"Property Rights, Liquidity Constraints and Internal Migration" [1]

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Abstract

Liquidity constraints in both labor and land influence the decision to migrate. The Stolypin agrarian reform in Russia provides a unique natural experiment that exogenously varies liquidity constraints in land. The reform gives the peasant the right to withdraw from the commune and to sell one's share of land. Peasant households could then take this opportunity to migrate. Since the reform did not affect all communes, we can employ difference-in-differences analysis on a panel of regional migration data from 1901-1914. Our results show that the relaxing of liquidity constraints explains at least 15% of all migration during this period.

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). While wage differentials remain the dominant explanation, economists often supplement it with imperfect markets in labor and land. In particular, liquidity constraints can reduce the ability of households to use their land and labor to finance migration, limiting mobility and undermining economic growth.

The migration literature usually focuses on the liquidity of labor, the ability to use future income from wages in place of destination to finance migration. However, the liquidity of land likely matters more in the development context because land markets, at least informally, are ubiquitous, while institutions that support the financing of migration through future labor are not. This paper highlights the liquidity of land determined by titling and property rights. We argue that individual ownership should ease the land liquidity constraint by both economic and institutional means. The economic effect is straightforward: households could now sell their land allotments. The institutional effect is indirect. Here, the opportunity cost of migration decreases because owners can now extract land rent without directly farming the land. However, we interpret both effects broadly as functioning through an increase in the liquidity of land because in both cases the value of land is less tied to time and space.

Economists have had difficulty empirically showing the importance of either type of liquidity constraint in the migration decision. This paper takes advantage of a natural experiment that provides a source of exogenous variation in land liquidity. Specifically, this paper investigates the impact of the 1906 Stolypin agrarian reform, and, in particular, its titling component, occurring in the European part of the Russian Empire, on migration to the Asian part of the empire, mainly to Siberia - an attractive destination for Russian peasants[2] - in 1901-1914.

[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 was influenced strongly by the Gulag archipelago and Stalin's forced migration, is correct only for the northern part of Siberia. The climate in Southern Siberia is very similar to the climate of the great plains of Canada and the northern part of the United States.

During these years the level of internal Europe-Asia migration in Russia compares to the settlement of the US West in the 19th C. Between 1800 and 1900 around 450, 000 individuals migrated to the US West annually, inclusive of population growth due to fertility/mortality rates (calculated from Mitchell 1998). Over the 14-year period discussed, we observe approximately 516,000 households migrating from the European part of the Russian Empire to Siberia; an average household contained 6 individuals, i.e. 221,000 individuals migrated in average year.

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*) of the empire. For our purposes, we view the reform as restructuring peasants' claims to land under the commune to claims with greater individual rights in the regions with repartition communes. Giving peasants increased 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. Figure 1 presents the distribution across time; migration level increased dramatically after the Stolypin reform.

Figure 1 somewhere here

To investigate the effect of change in property rights and the greater liquidity of land, we use province level data and construct a panel dataset of regional migration to Siberia, before and after the 1906 Stolypin reform. We apply difference-in-differences analysis to the provinces that were affected and those that were unaffected by the reform in order to analyze the link between the reform and migration. We find that the reform has a positive and significant effect on migration to Siberia. Our findings indicate that about 160,000 of the 516,000 migrating households during this time period can be attributed to the reform.

To unpack the mechanism of this link, we investigate the relationship between the number of title conversions, resulting in an exit from the commune, and migration to Siberia, and employ an instrumental variables approach to deal with the potential endogeneity problem. We find that 80,000 households, half of the overall effect of the reform, can be explained by the decision to exit the commune. These are our baseline results. With them, we contribute to the empirical literature on migration, showing directly for the first time that improvements in property rights contribute to an increase in migration via relaxing liquidity constraints.

The previous literature on land titling and individual decisions has stressed the indirect effect of better property rights through tenure security onto temporary migration (Field 2007, Do and Iyer 2008, De la Rupelle et. al. 2009). In this view, household members temporarily migrate to take advantage of better employment opportunities while the improvement in tenure security ensures the use of their assets upon their return. We investigate temporary migration to separate the effect of land liquidity from the effect of tenure security. In addition, households can also use their land as collateral to finance migration, a hybrid of the tenure security and land liquidity effects.

To strengthen the argument that this effect is indeed working through land liquidity, we test whether land sales drive this effect by adding the number of land sales to the main specifications. As robustness checks, we run a sensitivity analysis of our control and treatment groups, both contracting and expanding the control group. We also perform several placebo regressions playing on historical accounts of migration promotion. Unfortunately, with our data, we will not be able to distinguish empirically between the two forms of land liquidity, the financing effect and the opportunity cost effect.

In general, the liquidity 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 the uniqueness of the Stolypin reform to show that the pure economic effect of the titling reform might be larger than the institutional effect. Moreover, the existence of this institutional effect actually strengthens our results since the effects work in opposite directions.

Next, we take advantage of historical peculiarities of the reform to compare effects of different mechanisms to ease liquidity constraints. 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. During the time of the Stolypin reform, the government implemented large-scale spending on the resettlement administration, developed new lands, and provided credit and benefits to settlers. However, both before and after the reform, only approved migrants could

take advantage of these generous migration policies of the government. We study subsidized (those 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. Figure 2 shows the dynamics of subsidized and unsubsidized migration. One can see that unsubsidized migration follows subsidized migration with a lag. This pattern is consistent with the liquidity constraints story.

Figure 2 here

Rough estimates of the returns to migration both before and after the reform, 335% for land allotments[3], are larger than the returns to migration for European immigrants to the US during the 19th and early 20th centuries (Hatton and Williamson 1994 estimate a return of 150% and Abramitzky et al 2010 estimate 60-120%). These relatively larger returns and limited migration before the Stolypin reform support our argument that property rights and liquidity of land did indeed matter in the Russian case.[4] This evidence about the relative importance of liquidity of land in the migration decision informs 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 of migrating. Placing more emphasis on the opportunity cost of migration in terms of property rights and the ability of these rights to finance migration would shift the policy focus towards improving the liquidity of Russians' assets.

The structure of this paper is the following: First, 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 basic 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

[3] This number is calculated by taking the ratio of average allotment in Siberia which the government provided to newcomers (45 desyatinas, i.e. 49.1625 hectares) and the average peasant allotment in the European part in 1905 (13.4 desaytinas, i.e. 14.6395 hectares).

[4] Of note is the fact that Hanson (2006) finds a return of 200-400% for illegal migrants who were likely liquidity constrained.

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.[5] 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

[5] We are aware of an unfinished, ongoing randomized experiment that attempts to address the importance of financial constraints for the migration decision (Beam et al 2010).

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 Vollrath (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.

3. Historical review of the Stolypin reform.

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 but may decrease the attractiveness of migration. Although peasants obtained access to an additional source to finance their move, since they could privatize and then either sell or to lease their allotments, a title could also 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. Thus, in terms of migration, if liquidity

constraints mattered, a new source of financing was a more important immediate feature of title conversion (much similar to the modern movement to title land discussed in de Soto 2000).

The Stolypin titling reform affected the European part of the Russian Empire unevenly because repartition communes existed only in forty-one out of fifty European provinces for which we have data (Figure 3 gives the location of these provinces). There were almost no communes in the Baltic (Lifliandia, Estliandia, Kurliandia) provinces and those which existed were hereditary ones. 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, had no legal rights to sell their allotments and did not get any compensation for leaving one's allotment to the commune. There is evidence that in some cases peasants practiced illegal selling to each other under the commune's authority (Nafziger 2007), but by being illegal these purchases did not guarantee individual property rights (Ministry of Internal affairs 1912, 2 p.49) and this fact drove selling prices down (Yamzin 1912 pp. 42, 107). An exit was 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 legal right to sell plots.[6] To exit the commune a peasant had to appeal to the commune to arrange details. If they failed to

[6] The 1904 temporary rules for the first time eased the prohibition on receiving compensation for leaving one's allotment in repartition communes. 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 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 do not support the hypotheis that 1904 rules already eased budget constraints.

come to an agreement, a local imperial official (*zemskii nachalnik*) could arrange exit details under his authority. In both cases a local court on peasant affairs (*uezdnii sezd*) had to confirm an exit's arrangement details. There was a lot of bureaucratic red tape in this procedure, especially at the court level that lengthened time required to exit the commune. In 1908, the central government acknowledged the slow confirmation of exits by local courts and reorganized responsibilities of court officials in a way that focused their attention on the exit confirmation procedure, but without great success. The imperial government constantly put pressure on provincial governors as well as local and court officials to make the exit procedure shorter (see, for example, decree of the Ministry of Internal Affairs issued on 30.12.1909 and 14.06.1910 Ministry of Internal affairs 1910, 1 p. 15; 1912, 3 p. 106).

Figure 3 somewhere here.

Figure 4 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 15 429 157 hectares (38 096 683 acres). All in all, 22% of households privatized 14% of communal land over nine years of the implementation of the reform. Market price of average privatized allotment was 816.5 rubles (that equaled 668 percent of Russian 1913 per capita GDP, Markevich and Harrison 2011). However, the actual income from selling a plot of an average migrating household composed only 239 rubles (195 percent of 1913 per capita GDP) according to the 1911 survey (Sbornik … 1912 cited in Ablajei N. et al. 2010 p.31). The discrepancy arose because the most wealthy peasants having good prospects at their places of origins rarely decided to migrate and those peasants, who did, often managed to get only half of market price for their plots being under time pressure (Ablajei et al. 2010 p. 31). The sum was about the minimum amount recommended by the government for a peasant family to have after arrival at the place of destination in order to successfully start a farm (Voskresenskii 1909).

Figure 4 somewhere here.

Selling the plot was the main option to get additional resources for potential migrants. It was prohibited by law to mortgage privatized plots except through the Peasant bank. The Peasant bank statistics show that peasants rarely used this option if at all. The total number of loans with land as a collateral that peasants got did not exceed a two and a half thousand per year (Zak

1911, Dubrovskii 1963). Access of peasants, and of potential migrants in particular, to private short-term credit was very limited (Korelin 1988). According to 1912 survey of twelve districts in the European Russia, 12.8 percent of peasants who exited the commune sold their plots or parts of them and only 6.8 percent leased them. The rest 80.4 percent continued to cultivate their allotments. 12.6 percent of those who sold their plot and 2.3 percent of those who sold a part of the plot migrated to Siberia (Dubrovskii 1963 p. 359, 375).

Another important component of the new agrarian policy was the encouragement of migration to Siberia. The 10.03.1906 decree, issued half a year before the start of the titling reform, substantially enlarged the existing subsidies 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 per household (about the level of 1913 per capita GDP, i.e. about 14 percent of 1913 per household GDP). 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 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. (Resettlement administration 1908 pp.14-15, 1911a p. 74; Voshchinin 1915). Almost all authorized migrants applied for and got subsidies in the amount close to the upper limit. Thus, between 1894 and 1901, 86.3 percent of authorized migrants got subsidies (Ablazhej N. et. al. 2010) ; 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 provincial quotas on the number and time of granting permits in 1908. In 1911, all restrictions based on land availability were removed; a year earlier they were removed for resettlement into East Siberia (Sklayrov 1962, Simonova 1965, Shilovskii 2003, 2006). Obviously, unauthorized, unsubsidized migrants (but legal), by definition, did not face with any of these limitations.

The central government had no geographical preferences in its pro-migration policy, treating all provinces of out-migration equally. Thus, the government subsidized railway tariffs for migrants on pure distance basis, subsidizing per kilometer of travel regardless of which province of out-migration (Resettlement administration 1908 p. 73). When in 1908 and 1909 the government had to introduce provincial quotas for subsidies, it distributed them between provinces according to the level of the previous year migration without introducing any advantages for particular regions (Resettlement administration 1908 p. 17) other than actual current demand. Local government support of migration varied across provinces, however. Elected local government, or *zemstvo* (in 1913 existed in 38 out of 50 Russian European provinces), actively assisted to migration, but not all of them. Zemstvo governments in nine south provinces were most active; they established a union to promote migration. *Zemstvo* from the union formed organized group of migrants and hired special agents to accompany them during their move as well as hired agents in Siberia to assist peasants to settle down (Resettlement administration 1911a p. 4).

The migration to Siberia substantially increased after the reform. Figure 1 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.

What were other destinations except Siberia for peasants in European Russia who decided to abandon self-employment in agriculture both before and after the reform? Hired labor either in industrial sector or in landlord estates presented the main alternative. Dynamics of local wages demonstrate changes in demand for rural and urban workers. Migration to the New World or abroad was not really an option. While emigration from Russian empire was quite substantial during this period, about 1.6 mln people over fifteen years; it was not peasants from European provinces who migrated. Jews, Poles and Finns composed 40, 27 and 8 percent of migrants, correspondingly (Obolenskii 1928). 98 percent of Jewish migrants were city dwellers; Poles and Finns migrated from Polish kingdom and Finnish Grand Duchy, i.e. not from European provinces of the empire. Russians peasants from these provinces composed only about ten percent of all migrants. Main provinces of transatlantic outmigration belonged to both groups, to the group of provinces with repartition communes as well as to the group of provinces without. The share of emigrants from European provinces of the empire increased after the Stolypin reform from five to twelve percent (Obolenskii 1928).

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. The natural alternative hypothesis is that the titling reform influenced the migration process by increasing productivity. Peasants who exited the commune anticipate higher yields for their individually owned land allotments.[7] In this case, the reform would have a negative impact on migration. Another possible alternative hypothesis is that the titling reform had relatively little

[7] 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.

influence because the budget constraint had been totally eliminated by increased government subsidies.

As discussed in the introduction, observing a positive effect of the land reform on migration does not confirm the land liquidity constraints story. First, the effect of increased tenure security makes temporary migration less risky. Second, land liquidity could be driven by the collateral value of land and not land sales. 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).[8]

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. 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,

[8] 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 much shorter period of time for which we suppose migration is an immediate response to policy innovations.

many of them did not have accurate expectations of what this region would bring them.[9] 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 as well as asset structure. 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. The households' allotments, assets and obligations are important variables in judging the relative value of migrating to Siberia. Unfortunately, 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 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 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. This parameter reflects the restrictive land rights, obligations and arrears facing associated with the household's allotment. Note that in the alternative interpretation of opportunity cost, λ represents the friction in the labor allocation decision that the household loses its land if labor is allocated to Siberia. Given this constraint,

[9] 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…"

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. Some of these assets may be used as collateral. We introduce a tenure security parameter, γ_{ip}, to allow for the possibility that one can temporarily migrate. We treat (1-γ) as the probability that the household will lose its allotment even if it intends to return to the commune (i.e. the household does not transfer any of its allotment).

We summarize the expected benefit of migrating to Siberia with the variable, v_{Mig}. 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. Before the reform peasants were equally poorly informed about Siberia (Isaev 1891); after the reform, as it is described in the historical section, the government did not disseminate information differently across provinces.

The costs of migration, C_p, include transportation costs and start-up funds. Again, these are not small. We make the simplifying assumption that temporary migrants and permanent migrants face similar costs of migration. Subsidies, S_{ip}, available through the government's migration policy partially offsetting the cost of migration. 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.

Upon exiting, the allotment is fixed so there is no possibility to increase x. Peasants can increase their allotment by purchasing others' allotments but initial financing solely depends on the x. At least $\lambda_{ip}x_{ip}$ stays with the commune because of the restrictions on property rights. The remaining $(1-\lambda_{ip})x_{ip}$ is used to finance migration. Including the option to return migrate, the household can pay off its debt and retain the $(1- \lambda_{ip})x_{ip}$ upon reentering the commune, since, in expected terms, migration is optimal. However, the tenure security parameter will affect this value because with probability $(1-\gamma_{ip})$ the household will lose its allotment. Thus, we get $v(x_{ip}, \gamma_{ip}) = v_{Mig}[1 - (\delta - \delta^R)]/(1 - \delta) + (\gamma_{ip}x_{ip} + \varphi)\delta^R/(1 - \delta)$, where $\varphi(R)$ is the profit from temporary

migration in allotment units (this is in addition to x), R represents the date of return migration and δ describes the discount factor. For simplicity, we assume that R is determined exogenously by other factors.

Now we can determine the share of the population that migrates, given by $F(v > x \geq \xi; \mu, \sigma)$ and formulate our main predictions:

Land Liquidity Prediction: The proportion of migrants in a province is negatively related to the tightness of the liquidity constraint. In particular, $\partial F(v > x \geq \xi; \mu, \sigma)/ \partial\lambda < 0$.

Tenure Security Prediction: The proportion of migrants in a province is positively related to the strength of tenure security. In particular, $\partial F(v > x \geq \xi; \mu, \sigma)/ \partial\gamma > 0$. Note that this effect is higher the more temporary migration is, the lower R is.

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:

$$Migration_{it} = \alpha + \beta * Repartition_i + d * Reform_t + \gamma * Reform * Repartition_{it} + \phi X_{it} + u_i + \tau_t + \varepsilon_{it} \quad (1)$$

where by *Repartition* we mean a dummy indicating those provinces affected by the reform and *Reform* tracks the date of implementation. X_{it} is a set of control variables. u_i *and* τ_t are region and time fixed effects and ε_{it}, is a random disturbance. The coefficient γ is the effect of interest and we expect it to be positive. We will run several modifications of (1) to make consistent the use of certain variables with inclusion or exclusion of unobserved time and provincial heterogeneity. We should discuss migration variable here? Is it in levels or per capita?

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 and rural density. The size of the province in terms of population obviously influenced both the number of exists and migrants. 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. We also control for the unskilled wage rate in a province to condition on the attractiveness of 'urban' outside option. This wage rate should account for the outside option of non-farm activities in rural areas as well if this wage is in equilibrium. To account for the outside option of rural hired labor, we include rural wages of unskilled workers which is known only for harvest months, i.e. period of highest labor demand in the countryside. 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 kilometer to control for liquidity available to peasants and relative income. To account for differences in transportation costs, we use the railway tariff to the nearest point in Siberia from the capital of a province. To account for potential regional heterogeneity, we employ thirteen region dummies (described in the next section), among which fifty provinces of Russian are distributed. We also employ both fixed and random effects at the province level for some specifications.

Equation 1 is in levels whereas the percentage change may be of greater interest. The one difficulty with using logs is the fact that the main variable of interest is a dummy variable that changes over time. This implies that the unit of measurement of this effect is fixed while the

outcome variable's unit is variable. Moreover, there is a huge spike in migration from low levels before the reform. This initial spike will necessarily reduce the magnitude of subsequent jumps artificially dampening the effect of the fixed unit treatment variable. Thus, the presence of liquidity constraints makes it difficult to assess changes using both changes in migration and the treatment dummy variable.

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 F distributions could be different for the treatment and control group. 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. 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.

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 (that is, the effects are not additive as table 1 suggests). 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. 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.

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. In this case, 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. 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.

$$Migration_{it} = \alpha + \beta * Number\ of\ exits_{it} + \phi X_{it} + u_i + \tau_t + \varepsilon_{it} \quad (2)$$

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 proportion of applications over title conversion that were quickly confirmed by the local courts (*confirmation_rate*). As discussed in historical section, we interpret this variable as a measure of bureaucratic red tape. The government wanted to encourage exits and migration but nevertheless local officials could delay granting exit by being overburdened with other responsibilities.[10]

Thus, we initially reestimate (2) using 2SLS with the first stage as in (3a), adding controls and fixed effects to (3a) as before:

$$Number\ of\ exits_{it} = \alpha + \beta * [\ confirmation\_rate]_{it} + + \phi X_{it} + u_i + \tau_t + \eta_{it} \qquad (3a)$$

4.5 Tenure security and temporary migration.

We can construct measures of temporary migration from short-run migration and long-run return migration into a province. Given the theory, the bigger the R, the smaller the effect of tenure security on migration. Thus, we would expect β to be larger for the short-run than long-run migrants.

$$TempMigration_{it} = \alpha + \beta * Number\ of\ exits_{it} + \phi X_{it} + u_i + \tau_t + \varepsilon_{it} \qquad (4)$$

4.6 Short-run and long-run effects on migration outflows.

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

[10] Another possible instrument, the number of applications for exit that were later recalled (*hhrecall*), is 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. We imagine that this second instrument may signify the presence of social pressure that discourages exit in a particular commune. This instrument is valid if this social pressure is purely ideological with respect to the privatization of the commune and does not influence unobservable variables affecting migration. 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. We present the results for this instrument in the online appendix because the instrument does not perform well.

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.

4.7 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.

4.8 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 on regional migration to Siberia before, during and after the Stolypin reform. The bulk of our data come from the official periodical publications by various imperial authorities which normally reported current statistics at the province level. We collect information for fifty out of fifty-three provinces from European part of the empire.[11]

First, we use Resettlement Administration migration statistics. This administration registered both subsidized and unsubsidized migrants when they passed through (in both directions) two key railway stations of the Trans-Siberia railroad, namely Syzran' and Chelyabinsk. Because the Trans-Siberia railroad was basically the only transport for migrants to

[11] We do no have information on number of migrants from Atkhanglesk, Olonetz and Yaroslavl' provinces.

get their destinations, they could not bypass these stations.[12] The government demanded migrants to register and they had incentives to do this because registration affected their access to canteens, medical, bath and laundry services, which the government provided for them during their move (irrespective of the status of migrant - subsidized or unsubsidized). The authorities regularly published information about number of subsidized and unsubsidized migrating households by province of origin; N. Turchaninov (1910, 1915) replicated statistics for 1896-1914 in two summary volumes.

Second, we extract information on peasants' applications to exit the commune and to convert their land titles as well as actual number of exits from an official periodical journal published by the Ministry of Internal Affairs (*Izvestiya zemskogo otdela*). The government needed information about success of the Stolypin reform and demanded provincial government to report exit statistics regularly to the center (Ministry of Internal affairs 1912, 3, p. 106); part of this statistics irregularly appeared in the journal. Knowing number of applications and real exits, we are able to estimate the confirmation rate.

Third, we gather information on sales of privatized peasant plots in repartition communes from annual statistical volumes of the Ministry of Justice. Notaries had to register all land sales and report them to the government. For 1907-1909 and 1914 we do know only total number of sales in both repartition and hereditary communes in a province. We reconstruct these data applying shares of sales in repartition communes among total sales in a province estimated on 1910 - 1913 provincial figures. There is little variation over time in the latter.

Information on population, rural density, size and cost of allotments, yield and livestock are from official statistical volumes (*Statisticheskii ezhegodnik Rossiiskoi imperii*) which the Central Statistical Committee of the imperial Ministry of Internal Affairs started to publish annually since 1904. We use classification of provinces by regions from the same statistical volumes to construct thirteen regional dummies. Rural wages are from agricultural statistical volumes published annually by the Ministry of Agriculture since 1906 (*Sbornik po selskomu khozyastvu za ... god*); and urban wages are from annual labor inspection reports published by the Ministry

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

of finance (*Svod otchetov fabrichnikh inspektorov za … god*).[13] Railway tariffs are from 1911 information booklet published by the Resettlement administration for migrants. Finally, we use archival data on the number of land conflicts in a region, which local governors reported to the center, collected by previous generations of historians (Anfimov 1998, Dubrovskii 1956, 1963). Table A1 from the on-line appendix provides full list of variables from our dataset and sources.

Data availability determines the numbers of observations in our dataset. We use average annual regional data for seven periods, one before and five after the reform: 1901-1906, 1907, 1908-1909, 1910-1911, 1912, 1913 and 1914. The availability of exit statistics determines the reform periods.[14] We construct the pre-reform period sufficiently longer because 1904 and 1905 were abnormal years for migration to Siberia; one of consequences of Russian-Japanese 1904-1905 war was very low migration rate because the government prevented migration due to necessity to transport regiments to the war front via the only one Trans-Siberia railroad. In total, there are three hundred province-in-a-period observations in our dataset.

Table 2 presents summary statistics of our sample. There were on average nine and a half hundred migrating families 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 migrating households than an average province and there were several provinces without any migrants at all. Migrants composed about two percent of the local population from an average province in an average year. Rural population density was quite high, 36 inhabitants per 1 square kilometer 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

[13] Rural wages are wages of unskilled agricultural workers during the harvest season, i.e. the period of highest demand for labor during a year. Urban wages are average annual wages in industry (calculated as total annual payroll bill to industrial blue-collar workers under monitoring of the Labor inspection divided by their number and transformed to monthly rate) in so called industrial region, which composed of a group of provinces each, in order to allow for cross-province rural-urban migration,

[14] 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. We also do not have data on population, urban share, rural density and livestock for 1901, 1902 and 1903 years and yield and rural wages for 1901. We consider that these variables have missing values for these years when we construct annual averages of these variables for the 1901-1906 period.

possessed fifty-six cows and horses. As a result of the Stolypin reform, over six and a half thousand peasant households 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.

Table A2 from the on-line 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 from the on-line 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 5).

Figure 5 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. We obtain per year, per province estimates between 366 and 489 households who migrate in response to the reform, meaning as many as 160,000 households migrated due to the Stolypin titling reform, i.e. 36% 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 households subsequently migrate. This proportion is around two 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 migrating households can be attributed to title conversion, at least, 50% 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 column includes the controls discussed in the third section. The estimate for the coefficient of interest decreases when we include the controls by around 10%. In column 2 (without regional fixed effects) all the variables, except railway tariff, have the right signs. Here, there may be an issue that this control does not vary over time. The

third column also includes regional fixed effects. The coefficient of interest remains positive and significant although the coefficient decreases in size. Only one (livestock) 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 although statistically insignificant effect for the year following the reform. However, in the next two subsequent years, 1908-1909, around 977 to 1099 households migrated in response to the reform per province, per year; in following 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.[15]

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 2, by including the repartition province dummy, confirms that the variation in number of exits within the provinces drives the effect of the number of exits. Interestingly,

[15] Table A4 reports the results of our basic difference-in-difference model where the dependent and control variables enter in logs. The coefficients on the interaction between the reform provinces dummy and the reform period are positive in all specifications, but all statistically insignificant (shown in columns 1, 3 and 5). This 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 in the basic difference-in-differences model. When we allow the effect of the reform to vary over time, the coefficient on the period 1908-09 is positive and significant for unsubsidized migrants shown in column 6. We also see that the reform has a positive and significant effect for all migrants, subsidized and unsubsidized ones in the period of 1912-13. These results suggest that the reform has an effect on changes in migration, particularly for unsubsidized migrants. Although these results are not as robust as the results in levels, they support the liquidity constraints story. We would also like to remind the reader that when we change the variable of interest from a dummy to the continuous variable – the number of exits – the coefficient of interest becomes both positive and highly significant as table 4 demonstrates.

columns 5 and 6 of table 4 report an elasticity of 0.09 - 0.18 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 columns 5 and 1, respectively, of table 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 nor 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. Taking elasticities (shown in columns 4 and 8), we see that indeed the response is larger for the unsubsidized migrants (.11 for unsubsidized compared to .09 for subsidized). Again we find evidence that is consistent with the idea that the budget constraint matters. 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 has been discussed above, we 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 a potential candidate for an instrumental variable, the percentage of disputed title conversions confirmed by local authorities without being delayed (*confirmation_rate*). This instrument should be positively related to the number of exiting households and reflect bureaucratic pressure that results from the new opportunity to exit and should not correlate with unobservable variables that affect the migration decision.

The variable *confirmation_rate* is available for per year observations from 1907-1915. 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 *confirmation_rate*. In columns 2 and 4 of table 6, we present the basic specification for both all migrants and unsubsidized migrants and columns 3 and 5 add time and provincial fixed effects. We have included year fixed effects despite the fact that most of the time variation is occurring in the migration and exits variables. 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 and decreases when time effects are added. The IV estimations in the 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.[16]

6.3. Land liquidity Effect

[16] As discussed in the fourth section, there is another candidate for a possible instruments the proportion of applications for title conversion that were recalled by the household (hh recall). This variable should be negatively related. However, due to data availability, we need to restrict attention to the period of 1914. Using both instruments, the first stage regressions indicate that both variables appear to have enough explanatory power. The first column of table A5 from the online appendix shows that the coefficient on *confirmation_rate* 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. When we 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 *confirmation_rate* and it has an unexpected sign.

In this section, we investigate whether the alternative hypothesis that the reform increased migration indirectly by improving tenure security. As discussed in section 4, the tenure security effect should have a greater impact for temporary migration. Using data on temporary and return migration, migrants who have migrated and returned within one year, we construct two additional measures of migration, long-term migration, defined as migration minus temporary migration and short-term migration, return migration minus temporary migration.

Table 7 shows the results for long-term migrants, temporary migrants (all, subsidized and unsubsidized), and short-term migrants using lagged exits since short-term migrants likely did not migrate in the current period. The effect for long-term migrants is positive and significant while the coefficient on exits exhibits miniscule effects for neither short-term nor temporary migration.

As mentioned in the introduction, we take advantage of data on land sales to provide a more direct test of the land liquidity hypothesis. Table 8 shows robust evidence that selling repartition plots predicts migration patterns.[17] We present both pooled OLS and fixed effects regressions (columns 1 and 5, respectively), where we instrument for exits with the confirmation rate variable in columns 4 and 6 (column 3 gives the first stage results).

6.4. 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. We first exclude the Baltic provinces (5 out of the original 9). We rerun the basic specification for both all migrants and only the unsubsidized migrants. The results are presented in table 8, columns 1 and 2. For the Baltic exclusion, the effect of the reform is diminished for both types of migrants, but remains significant for the unsubsidized 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 20% to extend the control group to a larger set of provinces (by 3 provinces). In columns 3 and 4 of table 8, we

[17] Given the way the sales data is constructed, these coefficients underestimate the true effect if the hypothesis that liquidity constraints matter is true. Recall that we assume that the proportion of repartition sales in a given province is stable over time (a fact that bears true after 1910) . However, it is likely that repartition sales were much higher in the early years of the reform given the fact that there were much fewer restricitions on land transfers in hereditary communes since before the reform.

see the results. Again, the effect of the reform is positive and significant for both all migrants and unsubsidized migrants.

As an additional robustness check, we run two placebo regressions based on the idea that one possible interpretation of the reform "treatment" is to promote migration (both monetarily and non-monetarily). The institution that promoted migration most heavily was zemstvo, a form of local governance (see section 3 for details). The correlation between zemstvo and repartition provinces is rather high (.74), giving confidence that the presence of zemstvo is an appropriate placebo. We rerun the main specifications for all migrants, subsidized and unsubsidized migrants. Table 9 presents the results. The placebo has no effect for all migrants or subsidized ones. The placebo does have a positive and significant effect for unsubsidized migrants in column 3 of table 9. However, given the promotional efforts should have been mainly targeted to authorized migrants, we find it difficult to interpret this effect as a promotional one. Moreover, the observed effect appears smaller than for repartition provinces. The negative and significant coefficient on zemstvo could be attributed to better local governance in these provinces. Since not all zemstvo provinces were active in promoting migration, we run an additional placebo regression using only those provinces that were members of the union mentioned in section 3 as the placebo. Again, no significant effects are observed for subsidized or all migrants. The coefficient of interest is positive for unsubsidized migrants but not significant. Migration flows from these provinces are rather high suggesting that the formation of union followed the demand for migration.

Transatlantic placebo here.

Violence and conflict pre-reform here.

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 2 and 5 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.

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 narrow focus on wage differentials explains migration patterns by pointing to imperfect markets. A policy implication following from this literature is to decrease outflows by improving missing capital or insurance markets in the migrants' place of origin (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 that 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 effects 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. 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). In addition, for migration to Siberia, our estimates also suggest that the changes in migration policy and governmental subsides were less important than the titling reform. 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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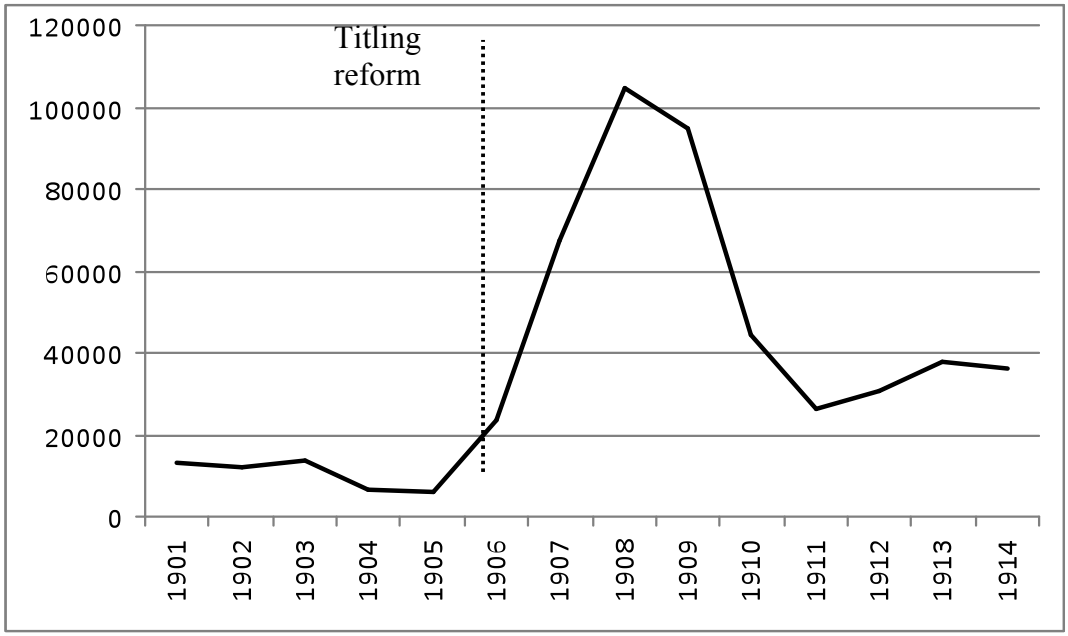
Figure 1. Migration dynamics 1901-1914 : the annual number of households that migrated to Siberia .



Source: Turchaninov(1910), (1915)

Figure 2: Migration dynamics for subsidized and unsubsidized migrants

Figure 3: A map of provinces in the European part of Imperial Russia

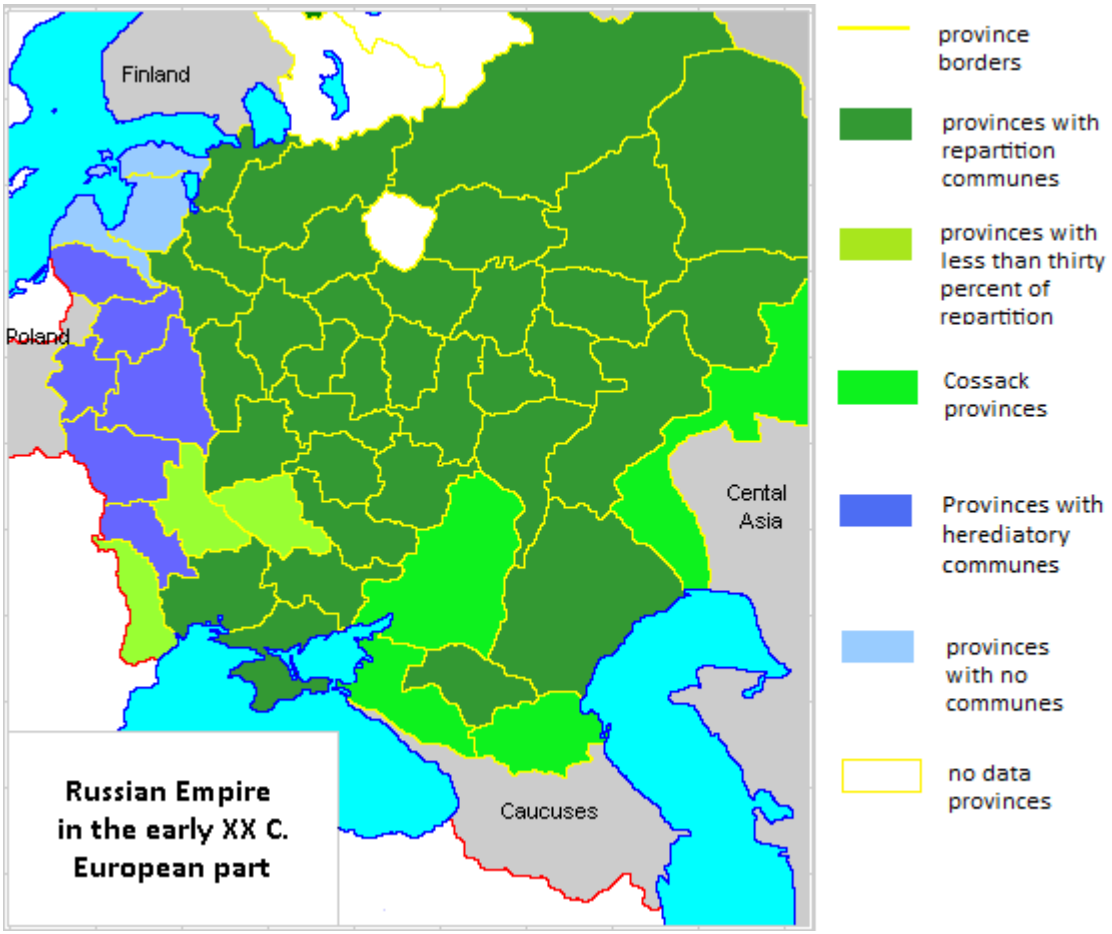
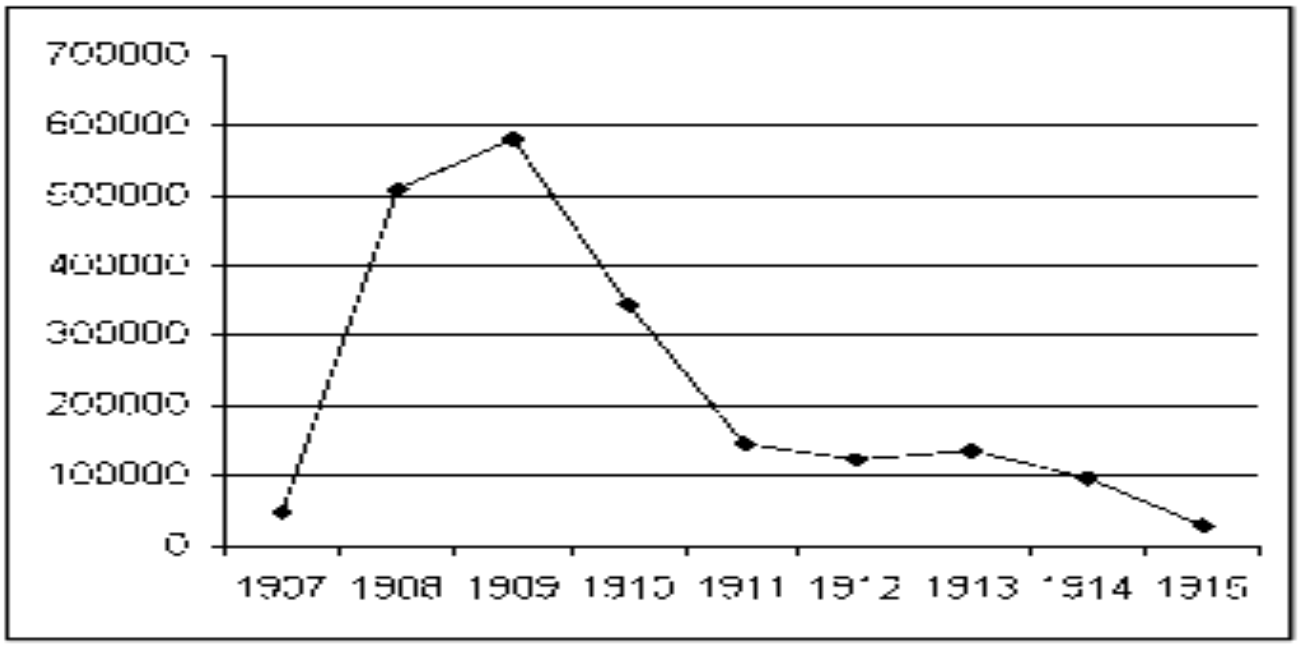
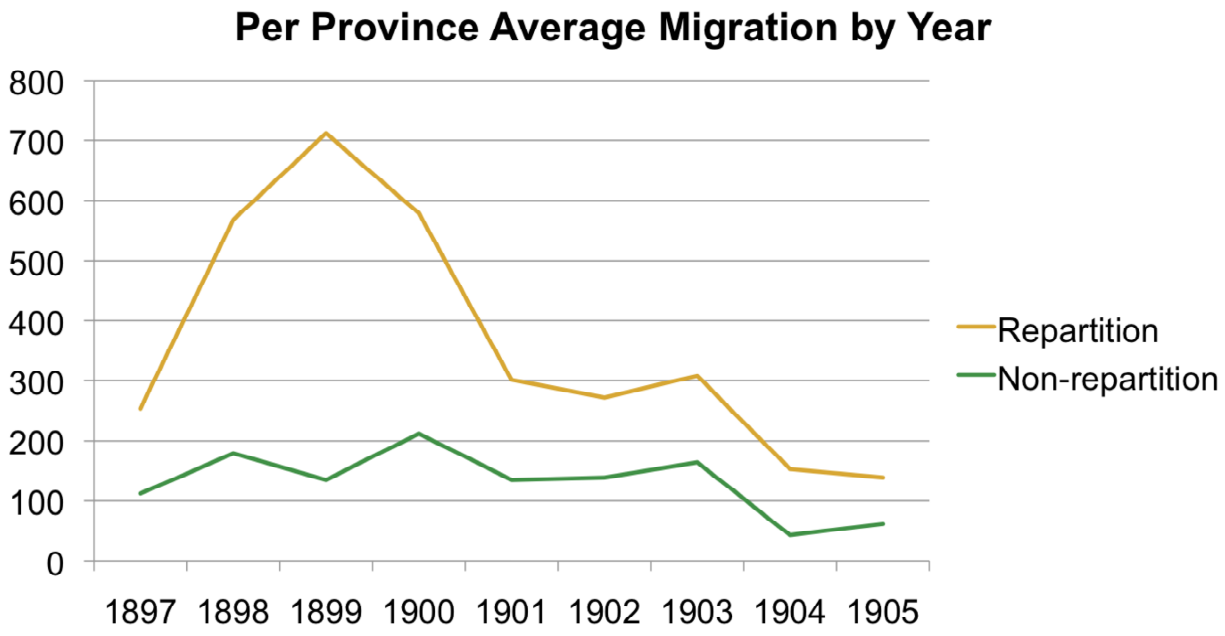


Figure 4. Titling conversion under the 1906 decree: the annual number of peasants who exited the commune fro 1907 to 1915.



Source: Dubrovskii (1963).

Figure 5. Migration dynamics 1897-1905 for Repartition and Non-repartition Provinces



ıurce: Turchaninov(1910), (1915)

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	350	0.82	0.38	0	1
Reform	350	0.86	0.35	0	1
Repartition_reform	350	0.76	0.45	0	1
Exits per 000 citizens	327	2.43	4.71	0	35.7
confirmation_rate	348	0.19	0.22	0	0.98
Sales per 000 citezens	337	0.81	1.21	0	7.34
Migratinghh per 000 citezens	349	0.33	0.45	0	2.8
Smigrantinghh per 000 citizens	349	0.2	0.31	0	2.49
Unsmigratinghh per 000 citizens	349	0.13	0.22	0	1.95
RWTariff (kopeks)	350	361.2	75.8	130	475
Popul (000)	350	2442.48	901.11	450.35	4890.25
Rdensity (rural population per sq km)	350	40.37	19.68	4.13	101
Rwage (per harvest month in rubles)	344	30.16	8.95	15.75	65.22
Yield (tons per hectare)	350	48.97	12.96	8.74	88.96
Livestock (cows and horses) per 00 citizens	350	55.87	19.08	30.5	132
Ruwage (per month in rubles)	347	19.89	4.56	9.33	31.3

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

	Diff-n-Diff			Pooled OLS	OLS with provincial FE	OLS with provincial RE
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
repartition_reform	0.20***	0.18***	0.15***			
	[0.050]	[0.053]	[0.050]			
repartition_year1907				0.22	0.22	0.22
				[0.146]	[0.161]	[0.150]
repartition_year190809				0.40***	0.45***	0.41***
				[0.127]	[0.137]	[0.128]
repartition_year191011				0.01	0.05	0.03
				[0.053]	[0.058]	[0.053]
repartition_year1912				0.11**	0.08	0.12***
				[0.049]	[0.053]	[0.042]
repartition_year1913				0.18***	0.17***	0.19***
				[0.040]	[0.046]	[0.039]
repartition_year1914				0.15***	0.16***	0.13***
Reform	0.11***	0.14**	0.05			
	[0.032]	[0.067]	[0.069]			
repartition_province	0.04*	0.11	0.22**	0.14		0.06
	[0.023]	[0.082]	[0.100]	[0.105]		[0.056]
rdensity		0.01***	0.00	0.00	-0.02*	0.01***
		[0.002]	[0.002]	[0.003]	[0.009]	[0.002]
livestock		0.01**	-0.00	-0.00	-0.00	0.00
		[0.002]	[0.002]	[0.002]	[0.005]	[0.002]
yield		-0.00	-0.01**	-0.01**	-0.00	-0.00
		[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
rwage		-0.01**	-0.01***	-0.01*	-0.02***	-0.01**
		[0.005]	[0.004]	[0.004]	[0.005]	[0.003]
ruwage		-0.02**	-0.01	0.00	0.01	-0.01
		[0.007]	[0.007]	[0.007]	[0.012]	[0.007]
rwtariff		0.00	-0.00	-0.00		
		[0.000]	[0.001]	[0.001]		
Year Effects	No	No	No	Yes	Yes	Yes
Regional Effects	No	No	Yes	Yes	No	No
Provincial Effects	No	No	No	No	Yes	Yes
Constant	0.06***	0.02	0.94***	0.63***	1.61***	0.21
	[0.016]	[0.264]	[0.274]	[0.219]	[0.547]	[0.204]
Observations	349	340	340	340	340	340
R-squared	0.082	0.235	0.396	0.514	0.394	
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 (per capita and logs)

	Pooled OLS (levels)			Fixed Effects	Pooled OLS (Logs)	
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Exits	0.04***	0.04***	0.04***	0.03***		
	[0.010]	[0.010]	[0.008]	[0.008]		
repartition_province		0.22**				
		[0.088]				
logexits					0.14***	0.13***
					[0.032]	[0.031]
rdensity	0.01***	0.01***	0.00	-0.02**	0.00***	0.00
	[0.002]	[0.002]	[0.002]	[0.006]	[0.001]	[0.002]
livestock	0.00**	0.01**	-0.00	-0.02***	0.00**	-0.00
	[0.002]	[0.003]	[0.002]	[0.005]	[0.002]	[0.001]
yield	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	[0.003]	[0.003]	[0.002]	[0.003]	[0.002]	[0.001]
rwage	-0.00	-0.00	-0.01**	-0.02***	-0.00	-0.01***
	[0.005]	[0.004]	[0.003]	[0.004]	[0.003]	[0.002]
ruwage	-0.02**	-0.01*	0.00	0.01	-0.01**	0.00
	[0.008]	[0.007]	[0.007]	[0.011]	[0.005]	[0.004]
rwtariff	0.00	0.00	-0.00		0.00	-0.00
	[0.000]	[0.000]	[0.001]		[0.000]	[0.000]
Tine Effects	Yes	Yes	Yes	Yes	Yes	Yes
Regional Effects	No	No	Yes	No	No	Yes
Provincial Effects	No	No	No	Yes	No	No
Constant	-0.07	-0.53*	0.71***	2.28***	-0.10	0.42***
	[0.202]	[0.310]	[0.212]	[0.516]	[0.143]	[0.114]
Observations	319	319	319	319	319	319
R-squared	0.420	0.438	0.581	0.474	0.429	0.631
Number of id				47		

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 (per capita)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Subsidized Migrants				Unsubsidized Migrants			
	OLS	OLS	OLS	OLS (logs)	OLS	OLS	OLS	OLS (logs)
Exits			0.02**				0.02***	
			[0.008]				[0.007]	
logexits				0.07**				0.08***
				[0.030]				[0.017]
Repartition_reform	0.06				0.09***			
	[0.037]				[0.019]			
repartition_year1907		0.15				0.07**		
		[0.133]				[0.027]		
repartition_year190809		0.08				0.32***		
		[0.083]				[0.068]		
repartition_year191011		-0.01				0.03		
		[0.040]				[0.018]		
repartition_year1912		0.04				0.06***		
		[0.030]				[0.023]		
repartition_year1913		0.12***				0.06***		
		[0.028]				[0.017]		
repartition_year1914		0.09***				0.05**		
Repartition Province	0.21**	0.16*	0.19**		0.01	-0.03	0.00	
	[0.080]	[0.083]	[0.072]		[0.034]	[0.038]	[0.028]	
Reform	0.05				0.00			
	[0.045]				[0.032]			
rdensity	0.00*	0.00*	0.00	0.00	-0.00	-0.00	-0.00	-0.00
	[0.002]	[0.002]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
livestock	-0.00	-0.00	-0.00	-0.00*	-0.00	-0.00*	-0.00	-0.00
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
yield	-0.01**	-0.00**	-0.00**	-0.00	-0.00	-0.00	0.00	0.00
	[0.002]	[0.002]	[0.002]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
rwage	-0.01***	-0.01***	-0.01***	-0.01***	-0.00	-0.00	-0.00	0.00
	[0.002]	[0.002]	[0.002]	[0.001]	[0.002]	[0.003]	[0.002]	[0.002]

ruwage	-0.01	-0.00	0.00	0.00	-0.01*	0.00	0.00	0.00
	[0.005]	[0.005]	[0.005]	[0.003]	[0.003]	[0.003]	[0.002]	[0.002]
rwtarif	-0.00	0.00	0.00	0.00	-0.00	-0.00	-0.00	-0.00
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Time Effects	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Regional Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Provincial Effects	No	No	No	No	No	No	No	No
Constant	0.47**	0.25*	0.28*	0.26***	0.47***	0.38***	0.24**	0.19**
	[0.182]	[0.140]	[0.159]	[0.091]	[0.143]	[0.137]	[0.103]	[0.077]
Observations	340	340	319	319	340	340	319	319
R-squared	0.425	0.497	0.533	0.585	0.264	0.465	0.542	0.582

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	All Migrating HHs		Unsubsidized Migrating HHs	
	# of exits	2SLS	Fixed Effect	2SLS	Fixed Effects
	(1)	(2)	(3)	(4)	(5)
Exits		0.04***	0.03***	0.02***	0.02***
		[0.013]	[0.009]	[0.006]	[0.004]
confirmation_rate	14.63***				
	[2.340]				
Yield	-0.02	-0.00	-0.00	0.00	0.00
	[0.019]	[0.002]	[0.003]	[0.001]	[0.001]
rdenisty	0.01	0.00	-0.02*	-0.00	-0.01
	[0.014]	[0.002]	[0.009]	[0.001]	[0.005]
livestock	0.02	-0.00	-0.02***	-0.00	-0.01***
	[0.022]	[0.002]	[0.005]	[0.001]	[0.002]
Ruwage	0.08	0.00	0.01	0.00	0.01
	[0.050]	[0.006]	[0.017]	[0.002]	[0.008]
Rwage	0.04	-0.01***	-0.02***	-0.00	-0.01*
	[0.036]	[0.004]	[0.006]	[0.002]	[0.003]
Rwtariff	-0.01	0.00		-0.00	
	[0.004]	[0.001]		[0.000]	
Time Effects	Yes	Yes	Yes	Yes	Yes
Provincial Effects	No	No	Yes	No	Yes
Constant	-2.00		2.25***		0.85***
	[1.339]		[0.598]		[0.294]
Observations	319	318	318	318	318
R-squared	0.670	0.420		0.410	
Number of id			47		47

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

Table 7: Temporary Migration

	Long-term Migrants	Temporary Migrants			Short-term Migrants	
	All Migrating Hhs	All Migrating Hhs	Subsidized Migrating HHs	Unsubsidized Migrating Hhs	All Migrating Hhs	All Migrating Hhs
exits	0.03***	0.00***	0.00	0.00***		
	[0.007]	[0.000]	[0.000]	[0.000]		
Lag1exits					0.00**	0.00**
					[0.001]	[0.001]
Lag2exits						0.00
						[0.001]
rdensity	0.10	0.01**	0.01	0.00		
	[0.090]	[0.004]	[0.004]	[0.002]		
livestock	0.03	0.01*	0.00	0.01**	0.02**	
	[0.098]	[0.004]	[0.003]	[0.003]	[0.007]	
yield	-0.26***	0.00	-0.00	-0.00	0.04**	0.02
	[0.062]	[0.004]	[0.003]	[0.002]	[0.017]	[0.013]
rwage	-0.16**	-0.01**	-0.00	-0.00**	-0.01	-0.03**
	[0.076]	[0.003]	[0.002]	[0.002]	[0.012]	[0.011]
ruwage	-0.04	-0.00	-0.00	-0.00*	-0.01	-0.03*
	[0.068]	[0.003]	[0.002]	[0.002]	[0.013]	[0.015]
Constant	2.04***	0.10***	0.07***	0.04**	-0.01	0.14
	[0.456]	[0.027]	[0.016]	[0.016]	[0.070]	[0.120]
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes
Province Effects	Yes	Yes	Yes	Yes	Yes	Yes
N of obs	310	311	311	311	268	226
R-squared	0.446	0.391	0.174	0.475	0.369	0.334
N of id	47	47	47	47	47	47

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

Table 8: Sales and Migration

	Pooled OLS		First-stage	2SLS	OLS with provincial FE		IVFE
			exits			without Ekaterinoslav	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
RHHsales	0.07***	0.05**	0.29	0.06*	0.05*	0.06**	0.05*
	[0.018]	[0.022]	[0.222]	[0.031]	[0.025]	[0.027]	[0.027]
repartition_province		0.18*					
		[0.104]					
exits	0.04***	0.04***		0.05***	0.03***	0.03***	0.03***
	[0.010]	[0.010]		[0.017]	[0.008]	[0.009]	[0.009]
rdensity	0.01***	0.01***	0.01	0.01***	-0.02**	-0.02**	-0.02*
	[0.002]	[0.003]	[0.015]	[0.002]	[0.007]	[0.007]	[0.009]
livestock	0.05**	0.07**	0.19	0.05**	-0.13**	-0.13**	-0.13***
	[0.022]	[0.027]	[0.218]	[0.020]	[0.050]	[0.050]	[0.048]
yield	-0.00	-0.00	-0.01	-0.00	-0.00	-0.00	-0.00
	[0.003]	[0.003]	[0.018]	[0.003]	[0.003]	[0.003]	[0.003]
rwage	-0.00	-0.01	0.03	-0.01	0.02***	-0.02***	0.02***
	[0.005]	[0.004]	[0.033]	[0.004]	[0.006]	[0.006]	[0.006]
ruwage	-0.02**	-0.01*	0.08	-0.02**	0.00	-0.00	0.00
	[0.008]	[0.008]	[0.047]	[0.007]	[0.011]	[0.011]	[0.017]
rwtarif1907	0.00	0.00	-0.00	0.00			
	[0.000]	[0.000]	[0.004]	[0.000]			
confrate			13.98***				
			[2.605]				
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Reional effects	Yes	Yes	Yes	Yes	No	No	No
Provincial effects	No	No	No	No	Yes	Yes	Yes
Constant	0.02	-0.39	-1.43	0.00	2.27***	2.33***	2.25***
	[0.193]	[0.340]	[1.478]	[0.197]	[0.520]	[0.531]	[0.595]
Observations	318	318	318	317	318	311	317
R-squared	0.445	0.456	0.673	0.431	0.482	0.475	
Number of id					47	46	47

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

Table 9. The effect of the reform on total migration and unsubsidized migration for alternative treatment and control groups.

	Excluding Baltic Provinces		Expanded Control Group <20% repartition commune	
	All Migrating Hhs	Unsubsidized Migrating Hhs	All Migrating Hhs	Unsubsidized Migrating Hhs
repartition_reform	0.11	0.09***	0.11*	0.08***
	[0.076]	[0.025]	[0.060]	[0.024]
reform	0.07	-0.00	0.08	0.01
	[0.098]	[0.043]	[0.072]	[0.031]
repartition_prov	0.25**	0.01	0.14	0.07
	[0.114]	[0.040]	[0.095]	[0.040]
yield	-0.01**	-0.00	-0.00	0.00
	[0.003]	[0.001]	[0.003]	[0.001]
rdensity	0.00	-0.00	0.00	-0.00
	[0.003]	[0.001]	[0.003]	[0.001]
livestock	-0.00	-0.00	-0.00	0.00
	[0.002]	[0.001]	[0.002]	[0.001]
ruwage	-0.01	-0.01*	-0.01	-0.01**
	[0.007]	[0.003]	[0.007]	[0.003]
rwage	-0.02***	-0.00	-0.02***	-0.00**
	[0.005]	[0.003]	[0.004]	[0.002]
rwtarif1907	-0.01**	-0.00	-0.00	0.00
	[0.003]	[0.001]	[0.003]	[0.001]
Regional Effects	Yes	Yes	Yes	Yes
Constant	0.98***	0.50***	0.77**	0.25
	[0.309]	[0.154]	[0.369]	[0.155]
Observations	307	307	340	340
R-squared	0.378	0.240	0.397	0.284

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

Table 10: Placebo Regression of Promotional Treatment

	All Migrating HHs FE	Subsidized Migrating Hhs FE	Unsubsidized Migrating Hhs FE	All Migrating Hhs FE	Subsidized Migrating Hhs FE	Unsubsidized Migrating Hhs FE
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
zemstvo_reform	-0.02	-0.09	0.07**			
	[0.126]	[0.109]	[0.028]			
SU_reform				0.23***	0.16***	0.07*
				[0.081]	[0.061]	[0.041]
Reform	0.15	0.14	0.02	0.09	0.05	0.04
	[0.121]	[0.102]	[0.035]	[0.064]	[0.045]	[0.028]
Zemstvo	-0.24**	-0.21***	-0.03			
	[0.096]	[0.070]	[0.043]			
SU				0.04	-0.04	0.07
				[0.093]	[0.057]	[0.047]
Rdensity	0.00	0.00*	-0.00	0.00	0.00*	0.00
	[0.003]	[0.003]	[0.001]	[0.003]	[0.002]	[0.001]
Livestock	-0.00	-0.00*	-0.00	-0.00	-0.00	-0.00
	[0.002]	[0.002]	[0.001]	[0.002]	[0.001]	[0.001]
Yield	-0.00*	-0.00**	-0.00	-0.01*	-0.01**	0.00
	[0.003]	[0.002]	[0.001]	[0.003]	[0.002]	[0.001]
Rwage	-0.02***	-0.01***	-0.00*	-0.02***	-0.01***	-0.01**
	[0.004]	[0.003]	[0.002]	[0.004]	[0.002]	[0.002]
Ruwage	-0.01	-0.00	-0.00	-0.01	-0.00	-0.00
	[0.008]	[0.006]	[0.003]	[0.007]	[0.006]	[0.003]
Time Effects	No	No	No	No	No	No
Provincial Effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.25***	0.89***	0.36***	1.40***	0.97***	0.43**
	[0.311]	[0.219]	[0.126]	[0.397]	[0.248]	[0.199]
Observations	340	340	340	340	340	340
R-squared	0.391	0.449	0.253	0.398	0.417	0.276

On line appendix (not for publication).

Table A1. Variables definitions and data sources

Variable name	Variable definition	Source
Migrantinghh per 000 citizens	Number of migrant families passed through Syzran and Chelyabinsk registration centers	Turchaninov N. (1910, 1915)
Smigratinghh per 000 citizens	Same but with official permits only	Turchaninov N. (1910, 1915)
Unsmigratinghhs per 000 citizens	Same but without official permits only	Turchaninov N. (1910, 1915)
RWTariff	Railway tariff per person in kopeks to get Chelyabinks from provincial capital city	Resettlement Administration (1911b)
Exits per 000 citizens	Number of exits from the commune accompanied by title conversion	Ministry of Internal Affairs (1908, 1915, 1910, 1912, 1914).
Rdensity	Rural population per 1 sq kilometer on January 1, corresponding year (sq versta are transformed into sq kilometers at 1.138 rate)	Central Statistical Committee of the Ministry of Interior (1905-1916)
Livestock per 00 citizens	Number of horses and cows	Central Statistical Committee of the Ministry of Interior (1905-1916)
Yield	Grain yield tons per hectar, calculated as total grain yield divided by total area under grain crops (desyatinas are transformed into hectares at 1.0925 rate; puds are transformed into kg at 16.38 rate)	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)
Confirmation_rate	Share of application to exit confirmed by local courts (i.e. formally confirmed)	Ministry of Internal Affairs (1908, 1915, 1910, 1912, 1914).
RHhsales	Number of sales of privatized plots in repartition communes	Ministry of Justice (1907-1915)

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.
Panel B. Provinces affected by the reform

Table A3. Correlation matrix.

Table A4. The effect of the reform on migration (logs)
Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table A5. Instrumental variables estimates of the effect of exit on migration in 1914 (levels)

	First Stage	First Stage	2SLS	2SLS	2SLS (logs)
			confirm	confirm, recall	confirm, recall
	(i)	(ii)	(iii)	(iv)	(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]
confirmation_rate	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.