

Democratic support for the Bolshevik Revolution: An empirical investigation of 1917 Constituent Assembly elections

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Abstract

Scholars have long-debated the causes of popular support for the Russian Revolution. We systematically investigate cross-district variation in Bolsheviks' popularity using voting outcomes of the All Russian 1917 Constituent Assembly elections, occurring right after the Bolsheviks seized power. We find that the Bolsheviks managed to mobilize more popular support in districts with a greater presence of industrial workers, soldiers and historically private land, which the Bolsheviks redistributed to peasants. We provide evidence in favor of the view that this coalition was hardly stable due to potential conflicts arising from the underpinnings of Bolshevik support, forewarning the autocracy and command economy to come.

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1. Introduction

One hundred years ago, on the 7th of November 1917, the Bolsheviks overthrew the Provisional Government and captured power in Russia, initiating one of the most significant social experiments in history and influencing regime change across the world for decades to follow.¹ A lesser celebrated but influential event, the national elections to the Constituent Assembly, occurred three weeks later on the 25th, 26th and 27th of November. The Bolshevik party received nearly one quarter of the votes and, after having failed to obtain plurality in the election, disbanded the assembly and went on to remain in office for more than seventy years, making the vote the last experience of running in democratic elections for Lenin's party.

The Constituent Assembly elections achieved global significance as one of the first elections to grant universal suffrage (including women) and as the electoral inauguration of communist parties in twentieth century politics. The election results aggregated the political preferences of over sixty million Russians, the vast majority of whom had previously had little control over their political destiny. During the nineteenth and early twentieth centuries, radical political movements on the left emerged to give voice to the newly politically empowered masses, who consisted of mostly wage workers in industrialized economies and a mixture of the industrial working class and peasants in late industrializers like Russia (Smith 2014). During the interwar period, communist parties in Germany, France and Czechoslovakia averaged above ten percent of the vote share and, after WWII, the Communist Party in Italy achieved as high as 31% of the vote. Thus, while the Bolsheviks were unique in their political success, they were no exception in terms of garnering popular support.

What were the factors that drove Bolshevik popularity? In short, war, redistribution and the proletariat (McDonald et al. 2018). Robert Service succinctly summarizes a prominent view: "No First World War, no October Revolution." (Service 2009, p.16). The war shock produced political and financial instability as well as devastation and loss of life that were acutely experienced by the masses. Even before the war, poor living conditions, coupled with the promise of better living standards in an industrialized economy, created a demand for redistribution (Service 2009). Lindert and Nafziger (2014) show that income inequality in 1904

¹ Huntington (1991) opens his influential work on the third wave of democratization describing the Portuguese revolution in terms of the Bolshevik one, a narrative that the major participants were keenly aware of at the time.

was higher in the capital provinces of Moscow and Petersburg, where the major events of the Bolshevik Revolution took place. The extension of the franchise during the Constituent Assembly elections should have given voice to any demands for redistribution by urban workers and rural peasants alike. In addition, increasing urbanization and the growing industrial working class increased the demand for food security, which was exacerbated by WWI.

Despite the vast amount of scholarship in the social science and historical literature aimed at understanding how such a comprehensive change of social order could happen, scant quantitative analysis of the political economy of the Bolshevik Revolution or the rise (and fall) of communist parties exists.² Moreover, little is known about the relative importance of the major explanatory hypotheses – war, redistribution and the proletariat – for Russian citizens. In this paper, for the first time, we systematically investigate factors associated with the level of popular support for the Bolsheviks in 1917 by exploiting local variation in election outcomes across nearly five hundred administrative districts. Local vote shares for the Bolsheviks represent a unique measure of preferences for the Bolshevik Revolution that was underway and offer a rare opportunity to test whether factors identified in the literature were salient to the interests of the masses. Quantitative analysis of this question contributes both to our understanding of the historical debates and the increase in popular support for far-left political parties in modern Europe and Latin America.³

Our estimation strategy uses election district fixed effects to account for unobservable factors that are constant within an election district (approximately the size of a province). To avoid making the ecological fallacy in interpreting our results as reflecting individual preferences, we employ instrumental variables analysis that exploits the arbitrary variation in industrial serfs during the eighteenth century. We find that, in line with the claims in the literature, the Bolsheviks' support was rooted in the war shock, measured with the presence of a garrison and the decrease in grain output per capita during the war, the demand for redistribution, measured by the share of private land, and class structure, measured by industrial workers per eligible voter. All of these factors increased the support for the Bolsheviks in a district.

² The empirical quantitative literature has been more interested in explaining the emergence of the far right (Bromhead et al. 2013, Adena et al. 2015).

³ See a summary of European elections data at <http://www.democraticaudit.com/2018/07/12/understanding-the-rise-of-the-radical-left-in-europe-its-not-just-the-economy-stupid/>.

Interestingly, the relative magnitude of each factor is roughly similar with one standard deviation increase in the factor corresponding to about one-seventh of a standard deviation increase in Bolshevik vote share in the aggregate. If we account for the fact that voting outcomes varied forty percent less within election districts than overall, we reach an effect size of about one-fourth of a standard deviation in magnitude. Thus, these effect sizes are small but meaningful. As we discuss below, these variables acted in concert and certainly were not independent forces. Therefore, summing up these effects, which would produce a large impact on vote shares, would be misleading.

While assessing the relative importance of these factors is a major contribution in itself, our empirical investigation of popular support for the Bolsheviks can also shed light on a deeper question in the political economy of regime change, namely whether democracy is a necessary feature to make political institutions that are designed to continually improve the economic condition of the masses effective. Here again, the Constituent Assembly elections play a central and globally significant role. The Bolsheviks could have respected the results of the election, encouraging democratic nation building and using their sizeable coalition to shape the policy discussion. Instead, the Bolsheviks rejected the political preferences of the masses, rationalizing their actions by arguing that the late industrialization of the agrarian economy of Russia set up conditions that precluded it from following a formal democratic path from the beginning (Lenin 1969, originally published in 1919). The left (and the right) both within Russia and abroad were critical of the Bolsheviks' move to shun democracy and centralize the control over political and economic development of the new nation (Kautsky 1964, originally published in 1919). Nevertheless, at the moment of this decision to reject democracy, the Bolsheviks still believed their development strategy would engineer a pathway to democratic rule in a Soviet dictatorship of the proletariat since, upon their vision's implementation, the majority would be the workers.

We can provide suggestive evidence, that is open to alternative interpretations, on whether the Bolsheviks would have been able to maintain the support of the masses in the soon-to-be fully industrialized economy. We find that the support of the proletariat was far from uniform across districts. Surprisingly, we find that proletariat support for the Bolsheviks was weaker in grain deficit regions, although it was stronger in districts that experienced larger decreases in grain output per capita during the war. The basis of this support appears to be the Bolsheviks' promise of a stable and secure livelihood for urban workers during times when

market conditions might make basic needs exceedingly costly for urban workers. The future Bolshevik policy of “War Communism” is evidence of such a strong commitment. We also show that working class preferences in Russia depended on the composition of skilled and unskilled industrial workers. On average, the industrial working-class support for the Bolsheviks was driven by unskilled workers. These workers were often former peasant farmers and maintained strong connections to the countryside. We find that support by unskilled industrial workers was higher in districts with higher returns from the land redistribution reform, a policy that the Bolsheviks strategically borrowed from the Socialist-Revolutionary party and initiated before the election the day after taking power. Hence, these results point to a weakening base of support as the Soviet development policies unfolded.

Our main findings are robust to a number of potential concerns with our analysis. The most important concern relates to how the elections were conducted. While the bulk of elections occurred on time, some were delayed or took longer to complete. Electoral fraud and voter manipulation were also possible. Controlling for these electoral irregularities does not alter our main findings. We also show that our results do not change if we use an alternative dependent variable that subtracts the votes of the strongest competing party from the Bolsheviks’ tally. Lastly, we explore the relationship between voter turnout and war, redistribution and the proletariat and demonstrate that our main results cannot be explained by differences in voter turnout.

With these findings, we contribute to two strands of literature. First, our results inform the current narratives on the political economy of the Russian Revolution. In particular, our findings are partially in line with Lenin’s story (1920) of the Bolsheviks’ success. However, Lenin underestimated the strong ties to the rural economy of urban residents in his grouping together of the urban and rural proletariat. This peasantification of the proletariat likely increased the costs of political stability and inhibited the democratic foundation of the Bolshevik regime. A counterfactual exercise best illustrates this point. In the average district, removing the possibility of land redistribution completely eliminates Bolshevik support by the proletariat.

Next, we contribute to the political economy and political science literature on revolutions. In most models of regime change, the disadvantaged are modeled as a homogenous group, and attention has been focused on securing stability in the face of revolution from below at the expense of the interests of the elite and/or the middle class. Lenin’s division of the peasant

class into rural proletariat and the capitalist kulaks fits this standard framework well (Lenin 1899). The results that we find, in contrast, demonstrate that the Bolsheviks mobilized support across multiple oppressed groups with different and conflicting interests.

In the remaining sections of the paper, we first give an overview of Russian politics in 1917 and the Constituent Assembly. Next, section 3 briefly covers the main narratives of the Russian Revolution. We then present the data in section 4 and the empirical analysis in section 5. We proceed in section 6 with a summary discussion of the results and their implication for counterfactual scenarios. Section 7 gives a conclusion and covers some limitations of our study.

2. An overview of Russian politics in 1917 and the Constituent Assembly

The Russian Revolution overthrew the “old” autocratic tsarist regime in March of 1917 and transferred power to the Provisional Government as a political compromise between major political parties. The new government was viewed as a temporary one, whose goals were to keep stability in a country during the ongoing First World War, to organize democratic elections to the Constituent Assembly and to secure a smooth transition. The Constituent Assembly was widely viewed as the true “master of Russian lands”, which should decide on the political regime and the further development of the country. The election to the Assembly was the first, and long-awaited, national election with a high level of political legitimacy. A famous Russian novelist and writer, Maxim Gorky, summarized the popular expectations with respect to the elections in 1918: “For a hundred years the best people of Russia lived with the hope of a Constituent Assembly, a political body, which would allow Russian democracy to openly express its will” (Gorky 1990).

The Provisional Government, nevertheless, had to decide on the procedure and timing of the future elections. There was little debate on the universal suffrage for adults older than 20 years old, including women and soldiers (18 was the minimum voting age for soldiers because it was the age of military draft), as a cornerstone of the new election law; however, the other foundations including the timing were less clear. Initially, the new leaders believed that the organization of the elections would require between three and six months to set up (Protasov 1997), but these expectations were not met.

The Provisional Government had only limited popular support and suffered from periodic political crises, which led to its reorganization; four coalition cabinets took the office of the Provisional Government during the eight months between the abdication of Tsar Nicolas the

Second on the 2nd of March, 1917 and the Bolsheviks' uprising on the 7th of November 1917. This lack of political stability certainly complicated the task of elaborating the new election law. In addition to these difficulties, the government strategically did not speed up the process because of the beliefs of its leaders that such strategy would lead to more votes in the election. In particular, the Provisional Government postponed the elections, originally scheduled for the 30th of September, to the 25th-27th of November 1917.

Being an outcome of political compromise, the Provisional Government did not have a clear party identification and did not support openly any party running for seats in the Constituent Assembly. Nevertheless, the Party of Socialist-Revolutionaries (PSR) was a de facto incumbent party at the moment of the Bolsheviks' coup. The prime minister and several ministers of the last Provisional Cabinet were members of this party as well as key regional officials in many provinces. The party positioned itself as a peasant party calling for land redistribution. The Mensheviks (a faction of Russian Social-Democratic Party after the split of the party into the Bolsheviks and Mensheviks) could be viewed as another incumbent party which primary relied on urban rather than rural support and aligned with PSR on a number of issues. At the time of the elections, several groups within the Mensheviks heavily competed with each other for party leadership, weakening its popularity.

The Bolsheviks, who later renamed the party to the Communist Party, represented the major alternative from the left. They postulated themselves as a party of the proletariat whose ultimate goal was the establishment of communism following Marx' blueprints. Another prominent point of their program was an immediate start of peace negotiations with the Central Powers and the signing of a peace treaty "without annexations or contributions". The Bolsheviks got support from the left wing of the Socialist-Revolutionists Party on the latter issue with whom they later organized a coalition once they overthrew the Provisional Government (the Socialist-Revolutionists Party participated in the 1917 elections as a single body). As part of this coalition, they initiated the land reform following the Socialist-Revolutionists' plans on the day after they took office, shelving their original program of the nationalization of land for the moment.

The Constitutional Democrats Party (*Cadets*), formally called Party of People's Freedom, was the major alternative from the right. As a classical liberal party, the urban middle class formed the basis of their support. The failure of the General Kornilov's coup d'état in early

September 1917 disorganized the political movement to the right of Cadets and led to a very limited number of candidates from the far right running for seats in the Constituent Assembly.

Various parties reflecting the interests of ethnic minorities represented another dimension of Russian politics in 1917. These parties catered to one particular ethnic group and often came in pairs, one socialist and the other non-socialist.

The law on the elections to the Constituent Assembly divided the country into seventy-three electoral districts (Protasov et al. 2014). Each electoral district roughly corresponded to a province, the administrative division of the country (but there were exceptions, like the Transcaucasia electoral district which included seven provinces or Saint-Petersburg and Moscow cities which were separated from their respective provinces' voting districts). The number of seats in an electoral district varied between one and thirty-six. The law prescribed that one deputy should be elected for every two hundred thousand citizens with voting rights. Elections in different electoral districts were independent in the sense that there weren't national lists of candidates and different lists of candidates ran in different districts, i.e. one party could run in one electoral district and not run in another or the party could suggest a list of candidates in one district which were not (or only partially) similar to the list in another district. In particular, parties could form strategic blocks in one region but then run separately in the rest of the country. Parties could also declare an ex ante disclaimer that they would set up a block in particular electoral districts, which required a joint counting of their voters. The latter was possible because only nine, mainly single-member electoral districts, followed the majority rule while the other sixty-four regions had a proportional representation system.

The law required only one hundred signatures of registered voters to set up a list of candidates that would compete in elections in a particular electoral district. All in all, 689 lists of candidates were registered, i.e. a bit less than ten per district on average (Protasov et al. 2014). A particular individual could run in no more than five separate districts; if elected in more than one district, he or she had to decide where he or she would be a deputy and transfer his or her deputy mandate in other districts to the next in line of the corresponding list of candidates. Such an election law punished national parties, which had their supporters sparsely distributed across all districts, like the *Cadets*, and benefited small parties with geographically concentrated supporters, like the parties of ethnic minorities.

The formation and registration of lists of candidates went on during September and October of 1917 and had to be completed thirty days prior to the elections, i.e. by the 25th of October. The Bolsheviks confirmed the timing of the elections two days after they captured power. However, in practice, elections happened later in some regions because the Bolshevik rebellion in Saint-Petersburg was followed by a number of violent conflicts in several cities, disrupting the organization of the elections on the ground. As a result of these political disturbances, which constituted first manifestations of the future Civil War, several local election commissions responsible for the organization in particular provinces asked for and got permission to postpone elections. The actual timing of voting varied between late November 1917, when elections took place in the bulk of regions, and February 1918. In some provinces, elections either did not take place at all or their results were not properly counted.

Provinces also differed in terms of which political forces oversaw the elections, either those appointed by the Provisional Government or new officials who supported the Bolsheviks or even the Whites who had overthrown the Bolsheviks by this time in some regions. There is no evidence that local authorities falsified the results; in particular, the Bolsheviks did not want to do that because they initially believed that they (together with the left wing of Socialist-Revolutionists) would get a majority in the Constituent Assembly, legitimizing their coup d'état. However, there is evidence that certain local groups, such as soldiers, tried to manipulate the electoral outcomes on the ground by applying direct pressure and, in some cases, violence against voters. Historians agree, however, that this pressure could have hardly changed the election results and did not have a systematic bias across districts. In this respect, the historical narrative portrays these elections as reasonably free and fair (Protasov 1997, Vishnyak 2010).

Once the first results of the elections appeared, and it became clear that the Bolsheviks would not get a majority, they changed their attitude toward the Constituent Assembly and, instead, argued that democracy was bourgeois and unnecessary. The Bolsheviks postponed the opening session of the Constituent Assembly as long as they could. At their first meeting day in early January 1918, the assembly refused to legitimize the Bolshevik coup d'état and the Bolsheviks summarily disbanded the assembly. Interestingly, this decision led to a division within the communist political movement that would lead to two factions, which ultimately contributed to the failure of the communist movement. The first interpreted the Bolshevik Revolution as one that is taken by force and thereby were committed to armed revolution.

Ironically, the Bolshevik Revolution stands alone as the most “peaceful” revolution in which communist parties took power (Smith 2014). The other faction was critical of the Bolshevik’s decision to abandon democracy and aimed at democratic reform. Rosa Luxemburg eloquently presaged the dynamic of communism without democracy:

Without general elections, without unrestricted freedom of press and assembly, without a free struggle of opinion, life dies out in every public institution, becomes a mere semblance of life, in which only the bureaucracy remains as the active element. Public life gradually falls asleep, a few dozen party leaders of inexhaustible energy and boundless experience direct and rule ... a dictatorship, to be sure, not the dictatorship of the proletariat but only the dictatorship of a handful of politicians, that is a dictatorship in the bourgeois sense ... such conditions must inevitably cause a brutalization of public life. (Luxemburg 1940, written in 1918)

In the end, the only accomplishment of the Constituent Assembly was the results of relatively free and fair national elections with universal suffrage. This accomplishment provides a unique snapshot of the preferences of Russian citizens in 1917, less than three weeks after the Bolshevik Revolution.

3. Hypotheses and related literature

The debate over which factors contributed to the (relative) popular support of the Bolsheviks has been a vibrant and contentious one ever since the October events in Saint Petersburg in 1917. We start with the Bolshevik self-description of their success. Already in 1920, i.e. before the end of the Russian Civil War, Lenin published an article containing his analysis of the results of 1917 Constituent Assembly elections. His main objective was to explain why, despite the lack of majority support in the elections, the Bolsheviks could win the Civil War. His triad of success included the support of the proletariat, the key social group according to Marx, the support of the army and support in key areas of the country, which he defined to be either the two capitals or more broadly the urban (the most educated and advanced) centers (Lenin 1969 vol. 40). Lenin’s view shaped the Soviet narrative, which largely underlined the inevitability of a victorious socialist revolution driven by the working class and urban citizens. Due to the Marxist “irons laws of history”, growing inequality (including the growing poverty of industrial workers) and increasing “class struggle” between the proletariat and the capitalists, the revolution must occur. The Soviet official view incorporated various history-specific nuances,

such as the influence of the Bolshevik Party on the Imperial army by the end of third year of the First World War and the “urban lead” (Lenin 1969 vol. 40) over the rural countryside.

In contrast, the dominant narrative on the Russian Revolution in the West before the 1960s, which was first presented by the losers of the Russian Civil War, focused largely on economic crises, triggered and deepened by the First World War, as well as on idiosyncratic Russian politics between the collapse of tsarism in February and the Bolshevik coup d'état in October 1917.⁴ One classic view depicts the revolution as an accident of the war, pointing to the popularity of the Bolshevik slogan of immediate peace without annexation and the support among soldiers. Another interpretation is that the land reform that the Bolsheviks ‘stole’ from the Socialist-Revolutionary Party secured the support of the largest group of population (Gerschenkron 1968). The latter argument is in line with writings of another leader of the Bolshevik Revolution, Leon Trotsky, who argued that that the agrarian problem was fuel for the worker revolution. In particular, in his history of the revolution, he offers a view that suggests that had the Stolypin reform been more widespread and better implemented, the revolution would not have happened (Trotsky 1932-1933). Some other notable explanations include one by John Maynard Keynes, who, in 1919, pointed to rapid population growth, becoming even more critical during wartime, as a major fundamental reason of dramatic political change in Russia as well as in Germany (Keynes 1920).⁵

Theories of regime change in the modern political economy literature focus on the threat of violence from the masses as one of the main drivers of the elite relinquishing power, although there are plenty of skeptics of the importance of popular mobilization for regime change (Geddes 1999, Kotkin 2009). Acemoglu and Robinson (2006) discuss several factors that are characteristic of nineteenth century Europe (a suitable comparison for early twentieth century Russia) that would have strengthened these threats: rising inequality, urbanization, and the rise of factory workers. What these factors have in common is the concentration of interests that would make overcoming the collective action problem of political mobilization or social unrest easier. The war only further concentrated these interests. WWI produced 1.8 million casualties and

⁴ The search for “social support” for the October Revolution became one of major objectives of the so-called “revisionist” historical literature after the 1960s (Kotkin 1998). This literature tended to find various fundamental factors as an explanation of support for the Bolsheviks. In contrast, economic historians tend to portray the late Russian empire as a dynamically developing country and point to WWI as the trigger of the revolution (Gregory 1982, Mironov 2012, Davydov 2016).

⁵ Grinin et al. (2010) and Nefedov (2010) recently revived a Malthusian interpretation of the Russian Revolution.

caused a breakdown in rural/urban trade in Russia. Workers, urban dwellers and soldiers would provide a powerful coalition for the Bolsheviks. However, for the Bolsheviks to be successful, they would likely need to mobilize the interests of the peasants. Even though it was one of the largest economies in the world and rapidly industrializing, Russia was still a primarily agrarian economy and industrial workers were mostly illiterate and had strong rural ties. Therefore, we would expect that Bolshevik support by the proletariat to depend upon the returns to land redistribution.

4. Data

The national results of the elections to the Constituent Assembly were never published officially because some regions never held the elections while others had not properly counted votes. Instead, a team of prominent Russian historians, led by the main specialist on the 1917 assembly elections, Lev Protasov, collected from a large number of disaggregated sources, including archival ones, and published all available information on election results in electoral districts where the elections had happened. We rely on the latest edition of these efforts (Protasov et al. 2014) for our data on the number of citizens that voted for a particular list of candidates.

We combine these electoral statistics with results of other censuses, namely the only population census conducted in the Russian Empire in 1897 (Trojnitskij 1905, Kessler and Markevich 2015), the 1905 land census, the 1912 census of agricultural machines, the 1912 horse census, the 1916 agricultural census (as used in Castaneda Dower and Markevich 2017) and the 1910 city census (Central Statistical Committee at the Ministry of Internal Affairs 1914), as well as official statistics published annually before the First World War (borrowed from Castaneda Dower and Markevich 2017). As it is easy to discern, we often need to rely on variables measured in years earlier than 1917 because of the lack of relevant figures for the revolutionary year. Table A1 in the online appendix provides a full list of our sources.

Altogether, we have data on election results in 485 administrative districts (*uezd* and the like units) located in fifty-four election districts all over the Russian Empire and 554 cities and industrial settlements.⁶ We construct our main dependent variable, the vote share for the Bolshevik party in an administrative district, by assigning particular lists of candidates to the

⁶ On top of that we have data on election results at the voting district level in seven military districts, namely North, North-West, West, South-West, Romanian and Caucasus fronts and Baltic navy; KVZhD railroad in China and three provinces, namely Zabajkalsk, Kamchatka and Stepnoj provinces. We do not use them in the baseline specifications because of the lack of within province variation.

Bolshevik party and then attributing the votes for these lists to the Bolsheviks and finally dividing by the voting age population in a district. We divide by the voting age population instead of votes cast so that selection into voting does not bias the results. In the majority of cases, the Bolsheviks clearly self-reported their party identification and the classification does not raise any controversy. In a few cases, in order to classify the list as the Bolshevik party or not, we had to consult the party identification of the candidates included into the lists. In 48 voting districts (that transferred into 434 administrative districts), the Bolsheviks ran as a separate party and did not establish any coalitions, in four voting districts, namely Olonetz, Samarkand, Turgaj and Ural, (or 18 administrative districts) they did not run at all, and in six voting districts, namely Altai, Bessarabiya, Irkutsk, Kiev, Lifyandia and Tobol'sk (or 33 administrative districts), they ran in a coalition with the Mensheviks. For our baseline results, we assign zero vote share to the places where the Bolsheviks did not run, assuming that they had correctly forecasted that they would get no support and decided not to waste resources. For districts where the Bolsheviks were in a coalition, we assign all votes for the coalition to the Bolsheviks since it is likely that they were the main coalition partner.

Given that this would be the first chance for the population to express their political preferences and the fact that about half of the adults in the country were illiterate, it is difficult to imagine that they voted strategically in any discernable way that would produce bias in the aggregate. We assume that the bulk of Russian citizens voted according to their first-best preferences. We accept that measurement problems are still possible. Historians provide examples of when particular rural communes enforced collective rather than individual voting, requiring their members to vote for a particular party chosen at a commune meeting. There are also examples of husbands trying to control the voting of their wives and daughters. Last but not least, there were examples of soldiers who tried to use violence or threats to manipulate voting. The scale of all such practices, however, was limited. If the local voting commission observed them on a large enough scale, the commission simply annulled the election results (Protasov 1997).

Those districts for which we do not have data either did not hold elections, voting procedures had been violated or votes were not properly counted. We check that the selection is not driven by observables once we account for province specific characteristics. We demean observables with election district-specific averages and compare districts with election data to

districts without them. They are not different in terms of any of thirteen observables for which we have data (table A2 of the online appendix).⁷

Table 1 presents descriptive statistics of our dataset: panel A reports district-level figures, while panel B includes city-level figures. The Bolsheviks got 14,968 out of 75,092 votes or 23.6 percent in an average district and 3,770 out of 11,445 votes or 23.2 percent in average city. Their share at the national level was about 23.3 percent, but the variation was huge. The Bolsheviks did not run in Olonetz, Turgaj, Ural and Samarkand provinces, and got zero accordingly. They also got zero votes in Zakataj district in the Caucasus region. In contrast, the Bolsheviks got all the votes in Verkhonii Ufalej town in the Urals; their second best city result was in Shelomi town in Chernigov province where they got 92.7 percent of votes. At the district level, their best result was in war front-line Pinsk district, namely 94.1 percent. Figure 1 portrays the geography of voting for the Bolsheviks in 1917 at the district-level. It is easy to see that the Bolsheviks achieved better results in the center and in the Northwest of the country, i.e. in the most developed industrial regions between Moscow and Saint Petersburg. Districts close to the war front line also demonstrated a large amount of support of the Bolshevik party. Outside of these territories, the level of support for the Bolsheviks did not exceed (with a number of exceptions) twenty percent. Figure 2 presents the distribution of district shares of votes for the Bolsheviks. One can see this variable is continuously distributed with more mass toward the left of the range.

According to the pre-war statistics, in 1913, there were about 227,000 people in the average district, and only about 11.4 percent of them lived in urban areas. The 1917 (unknown) figures are most likely higher because of the flow of the refugees from the occupied provinces who largely settled in industrial centers. In addition, the official statistics counted only settlements with city tenure as urban ones and did not include many of the new rapidly growing industrial centers established in the countryside (in our city-level dataset, we do have information about these settlements). Before the war, the population of empire grew rapidly because of high fertility; the net increase between 1897 and 1913 in an average district was 39 percent.

In line with the low level of urbanization, there were few industrial workers in the country. According to 1897 Imperial Census, the share of employees occupied in industrial sectors among the voting age population was only about 5.2 percent in the average district; roughly one-seventh

⁷ Alternatively, we ran regressions with the dependent variable as an indicator for having election data and our set of covariates as independent variables and control for province fixed effects. None of thirteen coefficients is statistically significantly different from zero at the 10% level, indicating that there is not likely systematic bias.

of them worked in sub-branches of industry which required a substantial level of qualification from all involved in the production process (metal, chemicals, polygraphy and production of instrumental equipment) and the remaining were occupied in relatively unskilled sub-sectors, where the skill level of workers varied a lot (metallurgy, production of fibrous substances, production of animal substances, wood industry, ceramics, production of wine and beverages, food industry, tobacco industry, clothes production, jewelry). Unfortunately, we do not have a better measure of skills than a sub-industry one. There was not an alternative population census that would allow measuring the share of proletarians at a closer date to the revolution. The 1910 city census reports information on the number of industrial workers in cities and large industrial settlements but exclude those who lived and worked in the small ones. Factory workers composed about 3.4 percent of citizens in an average city in 1910.

In the countryside, the main asset and means of production was land. About three-quarters of all land cropped with grain had communal tenure and about a quarter was under possession of individual private owners. Nearly three-quarters of communal land belonged to repartition communes. The Gini index of land ownership over all types was relatively low, only 0.124 in an average district. The Gini index is constructed from the 1905 Land Census, which was limited to the European part of the empire. The Russian countryside was poor in terms of capital; there were only about two agricultural machines per one hundred of rural citizens in the average district.

There was about 473 hectares of grain crops per thousand of rural citizens in an average district in 1913 with the grain production of 787 kilograms per average hectare before the war. According to Nefedov (2010), a rural citizen needed about 245 kilograms of cereals for subsistence, leaving about 219 kilograms of grain surplus per citizen on average. We estimate this figure deducting the difference between grain yield in a district and the amount of grain required for subsistence of the local rural population (the subsistence amount of grain per person, i.e. 245kg, multiplied by the number of rural citizens in a district) by number of citizens, both rural and urban, in a district. Peacetime grain surplus varied substantially between grain deficit and grain surplus districts. In the worst food-secure district, the deficit was 239 kilograms per average person, and grain surplus was 3353 kilograms per person in the most grain-abundant district.

We do not know wartime surplus in each district because of poor statistics on both population and local grain productivity. The change in cropped area of grain per citizen between 1913 and 1916 provides a proxy for the level of change. In the average district, grain cropped area per capita decreased by 4 percent. The gender balance (the difference between females and males) increased by 6.9 percent over the war years. Before the war, there were two percent more females than males in the average district. Another prominent feature of the wartime was the presence of military garrisons in many Russian cities and settlements. There were garrisons in about forty percent of districts (37.6 percent) and 29.5 percent of cities in our sample by November 1917.

In terms of languages, Eastern Slavic languages (Russian, Ukrainian and Byelorussian) speakers dominated and composed of 61.1 percent of the population in districts; share of Slavs in cities was even higher, 80.8 percent. Russians were heavily concentrated in the center of the country and were a minority in the outskirts of the former empire. There were both districts and cities where their presence was negligible.

5. Empirical analysis

We employ regression analysis to understand the relationship between popular support for the Bolshevik party and the three main determinants mentioned in the literature: war, redistribution and industrial workers. We estimate our regression model using district-level data since individual-level data are unavailable. Naturally, this data limitation raises the concern of aggregation bias since we are interested in individual voter behavior. However, two of the three factors that we are interested in, war and redistribution, are correlated phenomenon within districts, aggregation bias is not as an immediate concern and therefore we postpone the discussion of this issue here. A second identification problem that we need to address is that the legislation governing the election allowed for the strategic behavior of competing parties to vary across election districts and, in particular, this meant that the number and characteristics of running candidates differed across election districts. As such, there were likely party-specific factors determined at the election district level that are unobservable to us and that influenced voting outcomes. Therefore, our identification strategy employs election-district fixed effects and

our estimates rely on variation within election districts. Using fixed effects estimation comes at a cost since the between-election district variation in the election outcomes is important. We will return to this issue later, but for now we note that, if we do find a relationship between voting shares and any factor using within-district variation, we should have confidence in this association.

To be precise, we estimate the following baseline econometric model:

$$Share_Bolsheviks_{ij} = \beta Factor_{ij} + \mathbf{X}_{ij}'\gamma + \psi_j + \varepsilon_{ij}, \quad (1)$$

Subscript i indexes administrative districts and j refers to the election district to which administrative districts belonged. $Share_Bolsheviks$ denotes the share of votes for the Bolshevik party in a geographical unit, while $Factor$ stands for corresponding variables of interest. In all regressions, we control for the share of Eastern Slavic language speakers, 1913 urban share of the population, area under grain crops per rural citizen and land productivity averaged over the last two pre-war years. These controls are denoted by \mathbf{X}_{it} ; ψ_j are the voting districts fixed effects, and ε_{ij} is an idiosyncratic error term. We weight observations by population size and cluster errors at the voting district level.

Having discussed our baseline specification, we return to the issue of aggregation bias and ecological inference. This concern is primarily aimed at interpreting the coefficient on the share of industrial workers in a district as an estimate of the average voting tendency of individual industrial workers. Since we want to directly infer individual behavior from this aggregated data, we risk making an ecological inference. Fortunately, Spenkuch (2017) has shown that both OLS and IV estimation solve the problem of ecological inference when the standard assumptions hold for the disaggregated regression model. Since there is selection into becoming an industrial worker, we prefer to take a conservative approach and employ *Industrial serfs per capita in 1793* as an instrumental variable. Industrial serfs were a special class of peasants created by Peter the Great. In the early 18th C., Peter the Great initiated the construction of relatively large factories (both private and state) because of the growing demand for metal and textile goods

from the newly reorganized and dramatically expanded Russian army. Due to the shortage of labor caused by the restrictions on labor mobility under serfdom, the government reassigned state peasants to newly established factories and, in 1721, let these factories also buy private serfs. The gentry lobbied for removing this right from factory owners in order to defend their previously exclusive privilege of owning peasants. Eventually, in 1762, they managed to introduce a ban on buying new serfs but factories could continue to possess those who were previously bought as well as their descendants. In the end, the ban was removed in 1798 due to large inefficiencies in the labor market that the ban and other restrictions created. We use figures on industrial peasants from 1793 tax census, i.e. from the census conducted at the very end of the ban period.

The relevance of our instrument comes from path dependence in industrial production as well as the heavy regulation of labor mobility that continued throughout the nineteenth century. We argue that the exclusion restriction is satisfied primarily because the assignment of peasants to factories by the imperial authorities throughout the eighteenth century, coupled with the thirty year ban on buying serfs, produced variation in the spatial distribution of industrial serfs that was largely orthogonal to the unaccounted for determinants of political preferences in the early twentieth century. To make the exclusion restriction more credible, we control for the total number of serfs per capita in a district, measured in 1858, the last available measure before serf emancipation. Since these industrial peasants, created by an archaic institution by 1917 standards, worked both in the factory and field as well as operated in a pre-industrialization environment before the Napoleonic Wars and Enlightenment ideals spread to Russia, they likely only had an influence on political preferences through their effect on the spatial distribution of industrial workers in 1897 once we account for election district fixed effects and our other control variables. We include the reduced-form regression results since this is a test of statistical significance that is robust to the presence of weak instruments (Chernozhukov and Hansen 2008).

5.1 Main results

In Table 2, we present results of running the regression in (1), which allows us to evaluate the main hypotheses in the literature on the nature of support for the Bolshevik and other communist parties. We first discuss the WWI experience (column 1). The coefficients on two of the three variables related to WWI are statistically significant and positive, stressing the importance of the war shock to understanding the dynamics of the Bolshevik revolution. Both the decrease in agriculture production per capita from 1913 to 1916 and the presence of soldiers in a district are positively associated with support for the Bolsheviks. These findings confirm that WWI had an impact on the Bolsheviks' success, possibly through their addressing concerns about food security, their preference and policies for ending the war and the ease in mobilizing peasant soldiers as opposed to peasants in the countryside. The coefficient on the change in gender balance between 1913 and 1916, a measure reflecting the scope of mobilization of males into the Russian army, is not measure precisely and the F-test of joint significance of the three proxies just fails to obtain 10% significance level.

We now turn to redistribution in column (2). Since Russia was primarily an agrarian economy, there were two main types of redistribution that peasants and the proletariat cared about, land and grain. In column (2), we see that the share of cropped area under private land tenure (as opposed to communal land tenure) in 1913 is positively related to Bolshevik share. Private land in a district represented the return to peasants under the land redistribution policy of the Bolsheviks. Surprisingly, land inequality and land productivity in terms of grain output seem to play no role, suggesting that inequality itself did not strengthen preferences for redistribution. A F-test of joint significance obtains 10% significance level. These results make it clear that the Bolsheviks needed to appeal not just to workers but also to peasants.

In column (3), we find that the main claim by the Bolsheviks, including Lenin, is consistent with the election data. The share of industrial workers is positively correlated with the share of votes going to the Bolsheviks in a district. We can interpret this positive association as a preference of individual industrial workers for the Bolsheviks since the IV estimates are also positive and statistically significant at the 5% level in column (4). In column (5), we see that this inference is robust to the possibly weak first stage (F-stat is below 10 in column 4) since the coefficient on industrial serfs in 1793 per capita is statistically significant in the estimation of the reduced-form regression. According to the OLS estimates, an additional industrial worker of

voting age population would lead to an additional 0.37 votes for the Bolsheviks. For the IV estimates, the magnitude of the coefficient jumps to 1.07. The IV estimates, however, represent a local effect and depend upon the presence of industrial workers in 1897 being sensitive to the presence of industrial serfs in 1793 in a district. Industrial workers that were influenced by industrial serfs in 1793 could have had a more clearly defined class struggle impacting their voting preferences. Thus, it appears that Marx was right that the communist ideology did represent the interests of the working class. Moreover, the IV-LATE estimates additionally support a particular nuance in the relationship that Lenin hypothesized. He expected that workers would have had an externality on peasants' voting, leading to a greater than one to one relationship between workers and votes in the aggregate.

Having demonstrated the support for each of the three determinants, we can discuss the relative magnitudes. One s.d. increase in WWI grain drop p.c. is associated with 0.12 s.d. increase in the Bolshevik vote share or an increase of 1.7 percentage points (one s.d. in the share of the voting age population casting a vote for the Bolshevik party list is equal to 14.1 percentage points). This magnitude is a bit smaller than the effect of a garrison in a district. The presence of a garrison increased the Bolshevik share by 4 percentage points, which we could then divide by two to make more comparable to the standardized change of a continuous variable. One s.d. increase in private share of land is associated with 0.16 s.d. increase in the Bolshevik vote share, a somewhat larger, but similarly sized, effect than the two war shock variables. One s.d. increase in share of industrial wage workers is associated with 0.13 s.d. increase in the Bolshevik vote share (the IV estimate is larger, but as discussed above likely driven by a local average effect). Thus, each of the factors produce roughly comparably sized effects with the effect of the land redistribution possessing a slightly larger magnitude. Our interpretation of these results is that the coalition building exercise that the Bolsheviks engaged in was important for their success in the election. In section 6, we will discuss several counterfactuals to give a richer interpretation of the conclusions in the literature.

Before moving on to our second set of results, we briefly point out that in columns (1)-(3) of Table 2, the only control variables that are consistently statistically significant are the share of Eastern Slavic speakers in a district, which is positively associated with voting for the Bolsheviks, and total crop area per capita in 1913, which is negatively associated with voting for the Bolsheviks. The signs of the coefficients are not surprising. Ethnic minorities tended to vote

for their national parties and there might have been language barriers to the Bolshevik agitation. More agrarian economies on average were more likely to be conservative and less likely to support the revolutionaries.

We now turn to the results that aim to unearth the source of support of the proletariat. Specifically, we want to better understand the democratic underpinnings of the dictatorship of the proletariat by investigating heterogeneity in the relationship between Bolshevik vote share and industrial workers per capita according to the two main policies of redistribution, food security for urban workers and land redistribution. The first is consistent with the Bolshevik transformation of the agrarian economy, while the second one is not. We would expect the heterogeneity in the relationship between the proletariat and Bolshevik vote share to vary according to the salience of these policies in a district.

In Table 3, we add interactions between the share of the proletariat in a district and (demeaned) proxies for the salience of these policies. We first split Russia into grain surplus and grain deficit regions (Wheatcroft and Davies 1994). If grain redistribution was the primary factor explaining Bolshevik support, then we would expect to see the proletariat in grain deficit regions to exhibit stronger support. In fact, we find the opposite, the sign of the coefficient on the interaction term is negative and nearly offsets the magnitude of the positive coefficient on the share of proletariat in grain surplus regions. The negative coefficient could relate to the value of agricultural land that peasantified industrial workers expected to benefit from as a result of the land redistribution. We can also view the wartime drop in grain production as a measure of the salience of food security issues in a district. While regional grain markets existed, local grain availability mattered for household consumption in general, and especially during the war environment (Broadberry and Harrison 2005). In column (2) of Table 3, we find that the support for the Bolsheviks was indeed more strongly associated with the share of industrial workers in districts that suffered more from the decline of grain production during the war. Since the war effect is likely temporary, we find that urban bias in the Bolshevik vision likely could not have driven sustained democratic support.

For land redistribution, as before, we use the share of private land in a district (demeaned) and interact this variable with the share of industrial workers. In column (3), the coefficient on the interaction term is positive and statistically significant at the 1% level. We interpret this finding as evidence of the strong rural ties of the working class in Russia during

this time. Workers were more likely to support the Bolsheviks in districts with a greater share of historically private land, which had recently been transferred to peasants. Importantly, if ownership of this land mattered to the working class and voters were rewarding the Bolsheviks for land redistribution, then this basis of support presents a serious conflict with the Bolsheviks' vision.

If the Russian proletariat wanted to return to the land and peasantify instead of modernizing into an industrial working class, then we would expect to see differences within the proletariat according to how much human capital, possibly occupation-specific, had been accumulated as industrial workers. We thus differentiate the proletariat between skilled and unskilled industrial-wage workers and then interact them separately with the proxies. These two groups should face different incentives with respect to these strategic policies. Skilled workers, having invested in human capital, were likely entrenched in urban living and far removed from their rural roots. In contrast, unskilled workers mostly arrived in cities to work because the opportunity cost of rural wage work or subsistence farming was low. Many historians (e.g. Burds 1998) underlined the particularly close and strong ties of Russian unskilled industrial workers with their villages of origin, where they often retained their formal rights to commune land. As such, skilled workers should have mobilized around food security for cities and grain redistribution in favor of urban dwellers. In contrast, if unskilled workers had a connection to rural areas, such as having a plan to return to farming if land were to become available, then they could mobilize around the land redistribution reform. The contrast between these two groups is further emphasized by the fact that the beneficiaries of land redistribution would suffer from a policy of grain redistribution since the returns of their newly acquired lands would be redistributed away, setting up a potential conflict within groups that supported the Bolsheviks.

In column (4), we first present the baseline regression with the proletariat split into skilled and unskilled. The results suggest that the presence of unskilled workers in a district likely drove the working class' support of the Bolsheviks. The coefficient on unskilled is positive and statistically significant at the 5% level while the coefficient on skilled is imprecisely measured. Moreover, a comparison of the point estimates suggests that the magnitude of the effect of the unskilled is also larger since the standard deviation of unskilled is five times larger than that of skilled. In column (5), the coefficients on interactions between the war grain drop and shares of skilled and unskilled both are statistically insignificant. This result further

emphasizes the temporary nature of this food security and the lack of a perceived connection between the Bolshevik long-term policies and the WWI shock. In column (6), we switch to the more problematic policy of land redistribution. The coefficient on the interaction term with skilled workers is not statistically different from zero, as expected if skilled workers were not beneficiaries of this policy. The coefficient on the interaction term with the unskilled workers is positive and highly statistically significant, suggesting that unskilled industrial workers were, in fact, beneficiaries of this policy that targeted peasants.

In the last column of Table 3, we explore how literacy rate, an additional measure of human capital, influences the voting of the skilled and unskilled proletariat. The coefficient on the interaction term with skilled is not statistically different than zero, while the coefficient on the interaction term with unskilled is negative and statistically significant at the 5% level. The negative coefficient is consistent with the previous results if unskilled workers in more literate districts had less of a desire or intention to return to the land. Interestingly, more literate districts supported the Bolsheviks more than less literate districts.

5.2 Robustness checks

In this subsection, we address several concerns with our results. The first concern is due to election irregularities. Given the epic nature of this unprecedented election, there were bound to be irregularities. Whether these irregularities bias our results is worth investigating further. We rerun the specifications in columns (1)-(3) of Table 2 including control variables for whether or not an election started late and the number of days that the election took to complete. The coefficients of interest are quite similar, suggesting that these election irregularities were not correlated with the determinants that we consider. Another possible election irregularity is electoral fraud on behalf of the Bolsheviks. We stress that if there had been strong evidence of voter fraud, the election would have been annulled. However, more subtle forms of voter manipulation may have been missed. We proxy for the ability of the Bolsheviks to manipulate the election by when they took power of the local soviet. The earlier that Bolsheviks controlled a district, the more scope for manipulation they likely had. Again, we rerun the specifications in columns (1)-(3) of Table 2 including dummies that mark when the Bolsheviks took control as control variables. The coefficients of interest are quite similar, suggesting that voter manipulation was not correlated with the determinants that we consider.

A second concern is that, in addition to the Bolsheviks, there were multiple competing parties in each election. The strength of the competing parties could have been correlated with war, redistribution and proletariat and therefore act as a confounding variable. To remedy this, we construct a new dependent variable that takes the number of votes obtained by the Bolsheviks less the votes of the competing party with the highest number of votes and divide this vote margin by the voting age population. Table 5 presents the results of rerunning Table 2 with this new dependent variable. Again, we find similar results.

A third concern is the correlation between voter turnout and war, redistribution and proletariat. To make our identification strategy more credible, the numerator in our preferred dependent variable contains information about political preference as well as the decision to vote. Since the decision to vote is not exclusively determined by voter identification with a political party, our dependent variable contains noise and a strong association between voter turnout and the factors would raise concerns that we are capturing variation in support for the Bolsheviks. In Table 6, we replicate Table 2 using voter turnout as the dependent variable. The only determinant that has a relationship is the number of males mobilized into the army. However, this association is likely mechanical, reflecting how we measure the voting age population which likely overestimates the population size in heavily mobilized districts.

6. Discussion of results

The Bolsheviks needed an additional 0.36 votes per eligible voter to obtain support from the majority of voting population or +2.54 s.d. increase in an average district. Of course, they would not have needed such a high level of support to win the election, but Lenin himself argued that the Bolshevik regime was unstable without the support of the majority (Lenin 1969).⁸ The revealed voting patterns, discussed above, show that the Bolsheviks managed a complex coalition of soldiers, peasants and industrial workers, who were driven by different and potentially discordant reasons. What if the Bolsheviks did not have to appeal to this coalition? We can ask what would pre-WWI factors that weren't associated with the war, redistribution or the proletariat have to look like to secure a majority for Lenin's party? Increasing the share of

⁸ The Bolsheviks needed +1.23 s.d. in average district to get majority of votes cast and only +0.82 s.d. in average district to get plurality of the voting population.

Eastern Slavic speakers to one in the average district would lead to an increase of .045 votes per eligible voter. Reducing total crop area per capita to zero in the average district would increase the Bolshevik's vote share by 0.038 votes per eligible voter. Taken together, these extreme values would not have achieved a similar level of support. From these rough and ready (stretching the limits of regression analysis) calculations, we can surmise that the strategic coalition building that the Bolsheviks undertook was necessary, echoing the argument of many scholars (e.g. Pipes 1994) that there was insufficient concentration of interests, especially in the countryside, to pose a strong and sustained threat of revolution.

Turning to coalition building, we can ask what would Bolshevik support have been if the specific war environment and strategic policies had not contributed to their success, i.e. no WWI shock to agricultural production, no soldiers and no private land to redistribute, In the average district, shutting down WWI shock would cut Bolshevik support by 13% (a decrease of $1.8 = 0.28 + 1.52$ percentage points out of 14.06). In the average district, shutting down land redistribution would decrease Bolshevik support by 20% (a decrease of 2.8 percentage points out of 14.06). Thus, if these variables lose their force, we would see a decrease in the Bolshevik vote share by a third, bringing their popularity much closer to the levels of communist parties in Germany and France during the interwar period.

For the final counterfactual, we turn to unskilled proletarians and the land reform. The strong rural basis of this support for the Bolsheviks posed problems for the dictatorship of the proletariat. If we remove the possibility of redistributing private land, then according to the results in Table 3, all of the support of the unskilled proletariat would have been annulled in the average district. Thus, the Bolsheviks' plan for the industrialization of the largely agrarian economy and the collectivization of agriculture would not lead to increased support by the peasantified proletariat because it would require them to relinquish control over land.

Finally, our results allow us to speculate on the success of the Bolsheviks in the Civil War and their failure during the 1905 revolution. Their ability to mobilize empire-wide support, in particular support from the peasants, was a crucial factor of their success or failure. If 1905 for the Bolsheviks was a worker revolution, piggy-backed by disgruntled peasants, in 1917 they clearly incorporated peasants. Their conflicting promises on grain and land redistribution shaped the development of the Civil War and we have research underway that will illuminate this phenomenon in more detail.

7. Conclusion

Our investigation of the 1917 Constituent Assembly elections provides new quantitative evidence on the relationship between the popular support of the Bolsheviks during their revolution and the key determinants of their success identified in the literature, the war shock, demand for redistribution and the establishment of the working class. We find that Bolshevik support was driven by each of these factors. The Bolsheviks seized the moment to mobilize popular support and develop a coalition of workers, soldiers and peasants. However, coalition building among the masses took place without an institutionalized mechanism of transferring the benefits of Bolshevik control across these various groups.

Why then did the Bolsheviks not sanction a more democratic system of maintaining broad support across heterogeneous groups? One possibility is that, as in the Acemoglu and Robinson model (Acemoglu and Robinson 2000, 2001, 2006), the threat of counterrevolution allowed the Bolsheviks to informally commit to concessions and redistribution to these varied groups of society without giving up control and democratizing. A different interpretation is the Bolsheviks aimed at a rapid industrial revolution in a predominantly agrarian economy and the dramatic changes necessary to redirect the organization of production, which required large amounts of cheap labor and food supplied to factories and urban dwellers, would have made the necessary transfers for continued support by rural residents counterproductive to the objectives of the regime. The Bolsheviks need not have correctly anticipated this conflict to opt for autocratic control instead of democracy. They could have felt emboldened to break the social contract of the election because of a self-enforcing promise of future democratic rule under a proletariat majority, once their development strategy had been fulfilled (Fearon 2011).

A last note is on the limitations of our analysis. In the paper, we have concentrated on the study of the variation within election districts. We accept and recognize that between-election district variation in voting outcomes and the determinants was important. Provinces of the Russian Empire, which roughly corresponded to the election districts, were quite different. The majority of coefficients on FEs (not reported) in Tables 2 to 6 are statistically significant. The electoral map in Figure 1 demonstrates that there were clear voting patterns. Table A4 in the appendix presents some more evidence on that. The voting was the most pro-Bolshevik (with a share of 45.8 percent) in the districts located in the Central Industrial Region, Northwest, Baltic provinces and Belorussia (column 1), i.e. broadly speaking the Northwestern part of the empire

with both capitals. In the other parts of the country, the Bolsheviks managed to get substantially less; the coefficients on dummies for all other regions are negative and statistically significant. Moreover, the difference was high; depending on a region, one could see between seventeen and forty-one percentage points less support. Cities voted more uniformly than the countryside; in city-level regressions, coefficients only on several regional dummies are statistically significant (column 3). The distances to the front and to Saint Petersburg negatively affected voting for the Bolsheviks (column 2 and 4), a pattern that fits well to the contours of the frontlines of the future Civil War. Unfortunately, since between-variation in Bolshevik vote share could be driven by strategic and unobservable differences in regional political parties, we cannot exploit this variation in our analysis without more deeply consulting regional archival material on party differences or taking a more structural approach.

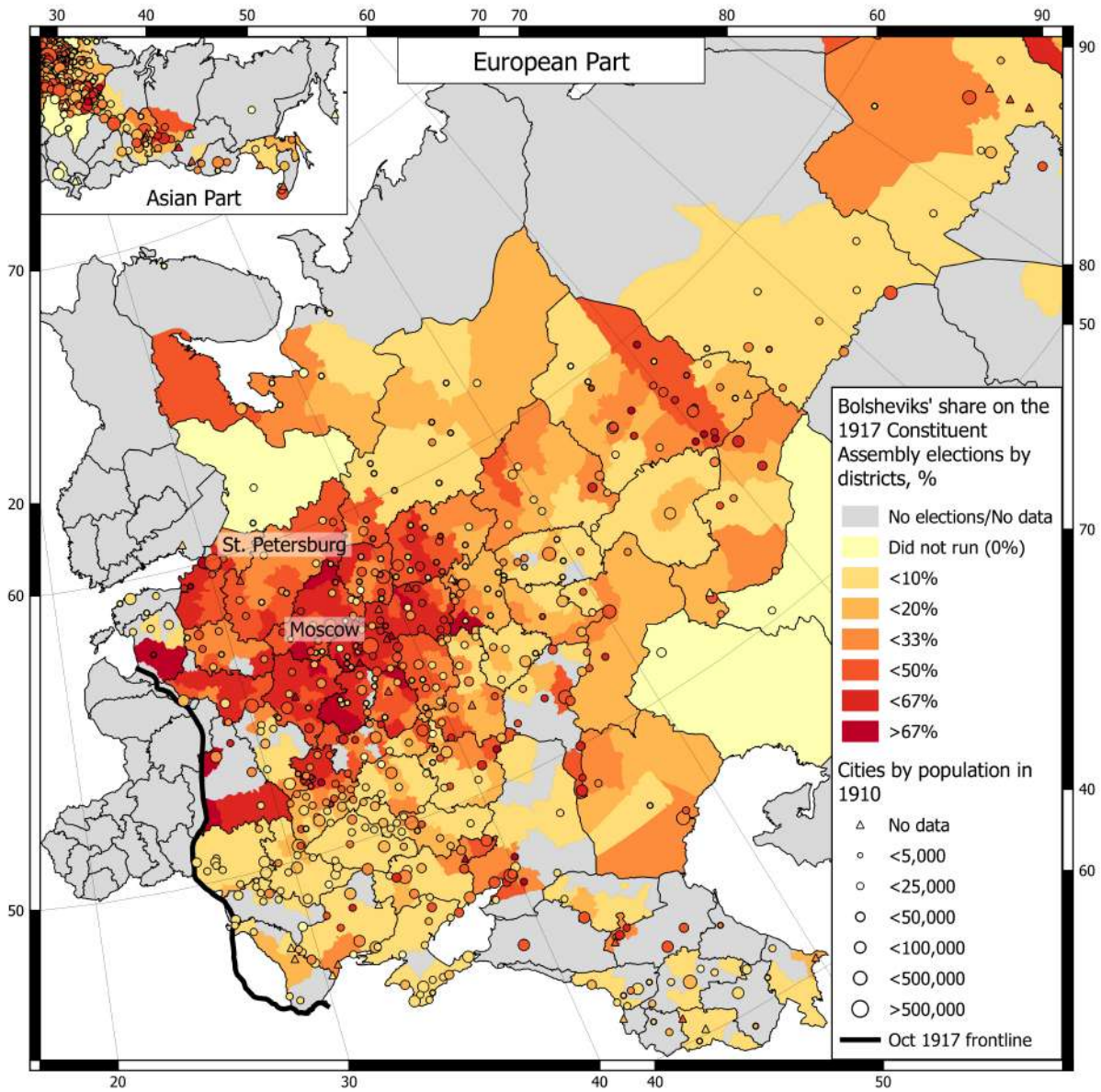
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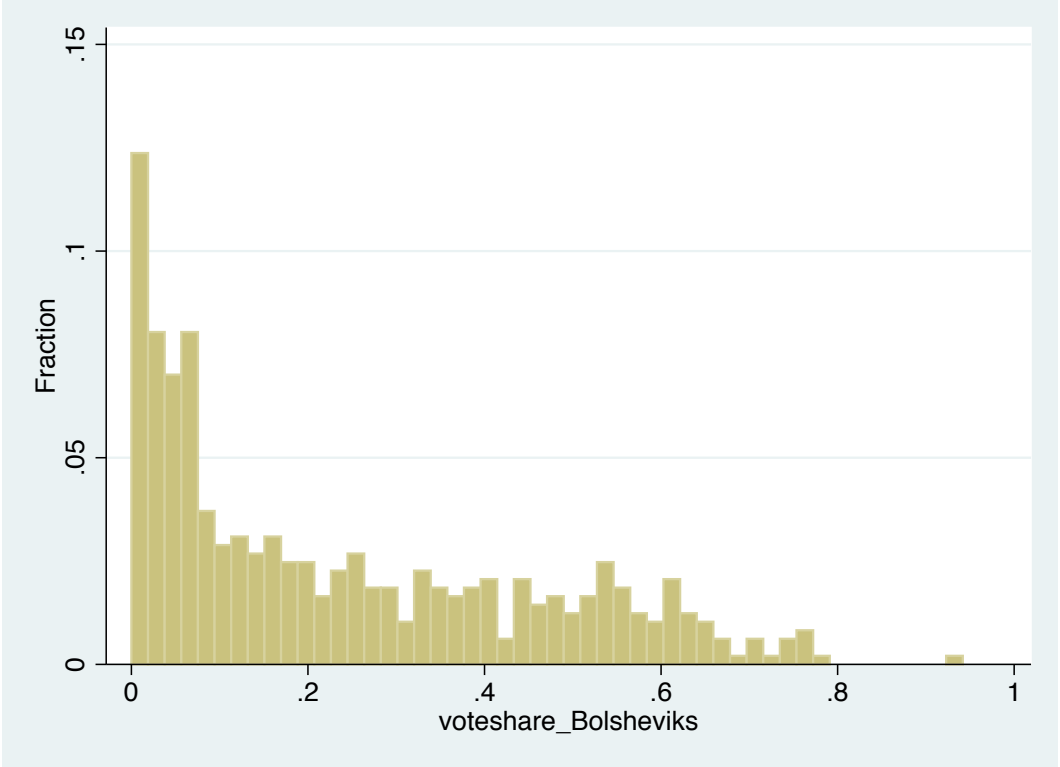
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Figure 1. Share of votes for the Bolsheviks at 1917 Constituent Assembly elections



Notes: Europe Lambert Conformal Conic projection is used. Thin black lines stand for province boundaries; shading represents within province administrative division, namely administrative districts. We run regressions both at district and city levels as well as for rural voters only, i.e. districts results without city votes.

Figure 2. Distribution of district shares of votes for the Bolsheviks at 1917 Constituent Assembly elections



Notes: Share of votes for the Bolsheviks represent their shares of votes in 485 administrative districts, i.e. including both rural and urban votes.

Table 1: Descriptive Statistics of district-level results of the 1917 elections and district characteristics

Variable	Obs	Mean	Std. Dev.	Min	Max
Votes	485	75092	56667	845	569870
Votes for the Bolsheviks	486	14968	15157	0	112176
Share of votes for the Bolsheviks	485	0.236	0.216	0	0.942
Share of voting age population in 1897	769	0.517	0.042	0.443	0.786
Population in 1913 (thousands)	750	227.066	169.710	13.4	2210.7
Share of votes for the Bolsheviks per eligible voter	471	0.141	0.141	0	1.155
Urban share in 1913	731	0.114	0.131	0	0.971
Total crop area per rural citizen in 1913 (in hectares per thousand citizens)	745	472.630	352.574	0	3224.08
Average grain yield per hectare in 1913-1914 (in tones)	683	0.787	0.212	0.225	1.531
Proletarians (employees occupied in industrial sectors in 1897) per eligible voter	742	0.052	0.051	0	0.593
Share of grain crops on private lands in 1913	741	0.253	0.194	0	0.955
Changes in hectares under grain crops per citizen between 1916 and 1913 (percentages)	516	0.0398	0.2994	-3.9217	1.6245
Changes in gender balance between 1913 and 1916 (percentage points)	580	0.0686	0.0329	-0.2454	0.1754
Garrison dummy	444	0.376	0.485	0	1
Share of speakers of Eastern Slavic languages in 1897	765	0.611	0.403	0.0006	0.9997
Land inequality Gini index	504	0.124	0.052	0	0.386

Notes: The summary statistics are reported for administrative districts, i.e. for both rural and urban areas of these districts.

Table 2. The Effects of War, Redistribution and the Proletariat on Bolshevik Support

	(1) War OLS	(2) Redistribution OLS	(3) Proletariat OLS	(4) Proletariat 2SLS	(5) Proletariat Reduced-form
Change in grain cropped area per citizen between 1913 and 1916	0.07* [0.041]				
Change in gender balance between 1913 and 1916	-0.11 [0.199]				
Garrison dummy	0.04** [0.015]				
Share of grain crops on private land in 1913		0.12*** [0.044]			
Commune land Gini index		-0.00 [0.091]			
Private land Gini index		-0.04 [0.046]			
Grain yield per capita in 1913		0.06 [0.055]			
Proletarians per voting age population in 1897			0.37** [0.151]	1.07** [0.481]	
Serfs per capita in 1858				0.02 [0.042]	0.06 [0.044]
Industrial serfs per capita in 1793					0.36** [0.177]
Share of Eastern Slavic language speakers in 1897	0.10*** [0.032]	0.11*** [0.032]	0.10*** [0.033]	0.12*** [0.041]	0.15*** [0.040]
Average grain yield per hectare in 1913-14	-0.04 [0.052]	-0.08 [0.073]	-0.04 [0.048]	-0.01 [0.071]	-0.02 [0.079]
Urban share of the population in 1913	-0.02 [0.077]	-0.10 [0.115]	-0.10 [0.097]	-0.27*** [0.062]	-0.20* [0.114]
Total crop area per rural citizen in 1913	-0.00** [0.000]	-0.00** [0.000]	-0.00** [0.000]	-0.00 [0.000]	-0.00*** [0.000]
Constant	0.06 [0.045]	0.09 [0.081]	0.01 [0.057]		0.08 [0.050]
Observations	320	418	466	343	343
R-squared	0.653	0.586	0.606	0.002	0.575

Notes: An administrative district is a unit of observation. Units are weighted by population. Standard errors are clustered by voting district. Share of proletarians is defined as all occupied in industry and mining divided by eligible voters. Private lands refer to lands with private (non-communal) tenure, and Eastern Slavic languages refer to Russian, Ukrainian and Byelorussian. Urban share refers to legally defined urban settlements only.

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

Table 3: Why did the proletariat support the Bolsheviks?

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	GrainRe dist	GrainRe dist	Land Redist	Skilled	GrainRe dist WWI	LandRe dist	Literacy
Proletarians per voting age population in 1897	0.77** [0.371]	0.31** [0.152]	0.74*** [0.150]				
Change in grain cropped area per citizen between 1913 and 1916		0.01 [0.010]			0.01 [0.010]		
Proletarians*Change in grain cropped area		1.19** [0.524]					
Proletarians*Grain deficit region	-0.68* [0.396]						
Proletarians*Share of grain crops on private land			2.92*** [0.979]				
Share of grain crops on private land in 1913			-0.06 [0.049]			-0.07 [0.051]	
Skilled proletarians per voting age population in 1897				0.92 [0.664]	0.76 [0.647]	0.58 [0.736]	1.00 [0.733]
Unskilled proletarians per voting age population in 1897				0.31** [0.132]	0.25* [0.129]	0.91*** [0.221]	0.41** [0.181]
Skilled*Change in grain cropped area					1.97 [8.415]		
Unskilled*Change in grain cropped area					1.01 [1.433]		
Skilled*Change in grain cropped area						-1.91 [4.033]	
Unskilled*Change in grain cropped area						4.12*** [1.159]	
Skilled*Literacy rate in 1897							-6.60 [9.988]
Unskilled*Literacy rate in 1897							-4.51** [2.153]
Share of Eastern Slavic language speakers in 1897	0.09** [0.035]	0.11*** [0.033]	0.10*** [0.034]	0.10*** [0.034]	0.10*** [0.033]	0.10*** [0.034]	0.08** [0.036]
Average grain yield per hectare in 1913-14	-0.04 [0.045]	-0.04 [0.051]	-0.03 [0.043]	-0.04 [0.047]	-0.04 [0.051]	-0.04 [0.042]	-0.03 [0.043]
Urban share of the population in 1913	-0.12 [0.107]	-0.12 [0.100]	-0.16* [0.094]	-0.11 [0.103]	-0.13 [0.102]	-0.17* [0.095]	-0.00 [0.064]
Total crop area per rural citizen in 1913	-0.00** [0.000]	-0.00** [0.000]	-0.00*** [0.000]	-0.00** [0.000]	-0.00** [0.000]	-0.00** [0.000]	-0.00** [0.000]
Literacy rate in 1897							0.29** [0.145]
Constant	0.00 [0.051]	0.08 [0.054]	-0.00 [0.048]	0.02 [0.057]	0.08 [0.053]	0.00 [0.049]	0.03 [0.058]
Observations	466	423	466	466	423	466	466
R-squared	0.617	0.610	0.636	0.607	0.611	0.638	0.638

Notes: An administrative district is a unit of observation. Units are weighted by population. Standard errors are clustered by voting district. Share of proletarians is defined as all occupied in industry and mining divided by eligible voters; for the definition of skilled and unskilled proletarians see the text. Private lands refer to lands with private (non-communal) tenure, and Eastern Slavic languages refer to Russian, Ukrainian and Byelorussian. Urban share refers to legally defined urban settlements only.

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

Table 4: Election irregularities

	(1) War OLS	(2) Redistribution OLS	(3) Proletariat OLS	(4) War OLS	(5) Redistribution OLS	(6) Proletariat OLS
Change in grain cropped area per citizen between 1913 and 1916	0.05 [0.035]			0.04 [0.057]		
Change in gender balance between 1913 and 1916	-0.05 [0.188]			-0.10 [0.226]		
Garrison dummy	0.04** [0.015]			0.03* [0.014]		
Share of grain crops on private land in 1913		0.13*** [0.043]			0.12** [0.055]	
Commune land Gini index		-0.11 [0.079]			-0.13 [0.094]	
Private land Gini index		-0.03 [0.074]			-0.05 [0.081]	
Grain yield per capita in 1913		0.07 [0.056]			0.09 [0.067]	
Proletarians per voting age population in 1897			0.30** [0.134]			0.27** [0.122]
Election started late	-0.00 [0.007]	0.00 [0.007]	0.00 [0.009]	0.01*** [0.003]	0.01*** [0.004]	0.01*** [0.004]
Number of days election lasted	0.02 [0.027]	0.05** [0.023]	0.04 [0.031]	0.00 [0.023]	0.03* [0.017]	0.01 [0.021]
Bolsheviks first controlled soviets before December 3rd, 1917				-0.01 [0.055]	-0.01 [0.027]	-0.01 [0.020]
Bolsheviks first controlled soviets between December 4 th 1917 and January 31 st , 1918				-0.09 [0.053]	-0.09** [0.022]	-0.05 [0.021]
Bolsheviks first controlled soviets after February 1st, 1918				0.09** [0.063]	0.11*** [0.040]	0.11*** [0.041]
Share of Eastern Slavic language speakers in 1897	0.09*** [0.030]	0.10*** [0.028]	0.10*** [0.032]	0.09** [0.035]	0.11*** [0.029]	0.11*** [0.036]
Average grain yield per hectare in 1913-14	-0.05 [0.052]	-0.10 [0.073]	-0.05 [0.049]	-0.05 [0.062]	-0.12 [0.079]	-0.06 [0.056]
Urban share of the population in 1913	-0.00 [0.078]	-0.08 [0.119]	-0.09 [0.104]	0.03 [0.084]	-0.09 [0.130]	-0.10 [0.115]
Total crop area per rural citizen in 1913	-0.00 [0.000]	-0.00** [0.000]	-0.00** [0.000]	-0.00 [0.000]	-0.00** [0.000]	-0.00* [0.000]
Constant	0.05 [0.050]	0.12 [0.090]	0.01 [0.063]	0.04 [0.081]	0.13 [0.105]	-0.01 [0.071]
Observations	308	406	454	266	348	386
R-squared	0.659	0.595	0.608	0.651	0.579	0.586

Notes: An administrative district is a unit of observation. Units are weighted by population. Standard errors are clustered by voting district. Share of proletarians is defined as all occupied in industry and mining divided by eligible voters; for the definition of skilled and unskilled proletarians see the text. Private lands refer to lands with private (non-communal) tenure, and Eastern Slavic languages refer to Russian, Ukrainian and Byelorussian. Urban share refers to legally defined urban settlements only. Robust standard errors in brackets. *** indicates p-value <0.01, ** p-value <0.05, * p-value<0.1.

Table 5: Vote margin

	(1) War OLS	(2) Redistribution OLS	(3) Proletariat OLS	(4) Proletariat 2SLS	(5) Proletariat Reduced-form
Change in grain cropped area per citizen between 1913 and 1916	0.12 [0.111]				
Change in gender balance between 1913 and 1916	0.03 [0.257]				
Garrison dummy	0.06** [0.028]				
Share of grain crops on private land in 1913		0.20*** [0.071]			
Commune land Gini index		0.04 [0.222]			
Private land Gini index		-0.02 [0.101]			
Grain yield per capita in 1913		-0.01 [0.161]			
Proletarians per voting age population in 1897			0.70*** [0.261]	2.72*** [0.889]	
Serfs per capita in 1858				-0.02 [0.093]	0.09 [0.097]
Industrial serfs per capita in 1793					0.92*** [0.242]
Share of Eastern Slavic language speakers in 1897	0.09 [0.075]	0.07 [0.060]	0.06 [0.061]	0.05 [0.092]	0.11 [0.085]
Average grain yield per hectare in 1913-14	-0.23* [0.115]	-0.22 [0.138]	-0.21** [0.096]	-0.14 [0.151]	-0.17 [0.153]
Urban share of the population in 1913	0.26* [0.149]	0.19 [0.152]	0.20 [0.121]	-0.12 [0.113]	0.04 [0.141]
Total crop area per rural citizen in 1913	-0.00 [0.000]	-0.00 [0.000]	-0.00 [0.000]	0.00 [0.000]	-0.00* [0.000]
Constant	-0.17* [0.090]	-0.18 [0.155]	-0.52*** [0.104]		-0.22*** [0.081]
Observations	320	418	466	343	343
R-squared	0.709	0.720	0.704	-0.270	0.692

Notes: An administrative district is a unit of observation. Units are weighted by population. Standard errors are clustered by voting district. Share of proletarians is defined as all occupied in industry and mining divided by eligible voters; for the definition of skilled and unskilled proletarians see the text. Private lands refer to lands with private (non-communal) tenure, and Eastern Slavic languages refer to Russian, Ukrainian and Byelorussian. Urban share refers to legally defined urban settlements only.

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

Table 6. Voter turnout

	(1) War OLS	(2) Redistribution OLS	(3) Proletariat OLS	(4) Proletariat 2SLS	(5) Proletariat Reduced-form
Change in grain cropped area per citizen between 1913 and 1916	-0.00 [0.102]				
Change in gender balance between 1913 and 1916	-0.32* [0.183]				
Garrison dummy	-0.00 [0.022]				
Share of grain crops on private land in 1913		0.02 [0.068]			
Commune land Gini index		-0.10 [0.125]			
Private land Gini index		-0.08 [0.060]			
Grain yield per capita in 1913		0.20* [0.109]			
Proletarians per voting age population in 1897			0.13 [0.164]	-0.53 [0.817]	
Serfs per capita in 1858				0.05 [0.035]	0.03 [0.035]
Industrial serfs per capita in 1793					-0.18 [0.271]
Share of Eastern Slavic language speakers in 1897	-0.00 [0.081]	0.04 [0.066]	0.03 [0.072]	0.11 [0.083]	0.09 [0.085]
Average grain yield per hectare in 1913-14	0.13** [0.055]	-0.02 [0.082]	0.09* [0.048]	0.11 [0.075]	0.12 [0.073]
Urban share of the population in 1913	-0.17 [0.120]	-0.32** [0.136]	-0.33** [0.144]	-0.41** [0.179]	-0.44*** [0.139]
Total crop area per rural citizen in 1913	-0.00 [0.000]	-0.00** [0.000]	-0.00 [0.000]	-0.00** [0.000]	-0.00** [0.000]
Constant	0.42*** [0.078]	0.57*** [0.114]	0.67*** [0.081]		0.60*** [0.080]
Observations	320	418	466	343	343
R-squared	0.370	0.438	0.398	0.160	0.457

Notes: An administrative district is a unit of observation. Units are weighted by population. Standard errors are clustered by voting district. Share of proletarians is defined as all occupied in industry and mining divided by eligible voters; for the definition of skilled and unskilled proletarians see the text. Private lands refer to lands with private (non-communal) tenure, and Eastern Slavic languages refer to Russian, Ukrainian and Byelorussian. Urban share refers to legally defined urban settlements only.

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

Appendix.

Table A1. Data sources and time span of the data

Variable:	District/ City level	Years:	Source:
Share for the Bolsheviks	District & City	1917	Protasov et al. (2014)
Population	District	1897, 1913	Kessler and Markevich (2015)
Population	City	1910	Central Statistical Committee (1914c)
Urban share	District	1913	Central Statistical Committee (1914a)
Total crop area	District	1913, 1916	Central Statistical Committee (1913b) Special Food Committee of Russian Empire (1916)
Grain crops on private lands	District	1916	Special Food Committee of Russian Empire (1916)
Grain yield	District	1913-1914	Central Statistical Committee (1913b, 1914b)
Agricultural machines	District	1910	Central Statistical Committee (1913a)
Changes in gender balance	District	1913 to 1916	Castaneda Dower and Markevich (2017)
Garrison dummy	City	1917	Protasov et al. (2014)
Occupations by sector	District	1897	Trojnitskij N.A. (1900-1910)
Population by gender and ethnicity	District	1897	Trojnitskij N.A. (1900-1910)
Population by gender and ethnicity	City	1910	Central Statistical Committee (1914c)
Female and male unskilled wages	City	1910	Central Statistical Committee (1914c)
Land inequality Gini index	District	1905	Central Statistical Committee (1905- 1907)
Lands with repartition tenure	District	1905	Central Statistical Committee (1905- 1907)
Residential buildings	City	1910	Central Statistical Committee (1914c)
Financial institutions	City	1910	Central Statistical Committee (1914c)
Religious centers	City	1910	Central Statistical Committee (1914c)
Students	City	1910	Central Statistical Committee (1914c)

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Table A2. Selection on observables.

Variable	Districts with election data			Districts without election data			Difference	p-value
	Obs	Mean	Std. Err.	Obs	Mean	Std. Err.		
Urban share in 1913	473	-0.00001	0.005	258	0.00003	0.009	0.00004	0.996
Total crop area per rural citizen in 1913 (in hectares per thousand citizens)	473	0.24	10.28	272	-0.417	20.59	-0.657	0.975
Average grain yield per hectare in 1913-1914 (in tons)	469	0	0.006	214	0	0.015	-0.0001	1
Share of proletariat (share of employees occupied in industrial sectors among all with source of income in 1897)	273	0.0001	0.003	293	-0.0002	0.004	-0.0003	0.952
Grain yield per citizen in 1913 (in 000 tones)	467	0.0002	0.01	278	-0.0003	0.022	-0.001	0.981
Number of agricultural machines per rural citizen	473	0	0.0007	277	0	0.001	-0.00001	0.997
Share of grain crops on private lands in 1913	471	0.0001	0.005	270	-0.001	0.013	-0.0001	0.991
Changes in area under grain crops between 1916 and 1913 (hectare per capita)	428	-0.00001	0.0101	88	0.0001	0.052	0.0001	0.998
Changes in gender balance between 1913 and 1916 (percentage points)	462	0.0001	0.0013	118	-0.0004	0.0034	0.003	0.864
Share of Russians in 1897	472	0.001	0.006	293	-0.0008	0.021	-0.0013	0.942
Rural female to rural male gender ratio in 1913	334	-0.001	0.005	67	0.003	0.018	0.004	0.801
Population growth between 1897 and 1913 (percentages)	469	-0.0002	0.005	272	0.0004	0.079	0.0006	0.992
Land Inequality Gini Index	418	0.0001	0.002	86	-0.001	0.008	-0.001	0.866
Share of lands with repartition tenure in 1905	418	-0.0001	0.006	86	0.001	0.048	0.0007	0.979

Note: Variables have been demeaned with voting district-specific averages

Table A3. Determinants of Bolshevik Support in garrisons

VARIABLES	(1) Garrisons	(2) Garrisons
Number of industrial workers per city citizen in 1910	-0.63** [0.307]	-0.50 [0.353]
Grain 'surplus' per capita in 1913	0.08 [0.469]	-0.02 [0.764]
Number of agricultural machines per rural citizen in 1913	1.22 [2.349]	0.13 [3.510]
Share of grain crops on private lands in 1913	-0.31 [0.297]	-0.27 [0.377]
Changes in hectares under grain crops per citizen between 1916 and 1913		-0.22 [0.242]
Changes in gender balance between 1913 and 1916		-0.22 [0.613]
Share of Eastern Slavs in 1910	-0.09 [0.256]	0.13 [0.375]
Female to male unskilled wage ratio in 1910	-0.14 [0.322]	-0.14 [0.384]
Rural female to rural male gender ratio in 1913	-1.07 [0.696]	-1.24 [0.788]
Population growth between 1897 and 1913	0.19 [0.140]	-0.08 [0.450]
Number of residential buildings per capita in 1910	-0.67 [0.700]	0.05 [0.804]
Number of financial institutions per capita in 1910	394.45** [180.964]	444.81** [212.352]
Number of religious centers per urban capita	-96.71 [68.481]	-130.67* [70.544]
Number of students per urban capita	-0.74 [1.281]	-1.36 [1.059]
Average grain yield per hectare in 1913-1914	-0.15 [0.270]	-0.22 [0.304]
Log(City population in 1910)	0.03 [0.047]	0.05 [0.061]
Total crop area per rural citizen in 1913	-0.00 [0.001]	-0.00 [0.001]
Voting district FEs	Yes	Yes
Constant	1.23 [1.194]	1.24 [1.468]
Observations	126	111
R-squared	0.777	0.815

Notes: A garrison is a unit of observation. Units are weighted by number of voters. Standard errors are clustered by voting district. Grain surplus equals the division of the difference between grain yield in a district and the product of 245 multiplied by number of rural citizens over the number of citizens, both rural and urban, in a district. Private lands refer to lands with private (non-communal) tenure, and Eastern Slavs refer to Russian, Ukrainian and Byelorussian. Share of lands with repartition tenure equals to area of lands with repartition commune tenure divided by total area of commune lands (with both repartition and hereditary tenures). Financial institutions include banks and their branches, credit societies, saving societies and pawnshops. Religious centers refer to Christian churches of all types, Mosques and Synagogues.

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

Table A4. Geographical Determinants of Bolsheviks support at the 1917 Constituent Assembly elections

VARIABLES	(1)	(2)	(3)	(4)
	District		City	
North	-0.27***		-0.15**	
	[0.074]		[0.066]	
Northwest	0.04		0.02	
	[0.082]		[0.065]	
Baltics	0.04		-0.20*	
	[0.247]		[0.109]	
Bellorussia	0.07		-0.05	
	[0.113]		[0.088]	
Black Earth region	-0.17**		-0.07	
	[0.079]		[0.062]	
Volga	-0.27***		0.01	
	[0.068]		[0.079]	
Urals	-0.25***		0.09	
	[0.071]		[0.087]	
South	-0.27***		0.07	
	[0.074]		[0.061]	
West Ukraine	-0.37***		-0.21***	
	[0.063]		[0.059]	
East Ukraine	-0.27***		-0.02	
	[0.076]		[0.073]	
South Ukrain	-0.33***		-0.08	
	[0.066]		[0.076]	
Caucause	-0.38***		-0.18***	
	[0.063]		[0.056]	
Siberia	-0.30***		-0.02	
	[0.075]		[0.070]	
Central Asia	-0.41***		-0.18*	
	[0.063]		[0.092]	
Distance to Moscow		0.01		-0.00
		[0.005]		[0.004]
Distance to SPb		-0.03***		-0.01**
		[0.006]		[0.005]
Distance to the frontline		0.02***		0.01***
		[0.004]		[0.004]
Front province dummy		0.15		-0.07
		[0.109]		[0.052]
Constant	0.42***	0.34***	0.28***	0.27***
	[0.063]	[0.036]	[0.056]	[0.027]
Observations	473	472	549	548
R-squared	0.469	0.339	0.143	0.083

Notes: An administrative district or a city is a unit of observation. Units are weighted by population. Standard errors are clustered by voting district. Central Industrial Region is the reference region.

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