Labor Surplus, Mass Mobilization and Peasant Welfare: Russian Agriculture during the Great War

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Labour surplus; mass mobilization; Russia; World War I
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Summary: The classical narrative of economic development gives a central role to labor surplus in the agricultural sector. While there has been much debate about the concept of labor surplus, there is still relatively little empirical evidence on the matter. We construct a district-level panel on agricultural production in the Russian Empire before and during the Great War. We use mass mobilization as an exogenous source of variation to test certain propositions about labor surplus. If there were high levels of surplus labor, one would not expect peasants' production to be very sensitive to mass mobilization. We first show that districts that experienced greater mass mobilization responded by decreasing area under crops. We next investigate the differential effects of mobilization for commune and private farm production, peak and slack season production and cereals and husbandry production. Taken together, these results demonstrate that peasants responded to mass mobilization in a dramatic way, reflecting changes in relative prices and the scarcity of labor. We provide a generous estimate on the upper bound of labor surplus in the economy, which is conditional on this peculiar pattern of labor removal. This estimate is lower than what has been previously thought. Finally, we discuss the effect of mobilization on peasant welfare during the Great War years in order to shed light on our understanding of the causes of the Russian Revolution.

1. **Introduction.**

Labor surplus is at the heart of many historical understandings of economic development. The Russian case is commonly considered to be the ideal demonstration of how imperfect land and labor markets caused by institutional constraints lead to surplus labor. Indeed, already in 1901, a government commission estimated labor surplus at 51 percent of the labor force in the countryside. Many contemporary economists and later economic historians shared this view. In particular, Lev Litoshenko (written in 1926, published for the first time in 2001) and more recently Andrei Anfimov (1965) claimed that between 40 and 55 percent of labor was surplus labor before and after the Great War. Robert Allen (2003) agrees that the labor surplus in the Russian countryside before the collectivization was substantial. Other scholars, however, disagreed (see for example Tukavkin 2001). Despite these polar views we find no rigorous empirical analysis of the question of labor surplus in the Russian countryside before the Great War and more generally before Stalin's collectivization. To address this gap in the literature, we use mass mobilization as an exogenous source of variation to test certain propositions about labor surplus. While studying the effects of mobilization during the WWI on the rural sector is interesting in its own right, we aim to kill two birds with one stone by aiming directly at the question of labor surplus. Using our findings on labor surplus, we will then discuss the effect of mobilization on peasant welfare during the Great War years in order to shed light on our understanding of the causes of the Russian Revolution.

The basic interest in surplus labor stems from the compelling idea: if the marginal productivity of labor in agriculture is zero, removing labor from the countryside and putting it in industry can dramatically improve aggregate productivity and output without any fall in agricultural production. This concept of labor surplus is a bit narrow-minded, however. No loss in agriculture from labor removal is a necessary, but not a sufficient condition for labor surplus. Two important aspects of labor removal are the pattern of labor removal and the behavior of peasants in response to the removal (Ajaz and Ray 2012). Indeed, patterns of labor removal could affect the link between labor reduction and output.

For example, consider two different patterns of labor removal. The first removes whole households at once and the second only removes one member per household. Production could go down in the first pattern simply because inter-family redistribution of land takes time to adjust, while the second pattern may not cause output to go down because intra-family redistribution of land occurs relatively easily and quickly (Sen 1967). The pattern of labor removal will also influence how the remaining agricultural population reorganizes the allocation of labor and other resources in order to compensate for the possible loss of output. Since agricultural households can generally reoptimize after labor has been removed, labor surplus can exist even when the marginal productivity of labor is above zero. Accordingly, even if a social planner can design an allocation of resources such that some amount of labor can be removed without causing output to fall, labor surplus still might not exist if the incentive compatible responses to any pattern of labor removal fail to generate the socially optimal allocation. Thus, following the definition in Ajaz and Ray (2012), we condition our concept of labor surplus on a particular pattern of labor removal and define labor surplus to mean that some amount of labor can be removed (in the pre-determined way) without reducing output once peasants have had a chance to update their optimization problem given the change in labor but holding other factors fixed. The extent of labor surplus will then be defined as the upper bound of labor removed of all the patterns of labor removal that satisfy the above existence condition.

There is a vast literature on labor surplus, however, there are few, if at all, convincing empirical tests of the existence of labor surplus (Shultz 1964, Sen 1967, Basu 1992 etc.; summarized by Ajaz and Raj 2012). To illustrate the controversy in testing for the existence of labor surplus, we point to a recent paper by Foster and Rosenzweig (2010) who claim to find surplus labor in modern India. Their argument, however, relies on the level of mechanization and the distribution of land; surplus labor can exist when the distribution of land is such that there are many small farms with low levels of mechanization. Foster and Rosenzweig (2010) give empirical evidence of labor surplus by showing how exogenous increases in land holdings improve profitability through investment in machinery. A social planner

can simply change the distribution of land to guarantee for a group of farmers the minimal size of farm that would make mechanization profitable, causing these farmers to respond by raising their mechanization level and thereby requiring less labor; in this way, labor could be removed and output would not fall. However, our concept of labor surplus rules out this empirical approach as evidence of labor surplus. To see this, consider the condition for the existence of labor surplus: namely, whether *some* pattern of labor removal exists such that the corresponding behavioral response will generate no loss in agricultural output, holding all else fixed. In the above scenario, no pattern of labor removal alone would lead to the behavioral responses that would cause small farms to become profitable. This means that either the land and credit markets will permit poor farmers to consolidate landholdings such that it will become profitable to mechanize or they will not, and there is nothing in the evidence of Foster and Rosenzweig (2010) that suggests that they will. To put it in a slightly different way, any pattern of labor removal would generate a loss in output if institutional constraints prevented the distribution of land to adjust; yet, if institutional constraints were not present, there would be no surplus labor in the first place because farms would have already had optimal levels of mechanization and scale. Thus, we reject this concept of labor surplus as a means to operationalize a test of labor surplus, despite its widespread use in the literature.

We suggest two ways to operationalize the hypothesis that there existed labor surplus in Russian agriculture before the Great War, the strong form and the weak form. The strong form states that mass mobilization will have no effect on output. In this hypothesis, labor surplus is defined as above and the pattern of labor removal is exactly mass mobilization. This hypothesis is not a straw man since many authors that believed in labor surplus viewed the concept to mean zero marginal productivity of labor and assumed that the extent of surplus labor, given by Litoshenko and the others' numbers, for example, was at least as high as the amount of labor removed by mobilization. The weak form states that there is a significant amount of surplus labor before the Great War but on average mass mobilization exhausted it. Given mass mobilization as the pattern of removal and the

corresponding reorganizations, if agricultural output still falls, this would be evidence against the strong form of the hypothesis. If we then can make a convincing case that this pattern of labor removal was not unreasonable compared to the optimal, incentive-compatible labor-removal mechanism, then we have strong evidence against the extent of labor surplus being at the level given by the previous literature.

Indeed, Russian mass mobilization was not an arbitrary pattern of removal; the tsarist government tried hard to organize the mobilization in a way that would secure a high enough level of agricultural production and minimize output loss. We are not the first paper to use mass mobilization as an exogenous source of variation in labor supply. Acemoglu et al (2004) uses mass mobilization during the Second World War to identify labor supply impact on female wages in the US. Our use of mass mobilization is similar to the seminal study by Schultz (1964) who takes advantage of the Indian influenza epidemic of 191819 which killed 9% of the rural labor force to demonstrate that the provinces that had the highest death rates attributed to the epidemic also had the largest percentage decline in area under crops. He argues that this empirical relationship proves that surplus labor did not exist. Sen (1967) and later Ajaz and Ray (2012) point out that this epidemic hit entire households and Schultz's study did not give adequate time for the land to be subsequently redistributed. Moreover, as in the example above, one could imagine an alternative pattern of labor removal that would not cause a drop in output; consequently, this study is a poor test for labor surplus. In contrast, our approach does not suffer from these criticisms because labor removal due to mass mobilization only removed individual household members so that land could be easily redistributed within the household. Moreover, the Russian institutional context was such that the commune (in which most of the rural population lived) had well-established mechanisms in place to redistribute land within the commune to limit surplus labor.

To investigate the hypothesis of labor surplus empirically, we look at the effect of mass mobilization into the army onto area under crops for wheat and rye in both peasant farms in the commune and private farms (land tenure status –

commune vs. private – determines the difference between the two), using a newly constructed district level panel dataset. We also explore the effect of mobilization onto yields, but we view this exercise more as robustness check because of data limitations. We find that mobilization is negatively related to area under crops. Second, we find seasonal substitution within crop production: the removal of labor leaves the household more strapped in peak season than slack season causing a shift from summer crops to winter ones. Third, we find that private farms suffered from the mobilization more than the commune peasant farm. In some cases, we observe expansions of area under crops even in districts hit relatively hard by mobilization. One obvious explanation for this pattern is the substitution of wage labor with commune labor. As mobilization occurs, wage pressures combined with price ceilings on agricultural goods cause private farms to withdraw from production. This wage labor then moves back to the commune, compensating for the lost labor from mobilization.

Observing the large amount of substitution together with a drop in area under crops, one might wonder whether labor surplus really existed in the countryside. In fact, our results suggest that the majority of labor extracted by mass mobilization does not satisfy the conditions for surplus labor. However, the sheer magnitude of those who were mobilized (40 percent of male population in 18-43 ages) makes answering the question of the extent of labor surplus difficult. While we can easily rule out such large numbers as above, i.e. the strong form of labor surplus hypothesis, we cannot rule out labor surplus all together (the weak hypothesis). This is our contribution to the economic history of Russian development in the early 20th century.

The extent of labor surplus has important implications for how one interprets the effect of the war and mass mobilization on peasants' welfare and marketing strategies. We explore two of Kondrat'ev's hypotheses (1922): (1) peasants in commune farms became wealthier, but (2) withdrew from rural-urban trade because of lack of industrial goods. The second hypothesis could explain the food shortage in the cities during 1916/17 winter, widely considered the trigger of the Russian revolution. We do find some support of the first Kondrat'ev's

hypothesis, but not the second. With these findings we contribute to historical literature on economics and politics of the First World War where a dominate story for the continental economies during the war is the collapse of rural-urban trade caused mass unrests in many countries (Broadberry and Harrison 2005). Our findings on labor surplus and Kondrat'ev's hypotheses question this interpretation. To further confirm the rural side of the trade collapse, we show that demand for cereals mattered; there was smaller drop in area-under-crops in private farms in more urbanized districts and in the districts where the army (the largest consumer of grain) was located.

The rest of the paper is organized as follows: we start by discussing the historical background; then we outline our hypotheses in more detail; and lastly, we discuss the data and the results. In the results section, we include a subsection of robustness checks that provide additional support of peasant responses to labor removal. We find substitution of labor-intensive production with less labor-intensive production in private farms because of changes in relative prices, i.e. crop production for cattle production and substitution of capital for labor. Finally, we conclude with a discussion of the underlying causes of the Russian Revolution.

2. Historical Background: Russian agriculture before and during the First World War.

Agriculture was the largest sector of Russian economy before the First World War. It produced 44.26 percent of national income in 1913 (Markevich and Harrison 2011) and employed an even larger share of workers, up to 72 percent of the gainfully occupied population according to some estimates (Gukhman 1926, cited by Davies 1990 p. 251). Labor productivity in agriculture was substantially lower than in a whole economy, suggesting that too many people were involved into land cultivation. In addition, labor was concentrated in the European core of the empire, especially in the black earth provinces while the outskirts remained relatively unpopulated.

For a long time now, the economic and historical literature have viewed imperfect markets in land and labor as the main factors of low labor productivity in Russian agriculture. One conventional view is that the institution of the commune

was mainly responsible for these market imperfections and their consequences (Gerschenkron 1965). The commune restricted Russian peasants in their mobility and land rights. First, the commune controlled the allocation of peasant labor directly: peasants could not leave the commune without its consent, either permanently or temporarily. The commune was often very strict in this respect because of peasants' mutual responsibility for tax payments. Second, in repartition communes (which composed 80 percent of all communes) the land which peasants received as a result of the 1861 emancipation belonged to the commune, not to an individual peasant or household (but peasants cultivated this land individually). Collective property rights in repartition communes meant that land was a very illiquid asset and this prevented its optimal allocation and led to overinvestment of labor into agricultural activities and overpopulation of the Russian village. Some authors argue that, in the end, the commune produced labor surplus in the countryside. Litoshenko (1926 published in 2001 p.150) argues that about forty percent of labor (after accounting for the cottage industry) remained unutilized in an average peasant household. Anfimov (1969) produced even larger figure of fifty-one percent.

The most binding institutional limitations associated with the commune were removed by the 1906 Stolypin reform. The peasants received rights to exit the commune without its content and to privatize land. The reform improved both the allocation of land and labor, promoting rural-urban and rural-rural migration in the empire (Chernina et. al 2012; Castañeda Dower and Markevich 2012). However, due to the government's limited capacity to carry out the reform, the ownership structure in the countryside changed only partially. Over the years of the reform implementation, only 22 percent of households with about ten percent land left the commune while many more applications to take advantage of various aspects of the reform went unprocessed.

In 1906 about two-thirds (65.3%) of all non-state land was in communal ownership and only about one third was in private (Kondratiev 1922 p. 6). The distinction between communal and private ownership only related to the differences in property rights in land. Private land could belong to gentry,

merchants, urban citizens, and even to peasants. In the latter case, it meant that peasants bought this land from gentry after the 1861 emancipation; for this land, they could enjoy full scale of benefits granted by private land status.

Private land could be cultivated by large farms or alternatively could be leased to peasants in small plots. According to the 1916 agricultural census that distinguished land belonging to large and individual farms (individual farm is a farm where the owner personally participates in the production), the former cultivated 7.9 percent of land and the latter 92.1 percent.

In 1913 the value added output produced in Russian agriculture equalled 8.288 billion roubles or 44 percent of GDP; grain production composed 48.3 percent of this figure, potatoes - 15.6 per cent, industrial crops and husbandry – 8 and 28 percent accordingly (Markevich and Harrison 2011). In terms of sown area, grain share was much larger, about 90 percent (Davis 1990 p. 81). The four main crops – wheat, rye, oat and barley – produced the bulk of cereals. Rye was the main traditional crop of Russian peasants and used mainly for in-household consumption. Wheat was the most important market and export crop. The share of wheat in agricultural production rapidly increased in the late Russian Empire in parallel with the development of internal markets and an export boom. Barley was another market crop and oat was mainly used for livestock feeding. Agricultural specialization and distribution of land between the main crops depended on local climate conditions and the proximity to grain markets; in general, rye dominated in the north, while wheat in the south. To cultivate these cereals farms generally used three-filed system (fallow - summer crops - winter crops). Given seasonal nature of agricultural production that did not allow cultivating summer and winter crops on the same plot during the same year peasants could transfer labour between seasons. They also could redistribute efforts between seasons changing distribution of their leisure over the year. In terms of labour demand summer was a peak season and winter was a slack one. Technology remained quite primitive with horse as a main driving power pulling the traditional light wooden plough in a three-field rotation system; but the situation was rapidly changing. In particular, the amount of

advanced agricultural machines in the countryside rapidly increased during the last pre-war years and stopped to grow only after the start of the war.

The Great War produced a huge shock to the Russian countryside. During 1914 – 1917 about fourteen million males were mobilized into the army in addition to a million and half who were already in the regular army at the outbreak of the war. The Russian mobilization law classified all males between 18 and 43 into four groups, in reserve, first- and second-class home guards, and expelled. The first three groups were subject to mobilization under different circumstances. Soldiers in reserves had to be mobilized first, then first- and second-class home guards. Within each group, waves of mobilization could vary by age. In practice, the timing of mobilization of various groups varied between regions as well. By the start of 1916 summer season (May 15th) ten million males had been mobilized.

Mobilized males composed about forty percent of all males aged 18-43. However, this share varied substantially across regions because of the very complicated Russian 1874 and 1912 mobilization laws. First, the law excluded from mobilization all non-Cossack males from two Far East and one Central Asia provinces and all non-Russian population (Russian population broadly defined, including Belarusian, Ukrainians) from Caucasus, Siberian, Kazakhstan and Central Asia provinces. In contrast, Russian cassocks concentrated in several provinces were subject to more extensive mobilization. Second, Russian law granted a lot of complete expulsions and privileges (that put an individual either into the first or second class home guard) based on family status – number of sons in a family, the existence and number of other breadwinners, existence of a brother in the army, etc. Roughly 50 percent of males had various privileges based on family status. A crucial detail about family status was that the status of potential draftee was determined at the age of 21 (the age of conscription in peace time), and not according to his current status. Third, there were health expulsions and privileges which seventeen percent of males had; this number was relatively small in comparison to other European countries (Germany - 37%, France – 21% etc.). Fourth, there were privileges based on education level. Finally, additional expulsion and privileges

could be granted if an individual's occupation was considered necessary for national defense (Golovin 2001).

The huge labor reduction in agriculture was partially compensated by refugees and prisoners-of-the-war: 460,900 prisoners-of-the-war and 354,000 refugees were employed in agriculture by 1916 (Sidorov 1973 p. 452; Gatrell 2005 p. 156). But, it is easy to see that the overall drop in labor was large. The majority of authors (Kondratiev 1922, Anfimov 1962, Sidorov 1973, Gatrell 2005) agree that the war produced a shortage of labour in the countryside (except Litoshenko 1925 published in 2001 who still argued that there was labor surplus at least in the peasant household (p.153)), and link this shortage with the decrease in agricultural output. Total output and production of cereals in particular fell by 20 percent by 1916. The literature agrees that private land farms suffered more from the labor shortage; according to Anfimov (1962) private farms cut their area under crops by 22.3 percent, while peasants only cut by 11.3 percent. Since private farms were an important player in the internal grain market, the amount of grain brought to the market decreased.

The literature disagrees about how mass mobilization and the war affected peasants' welfare and how much grain peasants' chose to sell on the market. Kondratiev (1922), Litoshenko (1925 published in 2001) and Gatrell (2005) argue that peasant welfare increased because of the change in relative agricultural prices at least in grain producing provinces. According to this view, increasing food prices more than compensated for any loss of peasants' incomes from mass mobilization. The government tried to regulate grain markets but without success. Due to the very low level of food consumption before the war, cereals were likely not inferior goods. Peasants increased consumption in kind and decreased the share of cereals for markets. In the end, this contributed to food shortage in cities, unrest and to the Russian Revolution. In stark contrast, Anfimov (1962) argues that peasants' welfare went down because of relatively larger decline in production than in prices. According to this view, the food shortage in urban areas during the 1916/1917 winter was caused mainly by the decline in agricultural production and the collapse of Russian transportation system, rather than the decrease in market share of

peasants' grain production; in this view, the decrease in peasants' welfare contributed to the Russian Revolution directly.

3. **Hypotheses: Responses to Labor Surplus and Mass Mobilization in the Agricultural Sector.**

In this section, we formulate our hypotheses about peasants' responses to mass mobilization. We start with the consequences of mass mobilization using the standard assumptions of price theory. Then, we respond by formulating how the existence of labor surplus would alter peasant behavior from the basic price theory benchmark, maintaining the strong form of labor surplus. Finally, we deal with the effects of mass mobilization onto peasants' welfare and marketing strategies.

The economic consequences of mass mobilization from a neoclassical perspective are relatively straightforward and can be decomposed into the income and substitution effects once one knows the shape of the household utility function. We first consider the substitution effect. Under standard assumptions, the household will substitute labor for leisure, use labor-saving production technologies and switch to less labor-intensive production. In short, the prices of leisure and labor inputs increase and the household responds by supplying more labor and reorganizing production. The income effect reinforces the substitution effect if leisure in an inferior good and counterbalances it if leisure is a normal good. However, assuming optimal production before mass mobilization, agricultural output should decrease in the aggregate. In terms of area-under-crops the decline should be less pronounced because of land for labor substitution possible under three-field rotation system that allows redistributing cultivated lands between years to some extent. Given limits to which land could substitute for labor in early 20^{th} century agriculture, the decline in area-under-crops is a likely outcome if there were no surplus labor.

Hypothesis 1. Mass mobilization decreases agricultural production and in particular area-under-crops.

Since the opportunity cost of commune labor is higher during the peak season than the slack season, the household may choose to allocate more labor to the slack season even if labor productivity is higher during the peak season. The

household should substitute less labor-costly production technologies for more labor-costly ones when the cost of labor is increasing.

Hypothesis 2: Farms substitute efforts in slack season for efforts in peak season.

For the owners of private farms, all else equal, a shortage of labor drives down profits. We expect then labor to be reallocated from private farms to the commune as labor is removed from the countryside because private farms must hire labor, which became increasingly more costly and private farms became much less profitable. The difference in the effect of mobilization for private and commune farms was self-reinforcing because commune households could substitute their losses in labor with the labor they supplied to private farms before the war; in addition, commune households which had supplied labor to private farms might want to compensate losses in their incomes. Finally, private farms were mostly involved in exporting grains before the war and the collapse of foreign trade (because of blockade) would hit private farms more, strengthening the relative effect of mass mobilization.

Hypothesis 3: Commune production suffers less from mobilization than private farms.

Labor surplus certainly means peasant households will be less responsive than if labor surplus did not exist and we should observe little change in output at low levels of mobilization. As discussed in the introduction, the strong form of labor surplus would argue that mobilization would have no affect on area under crops (recall that area under crops is our preferred measure of total output). Once we expect that there will be full scale of substitutions together with drop in output and pattern of labor removal was structure in a way to minimize losses, we expect that there no labor surplus in Russian agriculture before the Great War, at least at the magnitude of mobilization.

Hypothesis 4: The strong form of the labor surplus hypothesis does not hold nor does the weak form hold for the extent of labor surplus at levels as high as 40% of the rural male labor force.

The neoclassical model assumes that production and consumption decisions are separable, but there is a long line of literature on the rural economy that assumes otherwise, the non-separability of production and consumption (Chayanov). What matters is that in the peasant household, income for a particular household member is the average product while income for the laborer is simply wage income. Accordingly, the marginal productivity of labor in a commune household farm may be lower than the wage equivalent on private farms. Thus, when labor is removed from the peasant household, the average product may increase for the remaining family members. Since the peasants have an ownership stake in the commune, certain amounts of labor removal will be beneficial for the remaining peasants. This question got huge attention during and after the Great War (Kondrat'iev 1922) when income elasticity of agricultural surplus became an important policy issue because the government had problems to secure the grain supply to cities. We can then test the two Kondratiev's hypotheses on the consequences of mass mobilization for peasants' welfare and marketing strategies.

Hypothesis 5 (1st Kondratiev hypothesis): Peasant welfare increased as a result of mobilization.

Kondratiev (1922) argued that peasants' welfare in per capita terms went up since their marginal productivity of labor increased.

Hypothesis 6 (2nd Kondratiev hypothesis): Despite their increased welfare, peasants marketing share of grain decreased.

Despite their increased income, Kondratiev argued that they did not trade more with cities since rural-urban trade suffered because of shortage of industrial goods caused by the mobilization of industry for the war needs.

Hypothesis 7: Positive changes in demand counterbalance drops in production caused by mobilization.

Further, we expect that changes in demand will affect magnitude of the effect of mobilization and more so for private farms because they were more market oriented before the war.

In our context, facing labor shortages, farms will move away from animal husbandry and labor intensive crops such as cotton, beets, potatoes, etc. The farms

should move towards cereals such as wheat and rye that were relatively less labor intensive. Similarly, farms have to substitute capital for labor where possible. In both cases private farms most likely substituted more because, as we expect, commune farms suffered from mobilization less.

Hypothesis 8: Farms substitute labor-savings for labor-intensive technologies, and private farms do so more than commune ones.

Distribution of agricultural machines and capital for labor substitution patterns provide an additional way to check the question of labor surplus. If there was labor surplus before the WWI, machines went to districts where it was less sharp. And we should expect that these districts would demonstrate larger decline of output. In opposite if there was no surplus of labor, distribution of machines across districts was determined by other factors, and number of machines in a district would be positively correlated with change in agricultural production because of substitution labor for capital.

5. Data.

We construct a district (*uezd*) level dataset to study the effect of the mobilization onto agriculture. We use 1913 as a benchmark year and 1916 – the last pre-revolutionary year - as a treatment year. The dataset covers the whole Russian Empire, excluding Finland. There were more than eight hundred districts in the empire in 1913. We have fewer observations for 1916 than for 1913. First, about ten percent of Russian territory was occupied by the central powers by 1916. Second, a number of provinces did not send their grain figures to the centre, either at all or without the district distribution.

We combine various official sources to construct the dataset. First, we construct the mobilization measure using data on gender disbalance in the Russian countryside from the first All-Russian agricultural census conducted between May and July of 1916 (Ministry of Agriculture of Russian Empire, 1916), and deducting gender disbalance in rural areas before the war known from 1913 official statistics (Central Statistical Committee, 1913b). The overall quality of the census was quite high (Kovalchenko et al. 1988), and it is considered as one of the main source on geographical distribution of mobilization into the Russian army in the literature

(Golovin 2001). According to the census, total disbalance was about 10 mln people in 1916. If one deducts 1913 disbalance (about 1 mln) and inflow of refugees and prisoners of the war (0.8 mln), the obtained figure (8.2 mln) fits quite well to the number of people mobilized by May, 15 1916 (10 mln), known from military sources. The difference is due to mobilization from urban areas and from Western provinces occupied by Germans.

Second, we use data on area under crops and yields of wheat and rye in 1913 and 1916 (Central Statistical Committee 1913c, Special Food Committee 1916). For each district we have two observations: one for the private farms (those on private land) and the other for commune peasant farms (those on commune land). Unfortunately, there are quite a number of missing values in the 1916 Special food committee volume, especially for yields. We cannot employ data on area under crops from the 1916 census volume, which covers the whole empire, because the census did not distinguish private and commune farms but large and individual farms land, i.e. census data could not be matched with 1913 data.

We do not have data on capital that varies over time. Only one agricultural machines and equipment census was conducted in the Russian Empire in 1910. We employ its results published separately for private and commune farms (Central Statistical Committee 1913a). Russian pre-war statistics on horses and cattle is of problematic quality (Vainshtein 1969). So we employ data from the 1916 agricultural census, but we do not have separate figures for private and commune farms because of the reason discussed above.

Table 1 presents summary statistics. One hundred and eighty thousand rural citizens lived in an average Russian district. The largest district in terms of population was about eight times larger and the smallest more than twenty times smaller. Between 1913 and 1916, seven thousand people were mobilized from the countryside in an average district. We estimate the mobilization measure as the difference between 1916 and 1913 gender disbalance (we determined the latter as difference between rural female and rural male population) and this does not account for possible internal migration unbalanced by gender. Because of that our gender disbalance could be negative. This happens if males dominated in war

inflows of refugees, prisoners-of-the-war or migrants from other districts and their number was larger than number of mobilized males. According to our estimates, 143,000 people were the maximum number of draftees in a district. We overestimate actual mobilization if females dominated the war migration inflows and underestimate it if the opposite is true.

Average area under crops per district composed about 17,000 hectares for summer wheat, 5500 for winter wheat, 500 for summer rye and 21,000 for winter rye. These areas varied substantially between districts. Over the war years, the average area under summer wheat and winter rye in a district decreased by about 4000 and 2500 hectares correspondingly, while area under winter wheat and summer rye slightly increased. Unfortunately, we do not have many district-level yield figures, and have to work with yield information at the province level. An average province harvested about 75,000 tones of winter wheat and rye, and about 288,000 tones of summer cereals. An average winter yield decreased by 26,000 during the war, while summer yield increased almost by 1,000.

In 1916 there were about 95,500 heads of cattle (cows, sheep and goats) in a district and almost 57,000 horses. The 1910 agricultural machine census showed that the average number per district was almost 3,000. This number included seeding machines, harvesting machines, threshing machines, winnowing machines, mowing machines and horserakes. Urban population in an average district was low, only about eighteen percent; ninety-seven percent in Saint-Petersburg district was an exception.

6. Analysis: The Economic Consequences of Mass Mobilization.

We look at the impact of mass mobilization onto area under crops and yields in 1916 relative to 1913 to analyze the economic consequences of the Great War for Russian agriculture. Area under crops and yields of four cereals, namely winter and summer wheat and winter and summer rye, in various combinations are our main dependent variables. Because of data limitations we work with area-under-crops, first of all, and use yields more as a robustness checks. Our mass mobilization measure (denoted by M) is the main variable of interest. Very complicated Russian mobilization laws allow us to treat the number of mobilized males as a random variable determined by many factors working in various directions.

We employ two empirical approaches to explore the relationships of interest. First, we use a linear OLS regression model with fixed district effects and the 1913 year effect. To be precise, we estimate the following equation:

$$Y_{itj}=\alpha M_{it}+\beta P_{it}+C_j+\varphi_i+\tau_{1913}+\varepsilon_{itj} \qquad (1)$$

where subscripts *i* and *t* index districts and years, respectively, and *j* marks commune vs private farm and yields. *P* stands for rural population. C is a dummy for commune farms, is a 1913 year dummy, and are region fixed effects. Finally, ε is an error term, assumed to be uncorrelated across districts, but not necessarily within districts as we allow for clusters at the district level.

Second, we use similar models in first differences allowing us to control for variables for which we have data for only one particular year. Namely, we employ the following equation:

$$\Delta Y_{ij}=\alpha M_i+\beta \Delta P_i+\gamma AM_{ij}+\delta X_i+C_j+\varphi_i+\varepsilon_{ij} \qquad (2)$$

where Δ stands for the first differences, AM is a number of agricultural machines in 1910 in a district in possession of either commune farms or private farms, X is a vector of controls that includes 1916 cattle and horses in a district, and the rest of the notation is the same as in equation (1).

We modify both (1) and (2) to explore the effect of mobilization onto private and commune land separately adding corresponding interaction term. Finally, we estimate various modified versions of (1) and (2) which include interactions of the mobilization measure with a war front province dummy, agricultural machines, cattle and urban population share variables and/or province specific trends.

When we regress yields on mobilization, we can control for area under crops.

To explore the 1st Kondratiev's hypothesis we run similar regressions but with yields per capita as dependent variable and mobilization ratio as independent one. For his second hypothesis we analysis possible substitution of wheat for rye

under assumption that in the early 20th century countryside wheat was a market grain while rye was more for home consumption of peasant households.

6.1. *Mass mobilization and labor surplus*.

We start with the effect of mass mobilization for Russian agriculture by looking at the effect onto total area-under-crops of winter and summer wheat and winter and summer rye in a linear OLS specification with district fixed effects. The negative and significant coefficient on mobilization reported in the first column of table 2 demonstrates that mobilization decreases area-under-crops. The magnitude of the effect was large; an increase in mobilization by one standard deviation (11.88, or 6.36% of average rural population in a district) cut area-under-crops by 2851 hectares or by 6.5% in an average district. Mass mobilization affected summer and winter crops differently, however: increasing the number of mobilized men by one standard deviation decreased area under summer crops by 6152 hectares, but increased winter crops by 3445 hectares on average. These results provide support for our first and second hypotheses that the mobilization decreased agricultural output, measured by area under crops, and farms substituted efforts in the slack season for efforts in peak season, i.e. winter efforts for summer ones.

Table 2 is somewhere here.

The results in first differences are similar (columns 4-6). The only important change is for the case of winter and summer area-under-crops taken together, for which the coefficient of interest has the correct sign but is insignificant. The magnitudes of the effects are generally smaller, possibly because in the first difference case we account for cattle and agricultural machines. The controls have the intuitive signs and many of them are significant; horses and agricultural machines, i.e. proxies for capital, increase arable lands, while the negative coefficient on cows reflects the alternative use of land for husbandry. The main results hold even if we allow for province specific trends (columns 7-8).

In table 3 we present the results of treating the effect of mobilization for commune and private farms separately by adding the interaction between mobilization and the commune farms dummy. As coefficients in the first column suggest, we find support for our third hypothesis that private farms suffered more

from mobilization than commune farms actually increased their cultivated areas. One standard deviation increase in the number of draftees in a district increased area under crops by 14612 hectares in the commune farms and decreased by 20196 hectares in the private farms. We interpret the positive effect of mobilization for commune farms as strong evidence for the substitution of commune labor for labor on private farms. The drop in private farms is more pronounced for summer than for winter grains, 18414 vs. 6296 hectares per one standard deviation increase of draftees, while the opposite is true for the increase in commune farms, 5702 vs. 13306 hectares (columns 2 and 3). This fits well with the commune for private labor substitution story; peasants suffered from mobilization as well by substituting first of all during the slack season when labor was cheaper. Again we get the same results in first difference specifications (columns 4-6), and magnitudes on the coefficients of interest are smaller. Moreover, in the first difference specification there is no positive effect of mobilization for commune farms during the peak season (column 5).

Table 3 is somewhere here.

Yields are a better indicator of production than area-under-crops. However, we view our results of yields as a kind of robustness check because of data limitation. First, we have much less data on yields than on area-under-crops and often have to look at each yield separately or go to province-level analysis. Second, we have an omitted variable, namely weather – an important factor in agriculture especially a century ago. One could speculate whether weather affected mobilization.

The mobilization should affect yields and area-under-production in a similar way. However, the magnitudes of relative effects are ambiguous. On one hand, the effect might be larger in the case of yields because of substitution of land for labour and possible associated drop in land productivity; on the other hand it could be smaller if worst land were withdrawn from cultivation first. The weather effect is an additional source of ambiguity.

Table 4 repeats our analysis of the effect of mobilization onto agriculture but in terms of yields. Accordingly, we do not control for area-under-crops here.

Because of data problem, we have to disaggregate yields into four grains (we have very few districts for which we have data on all four). We interpret the results as broadly consistent what we have in area-under-crops analysis. Coefficients on mobilization are negative in the majority of cases and often significant; and coefficients on the interaction of mobilization variable and the commune farms dummy are positive and significant in the majority of cases. We have very few observations for summer rye to make any strong conclusion on positive (but not significant) effect of mobilization for private farms and negative (but again insignificant) for commune ones. The positive (but insignificant) coefficient on summer wheat in the specification which allows for province trend suggests that there was an important difference in the mobilization effect between provinces but again we do not have a lot of observations to explore details.

Table 4 is somewhere here.

In table 5 and 6 we explore the effect of mobilization onto total factor productivity accounting for the drop in area-under-crops. Because of data limitations, we undertake our analysis at the provincial level (table 5) and then repeat disaggregated analysis of table 4 (table 6). The majority of coefficients on the mobilization variable and the interaction between the mobilization variable and the commune farms dummy are insignificant, suggesting no effect of mobilization in terms of TFP. In several cases, however, the coefficients are positive and significant at the ten percent level. We interpret these results as evidence that the worst land withdrew from cultivation first and this effect produce positive coefficients. In all specifications among production factors variables only coefficients on area-under-crops are positive and significant, suggesting that drops in yields operated first of all via this channel.

Table 5 and 6 are somewhere here.

6.2. *Mass mobilization, peasant welfare and grain marketing*.

Did mass mobilization affect peasants' welfare and marketing strategies? We do not observe household consumption or market supply so our evidence is indirect. With our data we can address questions how the mobilization ratio (defined as an increase in gender disbalance between the war and the control years) affected

peasants' production per capita (to check the welfare effect) and whether peasants shifted to more market oriented production during the war (to address grain marketing issues).

We present evidence on the effect of the mobilization ratio on peasants' per capita production in table 7. In the case of yields we have to go to province-level analysis because of data limitations. Results reported in column 1 suggest that the mobilization ratio does not affect per capita production on private farms, but increased per capita yields in commune farms. An increase in gender disbalance by 1% increased per capita total yields by 3.7 kilograms or by 1.6 % during the war. First difference results provides similar but weaker results (column 3). The coefficient on the interaction term between the mobilization ratio and the commune farms dummy is positive but insignificant. We also have some evidence that the positive effect of mobilization decreased with the scale of mobilization; the coefficient on the squared interaction term between the mobilization ratio and the commune farms dummy is negative (columns 2 and 4) and significant at ten percent level in the first difference specification (column 4). These findings give credit to the first Kondrat'iev hypothesis that mobilization affected peasants' welfare positively, and also are consistent with the weak form of the labor surplus hypothesis if the extent of labor surplus is understood to be much more modest than what the previous literature had thought.

Table 7 is somewhere here.

While peasants in commune farms had more grain per capita at their disposal did they supply more to the market? We address this question by exploring whether peasants substituted wheat for rye; assuming that peasants' consumption preferences did not change over time, wheat was the market grain and rye was for home consumption. Table 8 presents the results. On average, mobilization contributed to the substitution of summer rye with summer wheat. One standard deviation increase in mobilization led to an increase in area-under-wheat by 2308 hectares or by 13 percent in a district with average area under rye (column 1). This effect, however, was mainly because of commune farms. Private farms substituted summer rye for summer wheat (column 2), which fits with their general trend of

substituting away from labor-intensive production (wheat is more labor-intensive when rye). The effect was much weaker for winter wheat for winter rye substitution (column 5 and 6). The results from the first difference specifications are similar (columns 3-4 and 7-8). In sum, we find weak evidence (because of additional assumptions we made) against the second Kondrati'ev hypothesis that peasants did not increase marketing share of their grains despite their growing welfare. They substituted wheat for rye and the former was a more market-oriented crop. We can not rule out that peasants might have held onto this increase in grain because there were fewer industrial goods to receive in return.

Table 8 is somewhere here.

6.3. *Robustness checks: demand and mass mobilization and further evidence of substitution*.

In table 9 we analyze whether additional demand for grain counterbalances the negative effect of mobilization. We use urbanization share as a proxy for additional demand for grain because the government actively developed new industries in old urban locations during the war. Another proxy is the front line provinces where the army – the largest consumer of grain – was located. However, one should be careful interpreting the results because both proxies have alternative interpretations. Urbanization share is also a proxy for additional demand for industrial labour in a district and the front line dummy might be associated with additional regulation of the agricultural sector by the military authorities in battlefield regions. Under the alternative interpretation one should expect a more pronounced rather than less pronounced cut in production during the war.

Coefficients on the interaction terms between the mobilization variable and our two proxies are both positive but insignificantly different from zero (column 1 and 3). However, if we allow the demand effect to differ by type of farm, introducing the triple interaction term between the demand proxy, the commune farms dummy and the mobilization variable as well as interactions between the mobilization variable and the commune farms dummy and the commune farms dummy and the demand proxies, we do find evidence of the demand effect for private farms. One standard deviation increase in district urban share (0.16) counterbalanced 17 per

cent of mobilization effect (0.16*2.58/2.4=0.172); and in the front provinces the mobilization effect was about twice smaller for private farms (0.97/1.77=0.548). Coefficients on proxies themselves are always positive and often significant but these coefficients mean little since they are conditional on no mobilization. Negative coefficients on triple interactions allow several interpretations. On the one hand, they might be interpreted in support of commune-for-private-labour-substitution story; on the other hand, one might argue that commune farms could respond more to labour demand from urban centres during the war or officers respected commune property rights less than property rights of landlords since both officers and landlords belonged mainly to the Russian gentry. Another possibility is that commune farms were more oriented towards self-consumption and reacted to market demand less (the latter interpretation, however, cannot explain the negative effect).

Table 9 is somewhere here

We explore several different possibilities for farms to substitute away from costly labor. We first investigate the substitution away from labor-intensive cattle grazing to less intensive grain production, adding the interaction term between cattle and mobilization into our main FD specification. Since commune farms were much less specialized in a particular type of agricultural activity than private farms and normally do both grain and cattle production simultaneously (notice the coefficient on the interaction term between the commune farms dummy and cattle is always positive and significant), we allow this type of substitution to vary by farm type, adding the triple interaction term between the commune farms dummy, mobilization and cattle as well as interactions between the commune farms dummy and mobilization variable and between the commune farms dummy and cattle. The coefficients on the interaction terms reported in the first column of table 4 shows that private firms in districts with larger amount of cattle cut areas under summer wheat and rye less, but the opposite was true for the commune farms (the coefficient on the triple interaction has different sign and is larger in magnitude then the coefficient on the interaction between mobilization and cattle). The magnitudes of both effects were substantial; in a district with average amount of

cattle, the negative effect of mobilization for private farms is 13 per cent less than in a district with no cattle (0.001*94.55/0.73=0.129 where 94.55 stands for average amount of cattle in a district measured in thousand heads); and the positive effect for commune farms is about 125% less ((-0.003+0.001)*94.55/(0.88-0.73)=-1.26). We interpret this as evidence in support of the effect of substitution from commune labor-intensive activities for the private farm. The opposite effect for the commune farm fits to the effect of substitution of commune labor for private one (one possible interpretation is that smaller cuts in private farms' area-under-crops because of grain for cattle substitution led to smaller amount of former wage labor moved back to the commune). An alternative interpretation would be that commune farms substituted private farms in the market for dairy products. There is no evidence of substitution from labor-intensive activities during the winter, i.e. the slack season (column 3). All these results are stable if we add province specific trends (columns 2, 4).

Table 10 is somewhere here.

We also present evidence of capital for labor substitution because of change in relative prices in column 5 of table 10. One standard deviation increase in number of agricultural machines (7.45) in district farms diminished the negative effect of mobilization by more than a quarter (0.02*7.45/0.56=0.266). We also note that if the presence of agricultural machines in a district before the war was a proxy for the marginal productivity of labor because of differences in labor surplus, then the sign of the coefficient is inconsistent with labor surplus before the war.

Again the effect differs for private and commune farms. We do not find effects for private or commune farms in general (column 6), but this is because they employed different substitution strategies. Commune farms substituted capital for labor in wheat production (column 7), while private farms did this for rye (column 8). We interpret these results as private farms had less space for substitution in case of wheat production because before the war they specialized mainly in wheat and already had more capital per hectare than private ones. The negative effects for private farms in case of wheat production and for commune farms in case of rye suggest that substitutions between crops were going on simultaneously. Note that in

case of agricultural machines we do not add the interaction between them and the commune, because our agricultural machines variable already varies by type of farms and we do not think that agricultural machines affected commune farms differently than commune farms.

7. Conclusion.

We find strong evidence that the mobilization into the army of forty percent of working age males during the Great War caused a wide range of various adjustments in allocation of input factors in the Russian countryside. Households re-estimated their optimization problem in the new war environment. Simultaneously, the mobilization was negatively associated with the grain output, especially in private farms. In those districts where there were more draftees, the cuts in production were larger. With these results we contribute to development economics and economic history literatures, which often view agriculture in the late Russian Empire as the classic example of large amounts of labor surplus. Our evidence allow us to rule out the strong form of the labor surplus hypothesis as well as the weak form for magnitudes of labor surplus as high as forty percent of the rural male labor force. However, we cannot yet reject the weak hypothesis of labor surplus at lower magnitudes.

We also provide a better understanding of the causes of the 1917 Russian Revolution, in particular, of the peasants' contribution to it. We find that commune farms became more important from the point of view of grain production during the war. However, we do not find support for the hypothesis that peasants reduced their marketing of grains; since Kondratiev (1922), the latter factor is widely viewed as the reason of decline in rural-urban trade and the consequent food shortage that triggered the revolution. Finally, according to our results, peasant's welfare increased during the war, which does not fit with another widespread explanation -- that the war contributed to the revolution via peasants' impoverishment.

We would like to emphasize that our analysis is still in its preliminary stages. We plan to investigate (but first gather data on) peasant responses to agricultural and industrial prices, several more crops that differ in their marketability and labor intensiveness, and transport flows of grain from rural areas to urban centers. This

would move our understanding of peasants' behavior during the Great War and the reasons of the Russian Revolution further. In addition, given that number of mobilized males was growing steadily over several years we plan to get data for 1914 and 1915 years to address the question whether the labor surplus of smaller magnitude than forty percent of male labor force existed in the Russian countryside. Finally, an important next step in the analysis of labor surplus would be to examine the variation in institutional constraints on the land market, namely variation in implementation of the Stolypin reform and strength of the commune before the war to analyses how imperfect land markets – usually viewed as the main reason of existence of labor surplus – varies with the mobilization effect onto Russian agriculture.

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Table 1: Descriptive Statistics.

Variable	N	Mean	St. Dev.	Min	Max
Total area under winter and summer wheat and rye (000 hectares)	2467	43.88	77.32	0	1189.8
Total area under summer wheat and rye (000 hectares)	2480	18.05	63.24	0	1173.22
Total area under winter wheat and rye (000 hectares)	2467	26.53	35.35	0	317.03
Area under summer wheat (000 hectares)	2480	17.38	62.24	0	1142.77
Area under winter wheat (000 hectares)	2467	5.57	19.81	0	282.7
Area under summer rye (000 hectares)	2480	0.67	4.11	0	108.85
Area under winter rye (000 hectares)	2480	20.92	29.34	0	262.5
1916-1913 difference in total area under winter and summer wheat and rye (000 hectares)	995	-5.64	41.51	-269.07	329.97
1916-1913 difference in total area under summer wheat and rye (000 hectares)	1008	-4.11	31.32	-238.41	329.97
1916-1913 difference in total area under winter wheat and rye (000 hectares)	995	-1.78	24.58	-121.33	243.07
1916-1913 difference in area under summer wheat (000 hectares)	1008	-4.19	30.75	-239.15	329.97
1916-1913 difference in area under winter wheat (000 hectares)	995	0.65	13.9	-120.11	155.58
1916-1913 difference in area under summer rye (000 hectares)	1008	0.08	4.49	-73.1	106.7
1916-1913 difference in area under winter rye (000 hectares)	1008	-2.44	17.22	-96.5	234.91
Total yield under winter and summer wheat and rye (000 tones)	239	287.69	355.36	0	2077.4
Total yield under summer wheat and rye (000 tones)	255	75.73	192.68	0	1916.95
Total yield under winter wheat and rye (000 tones)	250	212.76	257.37	0	1548.21
1916-1913 difference in total yield under winter and summer wheat and rye (000 tones)	68	-24.78	234.49	-872.84	765.41
1916-1913 difference in total yield under summer wheat and rye (000 tones)	84	-26.29	99.25	-632.21	133.09
1916-1913 difference in total yield under winter wheat and rye (000 tones)	78	0.92	197.07	-456.08	801.47
Gender disbalance (female minus male population in 000)	1330	8.38	13.99	-92.65	134.55
Mobilization (estimated as difference in 1916 and 1913 gender disbalances for 1916 and zeros for 1913)	1349	7.02	11.88	-93.65	143.55
Commune	3052	0.5	0.5	0	1
Rural population (000)	1330	186.9	121.31	4.3	1470.6
Urban population (000)	1265	48.91	119.03	0	2150.77
Urban share	1265	0.18	0.16	0	0.97
Cattle (000)	588	94.55	98.47	1.54	1193.67
Horses (000)	588	56.84	70.68	0.08	1001.22
Agricultural Machines (000)	3008	2.9	7.45	0	85.11

Table 2: The Effect of Mass Mobilization on Area under Crops

Dependent	TWR	SWR	WWR	TWR	SWR	WWR	SWR	WWR
Variable	AREA	AREA	AREA	AREA	AREA	AREA	AREA	AREA
Estimation	FE	FE	FE	FD	FD	FD	FD	FD
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mobilization	-0.24**	-0.54***	0.29**	-0.25	-0.38**	0.16**	-0.16**	0.16***
	[0.123]	[0.118]	[0.117]	[0.167]	[0.176]	[0.067]	[0.081]	[0.059]
Commune	53.39***	23.56** *	31.32***	26.51** *	11.68***	14.69** *	6.19***	13.80***
	[3.064]	[2.935]	[1.350]	[2.364]	[1.649]	[1.393]	[1.591]	[1.383]
Rural	0.04	0.04	0.01	0.11**	0.09***	0.02	0.13***	0.01
Population	[0.056]	[0.052]	[0.024]	[0.045]	[0.035]	[0.020]	[0.044]	[0.025]
Horses				0.14	0.03	0.11***	-0.12	0.04
				[0.086]	[0.071]	[0.035]	[0.081]	[0.049]
Cattle				-0.21***	-0.06	-0.13***	-0.03	-0.07**
				[0.054]	[0.046]	[0.028]	[0.053]	[0.028]
Agricultural				1.13***	0.02	0.98***	1.22**	1.15***
Machines				[0.333]	[0.313]	[0.210]	[0.483]	[0.233]
Year Effects	YES	YES	YES	NO	NO	NO	NO	NO
District Effects	YES	YES	YES	NO	NO	NO	NO	NO
Province	NO	NO	NO	NO	NO			
Trends						NO	YES	YES
Constant	10.39	5.59	3.36	-4.97	3.06	-8.91***	63.00**	-0.79
	[10.233]	[9.803]	[5.205]	[3.046]	[2.261]	[1.628]	[26.368]	[8.430]
Observations	2,428	2,441	2,428	992	1,005	992	1,005	992
R-squared	0.266	0.093	0.373	0.224	0.118	0.280	0.360	0.367
Number of iddistrict	731	731	731					

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

Table 3: Mass Mobilization and Substitution of commune labor for labor on private farms.

Dependent	TWR	SWR	WWR	TWR	SWR	WWR
Variable	AREA	AREA	AREA	AREA	AREA	AREA
Estimation	FE	FE	FE	FD	FD	FD
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Mobilization	-1.70***	-1.55***	-0.53***	-1.24***	-0.70**	-0.25**
	[0.237]	[0.329]	[0.090]	[0.325]	[0.300]	[0.097]
Mobiliz*Commune	2.93***	2.03***	1.65***	2.12***	0.67	0.89***
	[0.337]	[0.556]	[0.162]	[0.527]	[0.458]	[0.261]
Commune	33.33***	9.22***	20.07***	-4.94	1.39	1.50
	[2.963]	[2.760]	[1.428]	[8.298]	[6.948]	[4.003]
Rural Population	0.04	0.04	0.01	0.09**	0.09***	0.02
	[0.054]	[0.051]	[0.024]	[0.039]	[0.033]	[0.019]
Horses				0.16*	0.04	0.12***
				[0.082]	[0.070]	[0.035]
Cattle				-0.19***	-0.06	-0.13***
				[0.051]	[0.045]	[0.027]
Agricultural Machines				0.41	-0.22	0.68***
				[0.290]	[0.259]	[0.209]
Year Effects	YES	YES	YES	NO	NO	NO
District Effects	YES	YES	YES	NO	NO	NO
Constant	20.30**	12.85	8.92*	9.23*	8.01*	-2.95
	[9.912]	[9.742]	[4.943]	[4.970]	[4.272]	[1.799]
Observations	2,428	2,441	2,428	992	1,005	992
R-squared	0.366	0.182	0.502	0.307	0.136	0.321
Number of iddistrict	731	731	731			

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

Table 4: The Effect of Mass Mobilization on Agricultural Yield

Dependent Variable	SW YIELD	SW YIELD	WW YIELD	WW YIELD	SR YIELD	SR YIELD	WR YIELD	WR YIELD
Estimation	FD	FD	FD	FD	FD	FD	FD	FD
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mobilization	-0.65**	0.06	-0.11	-0.12	0.02	0.03	-0.32**	-0.41***
	[0.266]	[0.236]	[0.152]	[0.175]	[0.037]	[0.030]	[0.128]	[0.154]
Mobiliz*Commune	0.84***	0.34*	0.46*	0.44	-0.00	-0.00	0.91***	0.91***
	[0.243]	[0.204]	[0.269]	[0.287]	[0.017]	[0.014]	[0.275]	[0.287]
Commune	-4.86	0.15	0.14	0.08	0.23	0.26	3.68	4.74
	[3.969]	[3.472]	[4.554]	[4.741]	[0.379]	[0.239]	[4.218]	[4.442]
Rural Population	0.06	0.08	0.04	0.01	0.01	0.02	0.01	0.03
	[0.062]	[0.069]	[0.027]	[0.036]	[0.007]	[0.015]	[0.018]	[0.021]
Horses	0.01	-0.20**	0.27**	0.36***	-0.01**	-0.02	0.08	0.17**
	[0.073]	[0.084]	[0.107]	[0.135]	[0.005]	[0.015]	[0.060]	[0.068]
Cattle	-0.11**	-0.13**	-0.19***	-0.12***	0.01	0.02	-0.09***	-0.07**
	[0.051]	[0.056]	[0.049]	[0.045]	[0.007]	[0.018]	[0.024]	[0.028]
Agricultural Machines	-0.15	0.55**	0.87**	0.76***	0.01	0.03*	-0.02	0.07
	[0.225]	[0.233]	[0.361]	[0.250]	[0.009]	[0.018]	[0.152]	[0.205]
Year Effects	NO	NO	NO	NO	NO	NO	NO	NO
District Effects	NO	NO	NO	NO	NO	NO	NO	NO
Province Trends	No	Yes	No	Yes	No	Yes	No	Yes
Constant	14.00***	99.14***	1.55	-1.69	-0.15	-2.47	-2.25	-30.56**
	[5.062]	[23.620]	[2.832]	[4.117]	[0.172]	[2.761]	[1.918]	[11.834]
Observations	423	423	389	389	143	143	783	783
R-squared	0.242	0.527	0.397	0.597	0.045	0.183	0.294	0.416

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

Table 5: The Effect of Mass Mobilization on TFP in Agriculture: province-level analysis.

Dependent Variable	TWR YIELD	TWR YIELD	TWR YIELD	SWR YIELD	SWR YIELD	WWR YIELD	WWR YIELD
Estimation	FD	FD	FD	FD	FD	FD	FD
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mobilization	-0.05	0.91*	0.58	0.36	0.37	0.26	0.12
	[0.533]	[0.479]	[0.438]	[0.257]	[0.261]	[0.188]	[0.225]
Mobilize* Commune			0.66		-0.01		0.27
			[0.468]		[0.113]		[0.239]
Commune	58.84**	55.54	-30.98	3.51	5.54	30.99*	-4.61
	[26.655]	[37.255]	[43.070]	[11.933]	[11.927]	[15.975]	[22.672]
Area under crops	0.73***	0.62**	0.54*	0.34***	0.34***	1.13***	1.10***
	[0.228]	[0.286]	[0.311]	[0.072]	[0.070]	[0.068]	[0.082]
Rural Population	-0.01	0.03	0.02	0.03	0.03	-0.02	-0.01
	[0.118]	[0.063]	[0.065]	[0.037]	[0.037]	[0.038]	[0.038]
Horses		-0.47	-0.48	-0.28	-0.28	-0.15**	-0.14*
		[0.395]	[0.406]	[0.198]	[0.200]	[0.071]	[0.077]
Cattle		0.05	0.05	0.03	0.03	0.08**	0.08**
		[0.121]	[0.124]	[0.065]	[0.065]	[0.033]	[0.035]
Ag. Machines		0.68	0.65	0.29	0.29	-0.58***	-0.61***
		[0.723]	[0.775]	[0.461]	[0.481]	[0.202]	[0.209]
Year Effects	NO	NO	NO	NO	NO	NO	NO
District Effects	NO	NO	NO	NO	NO	NO	NO
Constant	-14.92	-11.19	31.42	25.96	24.95	-27.83*	-9.69
	[20.946]	[38.798]	[27.319]	[16.837]	[15.808]	[15.408]	[13.238]
Observations	66	66	66	80	80	76	76
R-squared	0.564	0.630	0.640	0.595	0.595	0.897	0.899

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

Table 6: The Effect of Mass Mobilization on TFP in Agriculture: disaggregated crops district-level analysis.

Dependent Variable	SW YIELD	SW YIELD	WW
Estimation	FD	FD	
VARIABLES	(1)	(2)	
Mobilization	0.02	0.32*	0
	[0.177]	[0.193]	[0
Mobilize*Commune	-0.03	-0.10	0
	[0.134]	[0.137]	[0
Commune	1.29	2.03	-
	[1.771]	[2.023]	[1
Area under Crops	0.43***	0.41***	1.1
	[0.038]	[0.040]	[0
Rural Population	0.07*	0.00	-0
	[0.043]	[0.051]	[0
Horses	0.02	-0.09*	-0
	[0.048]	[0.052]	[0
Cattle	-0.12***	-0.13***	-0
	[0.031]	[0.035]	[0
Agricultural	0.09	0.21	0
Machines	[0.211]	[0.208]	[0
Year Effects	NO	NO	
District Effects	NO	NO	
Province Trends	No	Yes	
Constant	8.64***	58.40***	0
	[3.183]	[18.329]	[1
Observations	423	423	3
R-squared	0.517	0.702	0

Robust standard errors in brackets. ***

p<0.01, ** p<0.05, * p<0.1

Table 7: Peasant Welfare and Mass Mobilization

	TWR YIELD	TWR YIELD	TWR YIELD	TWR YIELD
Dependent Variable	per capita	per capita	per capita	per hectare

Estimation	FE	FE	FD	FD
VARIABLES	(1)	(2)	(3)	(4)
Mobilization ratio	-0.02	0.39	-0.21	-4.07
	[0.118]	[3.252]	[0.233]	[5.752]
Mobilization ratio	0.37***	6.20	0.50	12.73*
*Commune	[0.133]	[3.960]	[0.513]	[6.384]
Commune	-0.24*	-3.49	-0.55	-7.90**
	[0.145]	[2.201]	[0.632]	[3.795]
Mobilization ratio 2		-0.09		1.61
		[1.379]		[2.399]
Mobilization ratio 2		-2.59		-5.08*
*Commune		[1.760]		[2.690]
Horses per capita			-0.13	-0.15
			[0.290]	[0.289]
Cattle per capita			-0.01	0.01
			[0.071]	[0.077]
Ag. Machines per capita			1.90	2.00
			[1.379]	[1.414]
Year Effects	YES	YES	NO	NO
District Effects	YES	YES	NO	NO
Constant	0.08	-0.30	0.21	2.52
	[0.147]	[1.906]	[0.290]	[3.486]
Observations	233	233	66	66
R-squared	0.506	0.512	0.330	0.344
Number of iddistrict	86	86		

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

Table 8: The Effect of Mass Mobilization on Marketing

Dependent Variable	SW Area				WW Area			
Estimation	FE	FE	FD	FD	FE	FE	FD	FD
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mobilization	-1.22***	-1.43***	-0.44**	-0.92***	0.10**	0.02	0.12***	0.02
	[0.406]	[0.431]	[0.192]	[0.253]	[0.043]	[0.068]	[0.045]	[0.049]
Commune	17.75***	8.62***	12.71***	-3.75	4.37***	3.25***	2.46**	0.64
	[2.051]	[1.934]	[1.750]	[4.397]	[1.125]	[1.168]	[1.045]	[1.856]
Mobilization* Commune		1.02***		1.01***		0.45***		0.13
		[0.251]		[0.287]		[0.152]		[0.095]
Season Rye Area	1.49	-13.39**	-0.11	47.90***	-0.05**	0.03	-0.07	0.05
	[1.145]	[6.285]	[0.204]	[11.795]	[0.024]	[0.031]	[0.127]	[0.096]
Season Rye Area * mobilization	0.29***	-1.30***	0.04**	-2.06***	0.002**	0.00	0.00	-0.00
	[0.031]	[0.379]	[0.019]	[0.400]	[0.001]	[0.005]	[0.005]	[0.003]
Season Rye Area * mobilization * commune		1.54***		2.15***		-0.00		0.01
		[0.384]		[0.403]		[0.005]		[0.007]
Season Rye Area * commune		15.02**		-48.17***		-0.09***		-0.15
		[6.237]		[11.815]		[0.032]		[0.203]
Horses			0.06	0.09			0.06***	0.05**
			[0.073]	[0.072]			[0.021]	[0.021]
Cattle			-0.06	-0.04			-0.06***	-0.06***
			[0.046]	[0.043]			[0.017]	[0.017]
Agricultural machines			-0.21	-0.64**			0.49***	0.47***
			[0.305]	[0.258]			[0.165]	[0.163]
Year Effects	YES	YES	NO	NO	YES	YES	NO	NO
District Effects	YES	YES	NO	NO	YES	YES	NO	NO
Constant	21.14***	22.96***	-0.80	6.38*	1.98**	1.59*	-1.88	-0.35
	[5.854]	[5.515]	[2.618]	[3.592]	[0.806]	[0.925]	[1.149]	[1.246]
Observations	2,479	2,479	1,005	1,005	2,466	2,466	992	992
R-squared	0.231	0.317	0.116	0.253	0.043	0.075	0.187	0.191
Number of iddistrict	750	750			750	750		

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

Table 9: Demand for grain: Urbanization and Army effects

Dependent Variable	TWR AREA	TWR AREA	TWR AREA
Estimation	FE	FE	FE
VARIABLES	(1)	(2)	(3)
Mobilization	-0.25	-2.40***	-0.24*
	[0.180]	[0.333]	[0.125]
Mobilize*Commune		3.80***	
		[0.485]	
Mobilize*Urbane Share	0.66	2.58***	
	[0.448]	[0.627]	
Mobilize*UrbShare*		-354.85**	
Commune		[138.386]	
Commune	53.46***	37.41***	53.39***
	[3.066]	[3.443]	[3.065]
		342.20**	
Commune*Urban Share		[141.920]	
Urban Share	56.52**	71.10***	
	[26.550]	[22.408]	
Front province			2.38
			[2.958]
Front province *			0.22
mobilization			[0.250]
Front province *			
mobilization* commune			
Front province * commune			
Year effects	Yes	Yes	Yes
District effects	Yes	Yes	Yes
Observations	2,419	2,432	2,428
R-squared	0.268	0.227	0.266
Number of iddistrict	726	726	731

Table 10: Mass Mobilization and Substitution from Labor-intensive Production.

	SWR	SWR	WWR	WWR	TWR	TWR	TWheat	TRye
Dependent Variable	AREA	AREA	AREA	AREA	AREA	AREA	AREA	AREA
Estimation	FD	FD	FD	FD	FE	FE	FE	FE
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mobilization	-0.73***	-0.41***	-0.28*	-0.38**	-0.56***	-0.96***	-0.31	-0.50***
	[0.230]	[0.151]	[0.151]	[0.183]	[0.216]	[0.249]	[0.219]	[0.132]
Mobiliz*Commune	0.88***	0.47**	0.84**	0.85**		1.73***	0.40**	1.20***
	[0.299]	[0.238]	[0.394]	[0.415]		[0.275]	[0.199]	[0.157]
Mobiliz*Cattle*Commune	-0.003***	-0.003***	0.00	0.00				
	[0.001]	[0.001]	[0.003]	[0.003]				
Mobiliz*Cattle	0.001***	0.002***	-0.00	0.00				
	[0.000]	[0.000]	[0.001]	[0.001]				
Cattle*Commune	0.28***	0.26***	-0.06	-0.07				
	[0.076]	[0.068]	[0.041]	[0.045]				
Mobilize*AgMach					0.02**	-0.05	-0.10**	0.04*
					[0.012]	[0.061]	[0.052]	[0.020]
Mobilize*AgMach*						0.05	0.10*	-0.05***
Commune						[0.063]	[0.055]	[0.017]
Commune	-19.84***	-16.55***	5.77	5.62	27.77***	17.65***	0.47	17.76***
	[5.794]	[4.788]	[5.531]	[5.902]	[2.281]	[2.326]	[1.793]	[1.232]
Rural Population	0.07**	0.13***	0.02	0.01	0.07	0.03	0.01	0.01
	[0.030]	[0.040]	[0.019]	[0.025]	[0.062]	[0.052]	[0.051]	[0.016]
Horses	0.06	-0.18*	0.11***	0.04				
	[0.080]	[0.097]	[0.033]	[0.046]				
Cattle	-0.20***	-0.18***	-0.10**	-0.06*				
	[0.056]	[0.068]	[0.039]	[0.034]				
Agricultural	-0.54**	0.77*	0.71***	0.80***	5.50***	5.32***	4.61***	0.77***
Machines	[0.263]	[0.413]	[0.240]	[0.250]	[0.789]	[0.792]	[0.684]	[0.246]
Year Effects	NO	NO	NO	NO	YES	YES	YES	YES
District Effects	NO	NO	NO	NO	YES	YES	YES	YES
Province Trends	NO	YES	NO	YES	NO	NO	NO	NO
Constant	17.33***	-160.49***	-4.11	-13.15	2,415	2,415	2,415	2,428
	[3.863]	[20.948]	[2.991]	[14.135]	0.547	0.580	0.441	0.524
Observations	1,005	1,005	992	992	725	725	725	725
R-squared	0.220	0.437	0.326	0.413	2,415	2,428	2,415	2,415

Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.