00***	0.00***
	[0.064]	[0.064]	[0.076]	[0.000]	[0.000]
rdensity	20.22***	22.04***	1.59	0.03***	-0.01
	[4.967]	[5.222]	[6.385]	[0.006]	[0.012]
livestock	8.93***	12.47***	-4.82	0.04***	-0.00
	[3.249]	[3.612]	[4.638]	[0.007]	[0.011]
yield	-6,685.78	-3,913.96	-12,017.60*	-0.50	-0.91
	[6,458.227]	[6,548.762]	[6,918.731]	[7.538]	[6.288]
rwage	0.19	0.01	-15.07*	-0.03***	-0.06***
	[6.174]	[6.166]	[7.719]	[0.012]	[0.015]
ruwage	-24.73*	-19.96	-1.01	-0.06***	0.02
	[13.867]	[13.711]	[20.999]	[0.022]	[0.022]
year1907	1,161.73***	1,181.46***	772.72***	0.85**	0.19
	[259.569]	[262.268]	[240.989]	[0.341]	[0.347]
year190809	821.53**	880.01**	525.97*	0.91**	0.36
	[353.122]	[369.052]	[276.009]	[0.363]	[0.360]
year191011	59.28	81.12	-235.51	-0.11	-0.67*
	[191.560]	[195.634]	[181.868]	[0.343]	[0.346]
year191213	283.18*	270.57	67.34	0.29	-0.29
	[166.780]	[166.673]	[187.182]	[0.338]	[0.306]
year1914	425.97***	405.49**	124.75	0.19	-0.49
	[160.654]	[160.070]	[174.518]	[0.359]	[0.315]
Regional dummies	No	No	Yes	No	Yes
Constant	-1,093.59***	-1,806.51***	523.18	2.14***	4.68***
	[413.994]	[608.676]	[584.604]	[0.709]	[0.935]
Observations	290	290	290	290	290
R-squared	0.482	0.487	0.627	0.491	0.736

Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 5. The effect of the reform on subsidized and unsubsidized migration

	Subsidized				Unsubsidized			
				Pooled OLS				
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
repartition_reform	238.82				316.96***			
	[157.409]				[90.514]			
repartition_year1907		562.15*				202.28*		
		[300.866]				[102.752]		
repartition_year190809		351.10*				1,036.09***		
		[208.696]				[219.343]		
repartition_year191011		59.22				130.17		
		[179.814]				[112.263]		
repartition_year191213		289.51				239.44**		
		[179.049]				[99.092]		
repartition_year1914		191.95				221.66**		
		[203.823]				[111.584]		
exits			0.02**				0.03***	
			[0.006]				[0.007]	
logexits				0.07**				0.09**
				[0.036]				[0.035]
reform	131.07				-115.72			
	[169.579]				[90.784]			
year1907		298.79	711.16***	0.93**		-75.21	46.28	-0.36
		[217.725]	[196.233]	[0.383]		[108.685]	[84.418]	[0.340]
year190809		359.64**	285.51*	0.79*		апр.73	261.95	0.48
		[171.426]	[159.596]	[0.419]		[108.485]	[163.964]	[0.390]
year191011		69.51	-5.02	0.01		-127.90	-227.05**	-0.80**
		[174.021]	[121.463]	[0.396]		[117.278]	[101.716]	[0.362]
year191213		-1.61	171.79	0.42		-216.04**	-96.30	-0.39
		[188.052]	[144.954]	[0.365]		[104.815]	[75.619]	[0.341]
year1914		20.73	204.05	0.25		-280.38**	-62.82	-0.62*
		[232.726]	[143.837]	[0.365]		[123.526]	[71.713]	[0.328]
repartition_province	428.68	309.87	307.41	0.19	264.45*	134.65	126.49	0.79**
	[322.799]	[302.946]	[269.432]	[0.335]	[152.159]	[123.742]	[93.211]	[0.369]
popul	0.24***	0.24***	0.17***	0.00***	0.33***	0.34***	0.23***	0.00***
	[0.055]	[0.053]	[0.055]	[0.000]	[0.070]	[0.060]	[0.052]	[0.000]
rdensity	2.66	5.21	5.08	0.00	-7.85**	-5.06	-5.82*	-0.01
	[4.093]	[4.252]	[4.124]	[0.011]	[3.890]	[4.035]	[3.145]	[0.013]
livestock	0.00	-1.59	-2.00	0.00	3.20	1.25	-1.73	0.00
	[2.794]	[2.964]	[3.427]	[0.010]	[2.821]	[2.686]	[1.842]	[0.010]
yield	-	-	-	-7.26	3,262.79	2,536.96	1,886.61	6.96
	[5,674.130]	[5,859.149]	[5,288.517]	[6.138]	[2,684.506]	[3,177.028]	[2,775.108]	[7.262]
rwage	-27.89***	-14.77**	-15.05**	-	-14.96***	-2.37	-2.19	-
	[5.449]	[6.005]	[5.823]	[0.015]	[4.717]	[5.418]	[3.869]	[0.015]
ruwage	-23.00	-3.59	-8.86	0.02	-14.39	13.00	2.93	-0.01
	[18.739]	[19.822]	[19.097]	[0.022]	[8.939]	[8.912]	[8.557]	[0.023]
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	656.57	85.77	389.10	3.13***	-495.77	-1,049.50***	-323.31	3.30***
	[466.297]	[515.547]	[511.343]	[0.964]	[358.774]	[373.065]	[290.212]	[0.987]
Observations	292	292	290	290	292	292	290	290
R-squared	0.503	0.557	0.568	0.759	0.325	0.519	0.582	0.731

Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 6. Instrumental variable estimates of the effect of the reform on total migration and unsubsidized migration.

| | First Stage | Pooled OLS | | Fixed Effect | | Random Effect | |
| | # of exits | All Migrants | Unsubsidized Migrants | All Migrants | Unsubsidized Migrants | All Migrants | Unsubsidized Migrants |
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
exits		0.05***	0.03***	0.03***	0.03***	0.04***	0.03***
		[0.008]	[0.006]	[0.007]	[0.004]	[0.007]	[0.003]
zemstvo_confirm	40,979.41***						
	[4,676.100]						
yield	-46,354.23	-9,203.65	1,245.80	-14,616.11*	673.44	-11,938.99*	919.83
	[40,208.731]	[6,574.987]	[2,101.103]	[7,707.644]	[4,175.197]	[6,167.512]	[3,009.237]
popul	1.83***	0.30***	0.18***	0.17	0.03	0.31***	0.17***
	[0.697]	[0.060]	[0.030]	[0.260]	[0.141]	[0.115]	[0.052]
rdenisty	9.15	20.49***	2.70	-45.04*	-13.17	14.63**	1.68
	[36.321]	[4.951]	[2.028]	[24.394]	[13.214]	[6.753]	[3.016]
livestock	48.76*	11.50***	1.89	-11.19	-5.67	6.43	0.98
	[29.546]	[3.288]	[1.232]	[8.963]	[4.855]	[5.870]	[2.738]
ruwage	92.17	-21.23*	-5.01	8.72	-4.25	-21.08	-8.02
	[96.205]	[12.550]	[5.302]	[33.239]	[18.006]	[18.304]	[8.711]
rwage	83.29*	-16.79***	-0.23	-49.12***	-9.78*	-32.54***	-3.16
	[44.072]	[5.649]	[1.959]	[10.556]	[5.718]	[8.455]	[4.114]
Constant	-11,128.75***	-227.06	-430.82**	4,760.33***	1,329.80**	944.96	-130.16
	[3,952.942]	[430.866]	[169.309]	[1,194.757]	[647.195]	[743.416]	[344.492]
Observations	288	287	287	287	287	287	287
R-squared	0.548	0.405	0.462				
Number of id				50	50	50	50

Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 7. Instrumental variables estimates of the effect of exit on migration in 1914 (levels)

	First Stage (i)	First Stage (ii)	2SLS confirm (iii)	2SLS confirm, recall (iv)	2SLS (logs) confirm, recall (v)
exits1914			0.09***	0.11***	
			[0.030]	[0.033]	
logexits1914					0.10***
					[0.031]
popul1914	1.38	0.77	-0.00	-0.02	0.00
	[1.072]	[1.171]	[0.093]	[0.107]	[0.000]
yield1914	-76,777.16	-117,634.22	16,011.98**	18,215.39**	6.58
	[68,202.577]	[72,934.950]	[7,472.303]	[8,409.430]	[6.441]
ruraldensity1914	-25.96	19.98	7.16	7.22	0.01**
	[46.349]	[46.665]	[5.530]	[5.647]	[0.006]
Livestock	-5.18	-35.91	6.11	7.35	0.02***
	[45.965]	[49.639]	[5.084]	[5.631]	[0.005]
urbanwage1914	215.43	120.83	-29.70**	-32.00**	-0.02
	[163.781]	[181.383]	[12.167]	[13.113]	[0.016]
Ruralwage1914	53.87	135.22	-10.63	-12.94	-0.01
	[76.305]	[125.694]	[11.096]	[12.516]	[0.010]
prevmigrants1914	4.65	5.99	2.70***	2.62***	
	[3.540]	[4.077]	[0.364]	[0.410]	
logprevmigrants					0.78***
					[0.081]
zemstvo confirm	19,441.68***				
	[4,481.530]				
hh recall		20,621.87***			
		[6,424.988]			
Constant	-4,158.84	981.58	-497.29	-579.85	0.69
	[5,237.906]	[5,819.739]	[562.148]	[635.151]	[0.868]
F Statistic			18.82	17.87	30.53
Hansen J Statistic				2.28	1.05
				p-value=.131	p-value=.306
Observations	50	50	50	50	50
R-squared	0.487	0.340	0.860	0.836	0.924

Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 8. The effect of the reform on total migration and unsubsidized migration for alternative treatment and control groups.

	Excluding Baltic Provinces		Excluding Cossack Provinces		Expanded Control Group <20% repartition commune	
	All Migrants	Unsubsidized Migrants	All Migrants	Unsubsidized Migrants	All Migrants	Unsubsidized Migrants
repartition_reform	414.96	289.74**	523.91**	337.97***	119.10	233.14**
	[296.983]	[120.868]	[234.765]	[105.293]	[257.069]	[106.194]
reform	139.50	-89.24	24.13	-139.83	346.97	-54.30
	[314.436]	[130.000]	[237.963]	[102.323]	[263.623]	[105.034]
repartition_province	829.33*	300.84*	1,039.14*	240.31	464.90	229.60*
	[438.440]	[172.126]	[539.900]	[205.978]	[348.369]	[133.595]
yield	-12,496.89*	3,448.42	-18,471.90**	2,077.88	-11,657.89*	4,761.94*
	[7,281.014]	[2,845.871]	[8,177.853]	[3,204.794]	[6,520.822]	[2,497.839]
popul	0.60***	0.35***	0.62***	0.36***	0.52***	0.32***
	[0.108]	[0.074]	[0.117]	[0.082]	[0.096]	[0.067]
rdensity	-5.52	-7.95**	-6.75	-7.47*	0.91	-5.32
	[6.763]	[3.932]	[7.004]	[4.055]	[7.153]	[3.773]
livestock	3.54	3.67	1.17	3.98	1.23	2.37
	[5.167]	[3.219]	[6.413]	[3.733]	[4.520]	[2.715]
ruwage	-38.83	-15.74*	-41.30*	-14.25	-38.61	-16.86*
	[24.006]	[9.364]	[24.191]	[9.295]	[23.665]	[8.680]
rwage	-44.43***	-15.30***	-45.84***	-15.20***	-42.78***	-16.18***
	[9.592]	[5.163]	[9.498]	[5.160]	[8.800]	[4.819]
Constant	1,672.71**	233.63	2,050.64**	-183.75	662.48	-360.14
	[769.849]	[366.660]	[956.929]	[509.090]	[603.279]	[320.838]
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	264	264	275	275	292	292
R-squared	0.459	0.308	0.478	0.321	0.454	0.320

Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 9. The effect of the reform on migration (logs)

VARIABLES	Diff-in-Diff (1)	(2)	(3)	Pooled OLS (4)	Provincial FE (5)	Provincial RE (6)
repartition_reform	0.31	-0.00	0.14			
	[0.536]	[0.455]	[0.364]			
repartition_year1907				0.11	0.01	-0.06
				[0.476]	[0.242]	[0.249]
repartition_year190809				0.17	0.13	0.11
				[0.383]	[0.213]	[0.217]
repartition_year191011				-0.08	-0.10	-0.12
				[0.425]	[0.242]	[0.240]
repartition_year191213				0.72*	0.66**	0.66**
				[0.430]	[0.246]	[0.262]
repartition_year1914				0.13	0.12	0.08
				[0.474]	[0.411]	[0.418]
reform	1.11**	1.22***	0.34			
	[0.443]	[0.423]	[0.375]			
year1907				0.65	1.33***	1.47***
				[0.459]	[0.287]	[0.276]
year190809				1.01**	1.60***	1.69***
				[0.397]	[0.292]	[0.273]
year191011				0.11	0.64**	0.76***
				[0.420]	[0.302]	[0.272]
year191213				-0.13	0.28	0.39
				[0.408]	[0.328]	[0.311]
year1914				0.00	0.41	0.58
				[0.440]	[0.533]	[0.495]
repartition_province	0.65	0.95**	1.07***	0.89**	0.00	0.55
	[0.480]	[0.430]	[0.400]	[0.386]	[0.000]	[0.443]
popul		0.00***	0.00***	0.00***	0.00	0.00**
		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
rdensity		0.04***	-0.01	-0.01	0.04***	0.03***
		[0.006]	[0.012]	[0.012]	[0.014]	[0.010]
livestock		0.04***	0.00	0.00	0.00	0.01
		[0.008]	[0.010]	[0.010]	[0.014]	[0.009]
yield		-1.60	-0.12	-2.67	-1.25	-1.46
		[7.469]	[6.667]	[6.536]	[6.440]	[5.577]
rwage		-0.04***	-0.08***	-0.06***	-0.03	-0.03*
		[0.012]	[0.014]	[0.015]	[0.017]	[0.015]
ruwage		-0.08***	-0.03	0.01	-0.01	-0.04
		[0.021]	[0.021]	[0.022]	[0.039]	[0.037]
Regional dummies	No	No	Yes	Yes	No	No
Constant	4.11***	2.05**	4.60***	3.92***	3.75**	3.12**
	[0.397]	[0.845]	[1.026]	[0.956]	[1.522]	[1.528]
Observations	299	292	292	292	292	292
R-squared	0.120	0.452	0.700	0.738	0.621	
Number of id					50	50

Robust standard errors in brackets. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Appendix. Table A1. Variables definitions and data sources

Variable name	Variable definition	Source
Migrants	Number of migrant families passed through Syzran and Chelyabinsk registration centers	Turchaninov N. (1910, 1915)
Smigrants	Same but with official permits only	Turchaninov N. (1910, 1915)
Unsmigrants	Same but without official permits only	Turchaninov N. (1910, 1915)
Exits	Number of exits from the commune that accompanied by title conversion	Ministry of Internal Affairs (1908, 1915, 1910, 1912, 1914).
Popul	Total population of January 1, corresponding year	Central Statistical Committee of the Ministry of Interior (1905-1916)
Rdensity	Rural population per 1 sq *versta* of January 1, corresponding year	Central Statistical Committee of the Ministry of Interior (1905-1916)
Livestock	Number of horses and cows per 100 people	Central Statistical Committee of the Ministry of Interior (1905-1916)
Yield	Grain yield (in thousands of pobyods) per desyatina, calculated as total grain yield divided by total area under grain crops	Central Statistical Committee of the Ministry of Interior (1902, 1903, 1905-1916)
Ruwage	Industrial wage in an industrial region (composed of a group of provinces each), calculated as total earnings of all workers, whom Labor inspection monitored, divided by their number	Ministry of Finance (1904-1915)
Rwage	Daily earnings of rural workers in harvest season	Ministry of agriculture (1906-1914)
zemstvo confirm	Percentage of applications ruled in favor of the exiting household by local authorities	Ministry of Interior Affairs (1908-1915)
Hhrecall	Proportion of applications for title conversion that were recalled by the household	Zyryanov (1992)

Table A2. Regional data on migration to Siberia, economic performance and implementation of the Stolypin reform in provinces affected and not affected by the reform, 1896-1914.

Panel A. Not affected provinces.

	Before Stolypin reform (1901-1906)					After Stolypin reform (1907-1915)				
Variable	Obs	Mean	Std,Dev.	Min	Max	Obs	Mean	Std,Dev,	Min	Max
migrants	12,00	130,47	152,10	7,60	509,80	60	471,78	639,62	6	2873
smigrants	12,00	69,43	77,56	2,00	219,60	60	371,78	533,24	5	2710
unsmigrants	12,00	61,03	109,94	3,80	380,00	60	100,01	159,45	1	734
Popul	12,00	1953,18	1043,24	450,4	3525,63	60	2228,22	1104,17	457,5	4215,4
rdensity	12,00	36,91	20,76	14,4	90,03	60	38,72	21,4	14,4	101
Ushare	12,00	0,14	0,07	0,07	0,29	60	0,15	0,08	0,072	0,4
Yield	12,00	0,05	0,01	0,03	0,08	60	0,056	0,01	0,03	0,08
livestock	12,00	76,39	28,46	36,00	132,00	60	68,8	22,11	34,5	124
Rwage	12,00	40,75	10,21	31,44	64,44	59	30,37	9,93	15,75	55,8
Uwage	10,00	17,05	5,83	6,13	24,04	51	21,35	7,47	5,5	32,7
Ruwage	12,00	17,72	5,67	9,33	24,12	57	22,3	4,9	13,84	31,29

Panel B. Provinces affected by the reform

	Before Stolypin reform (1901-1906)					After Stolypin reform (1907-1915)				
Variable	Obs	Mean	Std,Dev.	Min	Max	Obs	Mean	Std,Dev,	Min	Max
Migrants	38	282,28	300,10	0,60	1195,40	189	1291,87	1636,12	0,00	8506,00
Smigrants	38	115,34	161,11	0,20	592,40	189	747,88	1055,28	0,00	6486,00
unsmigrants	38	166,94	181,97	0,40	603,00	189	543,99	838,90	0,00	5775,00
popul	38	2281,74	781,01	901,33	4175,93	190	2542,73	842,21	696	4890,25
rdensity	38	38,56	18,09	4,13	84,48	190	41,09	19,3	4,2	88,8
ushare	38	0,12	0,12	0,02	0,70	190	0,13	0,13	0,03	0,74
yield	38	0,04	0,01	0,02	0,06	190	0,05	0,01	0,01	0,09
livestock	38	57,10	17,36	34,33	117,67	190	50,94	15,25	30,50	118,10
rwage	38	38,91	9,91	25,5	65,22	187	27,37	6,8	15,75	57,6
uwage	37	15,43	6,14	6,48	31,65	187	17,6	6,62	5,96	37,41
ruwage	38	16,26	4,24	9,33	24,12	190	19,75	4,02	13,8	31,29

Table A3. Correlation matrix.

	n_exits	migrants	Smigrants	Unsmigrants	Livestock	popul	Rdensity	Ushare	yield
n_exits	1								
migrants	0.51	1							
Smigrants	0.30	0.90	1						
Unsmigrants	0.63	0.83	0.50	1					
Livestock	-0.16	-0.22	-0.20	-0.17	1				
Popul	0.16	0.40	0.33	0.36	-0.33	1			
Rdensity	0.11	0.35	0.36	0.22	-0.63	0.48	1		
Ushare	-0.04	-0.13	-0.10	-0.13	0.05	-0.03	-0.05	1	
Yield	-0.07	-0.01	0.04	-0.03	-0.06	0.15	0.34	0.11	1