The Political-Economic Causes of the Soviet Great Famine, 1932–33*

Andrei Markevich†, Natalya Naumenko‡and Nancy Qian§

July 20, 2021

This study constructs a large new dataset to investigate whether state policy led to ethnic Ukrainians experiencing higher mortality during the 1932–33 Soviet Great Famine. All else equal, famine (excess) mortality rates were positively associated with ethnic Ukrainian population share across provinces, as well as across districts within provinces. Ukrainian ethnicity, rather than the administrative boundaries of the Ukrainian republic, mattered for famine mortality. These and many additional results provide strong evidence that higher Ukrainian famine mortality was an outcome of policy, and suggestive evidence on the political-economic drivers of repression. A back-of-the-envelope calculation suggests that bias against Ukrainians explains up to 77% of famine deaths in the three republics of Russia, Ukraine and Belarus and up to 92% in Ukraine.

JEL: N4, P2 **Keywords:** Repression, Mass Killings, Ethnic Conflict

1 Introduction

In just two years, 1932 and 1933, up to 10.8 million individuals died in the Soviet Great Famine. In terms of total deaths, this was the second worst famine in the 20th century. At least 30% to 45% of the victims were ethnic Ukrainians, who constituted 21% of the pre-famine Soviet population.[1]

*We are extremely grateful to Ekaterina Zhuravskaya for her generous support; and thank Daron Acemoglu, Maxim Ananyev, Paul Catañeda Dower, Michael Ellman, Ruben Enikolopov, Jeff Frieden, Scott Gehlbach, Mikhail Golosov, Sergei Guriev, Mark Harrison, Oleg Khlevniuk, Alexey Makarin, Victor Malein, Joel Mokyr, Gerard Padro-i-Miquel, Steven Nafziger, Marco Tabellini, Chris Udry and Yuri Zhukov for their insights; the participants of the Trinity College Applied Economics Workshop, CERGE-EI Applied Economics Workshop, EIEF workshop, HECER (Helsinki Center of Economic Research) Labor and Public Economics seminar, 2020 Summer Workshop in the Economic History and Historical Political Economy of Russia, Northwestern Economic History Lunch, Northwestern Development Lunch, George Mason Economic History Lunch, the NBER Political Economy Workshop, the Ridge Conference, the ASSA/AEA On the Role of and Culture and Community 2020 session. For excellent research assistance, we thank Pavel Bacherikov, Nikita Karpov, Ivan Korolev, Kaman Lyu and Carlo Medici. All mistakes are our own.

†New Economic School (Moscow, Russia), amarkevich@nes.ru, CEPR

‡George Mason University, nnaumenk@gmu.edu

§Kellogg School of Management at Northwestern University, nancy.qian@kellogg.northwestern.edu, NBER, BREAD, CEPR

[1]The Soviet Great Famine incurred an approximately similar mortality rate as the Chinese Great Famine (1959–61), which had a higher number of total deaths. The Background Section discusses the estimated range in mortality rates.

The causes of the famine and the high Ukrainian mortality have been a subject of much controversy. One side claims that the famine was a "terror" intentionally waged by the Soviet government on the Ukrainian peasantry (e.g., Conquest, 1986). Ukrainians were the largest ethnic group in grain-producing regions, they had a strong group identity, a history of confrontation with the Bolsheviks during the Civil War and resisted Soviet efforts to control agriculture, which constituted nearly half of GDP. Thus, the regime targeted Ukrainians in its efforts to control rural production (e.g., Graziosi, 2015). Some have gone further to argue that the famine was intended to annihilate the ethnic Ukrainian population.[2] The other side claims the opposite: that there was no systematic bias against Ukrainians. Historians note that areas outside of Ukraine also experienced famine (e.g., Kondrashin, 2008). Some acknowledge that Ukrainians experienced higher famine mortality, but do not believe that it was due to state repression. Instead, they argue that bad weather and pre-famine policies led to larger harvest declines and higher mortality in areas populated by Ukrainians (Davies and Wheatcroft, 2004; Kotkin, 2017). This heated debate is at an impasse because of the lack of disaggregated data to evaluate competing hypotheses.

The primary contribution of our study is to address the data limitation by constructing the largest and most comprehensive dataset for interwar Soviet Union, 1922–40. Drawing mainly from archival sources, we construct panel data at the province and district levels, which contain information about economic, political, historical, geographical and climatic factors. The data include the three largest and most populous Soviet republics: Russia, Ukraine and Belarus. The large sample size, long time horizon, disaggregated units of observation and rich set of variables allow us to distinguish between competing hypotheses and provide rigorous empirical evidence on the extent of Ukrainian bias in the famine.[3]

Our analysis aims to answer two questions: *i*) did ethnic Ukrainians experience higher famine mortality; and *ii*) was this due to systematic bias in Soviet economic policy or factors outside the control of the government in 1932? In addition, we provide a large body of descriptive evidence to shed light on the potential drivers of Ukrainian bias.

We begin by documenting the patterns of Ukrainian famine mortality rates. First, we examine whether ethnic Ukrainians experienced higher famine mortality when controlling for the important confounding factors that have emerged in the literature: weather, food production and urbanization. We use the province-level panel and regress mortality rates on the interaction of pre-famine Ukrainian population share and the famine year dummy variable and find that the interaction effect is positive. We infer Ukrainian mortality rates from this correlation because there are no ethnic-specific mortality data. Conceptually, the interaction coefficient captures mortality in Ukrainian-

[2] In Ukrainian, the famine is called the "Holodomor," which means "to kill by starvation." The Ukrainian Parliament (2006) and Applebaum (2017) refer to it as a genocide. The European Parliament (2008) condemned it as a "crime against humanity". See Background Section for a detailed discussion.

[3] The district-level panel includes Russia and Ukraine because of the lack of pre-famine mortality data for Belarus. See Appendix Section G for the list of data sources used to construct the sample used in this study.

populated regions during the famine relative to other years. This accounts for the fact that mortality can differ across regions for reasons unrelated to the famine. We use the terms *excess* and *famine mortality* interchangeably in the paper.

The baseline specification controls for lagged grain production (predicted by weather and geography), urban population share, each of their interactions with the famine year indicator, and province and year fixed effects. Thus, our finding of higher famine mortality in ethnic Ukrainian areas cannot be due to differences in agricultural production, weather or urbanization rates.[4]

We show that the results are robust to controlling for the intensity of *dekulakization*, which aimed to eliminate wealthy peasants who had resisted Soviet agricultural reforms, and the drop in livestock, which occurred a few years prior to the famine and could have affected grain production and the ability to survive harvest shortfalls. We also check that the estimates are robust to a large number of additional geo-climatic (e.g., latitude and longitude), demographic (e.g., age and gender ratios), pre-famine institutional (e.g., religion, share of serfs, share of peasants in repartition communes) and political controls (e.g., Bolshevik vote share in 1917). Since these additional controls are time-invariant, we control for their interactions with the famine dummy variables. To address potential measurement error in the historical data, we show that the results are robust to alternative measures of Ukrainian population share and mortality, as well as to examining natality rates as an alternative measure of famine severity.

We find that mortality is positively associated with Ukrainian population share *only* during the famine. In non-famine years, the association is negative. In addition, using a similar specification, we find that Ukrainian population share is uncorrelated with famine mortality during the 1892 famine, the last large famine under the Tsars. These results suggest that higher Ukrainian mortality is specific to the Soviet famine and unlikely to be driven by time-invariant correlates of Ukrainian population share (e.g., social capital, informal institutions, or cultural norms).

Second, given that existing studies focus on the comparison of the famine in Ukraine versus Russia, we examine the relative importance of ethnic versus administrative boundaries. We find that the positive relationship between ethnic Ukrainian population share and famine mortality in the province-level panel is present even if we omit Ukraine. Furthermore, we can use the more granular district-level panel to examine the presence of a Russia-Ukraine border effect. The data show a discrete decline in mortality rates when crossing the border from Ukraine to Russia. But this decline disappears when we control for the ethnic Ukrainian population share of each district. Thus, ethnic boundaries matter for the famine, while administrative boundaries do not matter.

Third, we investigate whether the positive mortality-Ukrainian gradient observed across provinces is also present within provinces. Soviet economic policies were centrally planned and implemented top-down through the bureaucracy. If the systematic pattern we observe between ethnic Ukrainian

[4]We also show that our results are robust to directly controlling for weather instead of weather-predicted grain production.

population share and famine mortality was an outcome of state policy, we would expect to see similar patterns at all levels of government administration. This is indeed the case. The district-level data show that famine mortality is also positively associated with Ukrainian population share *within* provinces (i.e., when we control for province-year fixed effects).

The results in the first part of the paper support the belief that there was systematic repression against Ukrainians during the famine. The finding that Ukrainian ethnicity matters while Ukrainian administrative boundaries do not reconciles the view that Ukrainians were systematically repressed with the observation that the famine was not isolated to Ukraine. A back-of-the-envelope calculation using the province-level estimates implies that ethnic bias against Ukrainians explains up to 92% of total famine mortality in Ukraine and up to 77% in the three republics in our sample. These estimates should not be interpreted literally, but as illustrative of the importance of ethnic bias towards Ukrainians in explaining famine mortality. We provide a large body of evidence against alternative explanations for our findings that do not require Ukrainian bias (e.g., weather, rigidity in centrally planned procurement) in the paper.

The second part of the paper presents additional findings that provide further support for the presence of systematic bias against Ukrainians, and shed light on the drivers of repression. We leverage the richness of our data to connect famine mortality to the economic and political motivations of the regime and policy. Most of this analysis uses the province-level panel for which we have a larger set of variables.

The main economic motivation for the repression of Ukrainians arises from the regime's objective to control agriculture combined with the conventional wisdom that Ukrainians were historically more resistant to the Bolsheviks than other groups. We investigate the extent to which the data support this view by first documenting that Ukrainians resisted agricultural collectivization more than other ethnic groups in the years before the famine. Then, we proxy for a region's importance to Soviet grain production with official 1928 grain production, which was used to design agricultural policy in the First Five Year Plan (1928–32). We estimate the triple interaction effect of the Ukrainian population share, the famine year indicator and reported 1928 grain production on mortality. The coefficient is positive, which means that famine mortality was increasing in Ukrainian population share in provinces that were important for Soviet agriculture, as perceived by policymakers. This result is robust to controlling for the triple interaction effect of Ukrainian population share, the famine year indicator and political loyalty to the regime and state capacity.

Interestingly, the latter triple interaction coefficient is statistically zero in this regression, which is effectively a horse race between the triple interaction with 1928 grain production and the triple interaction with political loyalty and state capacity. Thus, political factors unrelated to grain productivity do not explain Ukrainian famine mortality. The triple interaction estimates also show that the central planner's perception of regional grain productivity was positively associated with famine mortality only in regions where ethnic Ukrainians resided, and famine mortality was positively as-

sociated with Ukrainian population share only for productive regions. These results are consistent with the view that the repression of Ukrainians was focused on controlling grain production.

Finally, to link famine mortality and policy, we examine the centrally planned agricultural policies that most directly affected food availability – agricultural collectivization and grain procurement. Consistent with the conventional wisdom that these policies contributed to famine, we document that famine mortality was positively associated with the intensity of both collectivization and grain procurement. Next, we examine these policy variables as outcomes in our baseline and in the specification with the triple interaction of Ukrainian population share, famine dummy variable and 1928 grain production. Consistent with collectivization and procurement contributing to Ukrainian famine mortality, all of the estimates have similar signs as when we examined mortality as the outcome.[5]

Since collectivization and procurement are planned centrally, the results support the interpretation that higher Ukrainian mortality was an outcome of policy. We also examine the allocation of tractors, which were highly valued and also decided centrally. The estimated effects for tractors have the opposite signs as for mortality, collectivization and procurement. The fact that central planners withheld tractors from Ukrainian-populated areas supports the presence of Ukrainian bias in government policy and a non-cooperative relationship between Ukrainians and the regime at the time of the famine.

The findings from the second part of the paper show that centrally planned policies known to have contributed to famine mortality were more intensively enforced in regions with larger Ukrainian population shares. Moreover, the mortality-Ukrainian gradient and the policy intensity-Ukrainian gradient both increase in the importance of a region for agricultural production. Together, these findings support the interpretation that ethnic Ukrainians were systematically repressed during the famine. The nuanced patterns of repression are consistent with the view that the regime's desire to control grain production together with its fear of Ukrainian nationalist resistance resulted in the famine being especially harsh in ethnic Ukrainian areas (e.g., Graziosi, 2015).

It is beyond the scope of our empirical analysis to be conclusive about the motivation for repression. The empirical and historical evidence together suggest that it was likely the combination of Ukrainians' importance to agricultural production together with their opposition to the Bolsheviks that made them a target. We provide a speculative discussion in the Conclusion.

Our study contributes to several literatures. First, we add to a small but rapidly growing literature on the Russian and Soviet political economy in the 19th and 20th centuries. We are the first to provide rigorous empirical evidence that Ukrainians across the USSR suffered higher famine mor-

[5]To illustrate the effect of Ukrainian bias on famine through collectivization or procurement, we estimate a two-stage specification, where we instrument for the interaction of collectivization (procurement) and the famine dummy variable with the interaction of Ukrainian population share and the famine dummy variable. The coefficients are positive and statistically significant. These results should be interpreted as illustrative since there are other ways for Ukrainian bias to increase mortality rates.

tality rates or experienced differential exposure to collectivization policies, that ethnic delineations matter over administrative ones, or show the heterogeneity in Ukrainian famine mortality. In providing evidence on the political-economic determinants of ethnic-specific persecution, we are most similar to Grosfeld, Sakalli, and Zhuravskaya (2020), which finds that anti-Jewish pogroms during 1800–1927 were triggered by a break of borrower-lender relationships in times of political turmoil. Our study is related to Gregory, Schröder, and Sonin (2011) and Castañeda Dower, Markevich, and Weber (forthcoming), which explain why dictators, such as Stalin, would kill citizens who are not real enemies; and Egorov and Sonin (2011), which considers the tradeoffs for dictators like Stalin, in maximizing the loyalty of followers.[6] We also complement macro calibrations of Soviet industrialization policies by Cheremukhin, Golosov, Guriev, and Tsyvinski (2017), which intentionally excludes the cost of famine because of data limitations.

Our study sheds light on the root causes of ethnic tensions between Ukrainian and Russians, which has been found to affect the behavior of firms (Korovkin and Makarin, 2019) and political outcomes in the Ukraine today (Rozenas and Zhukov, 2019).[7] In this sense, we are related to studies on the persistence of historical features in this context, such as in the case of the abolition of serfdom (Markevich and Zhuravskaya, 2018; Buggle and Nafziger, 2019), forced migration (Bauer, Braun, and Kvasnicka, 2013; Becker, Grosfeld, Grosjean, Voigtlander, and Zhuravskaya, 2020), peasant rebellions (Castañeda Dower, Finkel, Gehlbach, and Nafziger, 2018; Finkel and Gehlbach, 2020), mass repressions (Talibova and Zhukov, 2018), and anti-Semitism (Grosfeld, Rodnyansky, and Zhuravskaya, 2013; Acemoglu, Hassan, and Robinson, 2019).[8] Korovkin and Makarin (2019) documents the effect of modern ethnic tensions between Ukrainians and Russians on firms, and Rozenas and Zhukov (2019) documents the impact of famine-induced ethnic tensions on political outcomes today. Also related is Egorov, Enikolopov, Makarin, and Petrova (2020), which studies the cost of ethnic diversity, a legacy of historical ethnic tensions in Russia. Gorodnichenko and Roland (2017) and Roland (2010) document the long-run effects of Communism more generally.

The findings add to recent studies on the causes of ethnicity-delineated mass killings in Eastern and Central European contexts such as Croatia-Serbia (DellaVigna, Enikolopov, Mironova, Petrova, and Zhuravskaya, 2014) and Nazi Germany (Adena, Enikolopov, Petrova, Santarosa, and Zhuravskaya, 2015).[9]

Our study contributes to the large literature on the causes of famine. Recent empirical analyses have examined contexts such as China (e.g., Li and Yang, 2005; Meng, Qian, and Yared, 2015),

[6]For a comprehensive overview of the political economy problems faced by autocrats, see Gehlbach, Sonin, and Svolik (2016) and Egorov and Sonin (2020).

[7]The emergence of repression when Bolshevik ideology proclaims equality across all ethnicities complements the theoretical insights from Mitra and Ray (2014) on the origins of conflict between Hindus and Muslims.

[8]Also, see Finkel, Gehlbach, and Kofanov (2017) for a study of the causes of peasant rebellions in 1917.

[9]Our results are consistent with the theoretical predictions from Caselli and Coleman II (2013) and Esteban, Morelli, and Rohner (2015) that ethnic conflict and strategic mass killings are more likely with high levels of natural resources (agriculture in the Soviet famine context).

India (e.g., Sen, 1981; Burgess and Donaldson, 2017), and Ireland (e.g., Ó Gráda, 1999).[10] Existing studies have not rigorously examined the Soviet famine, which had very different political and economic conditions compared to other contexts. For example, we show that the mechanisms Meng, Qian, and Yared (2015) found to have contributed to famine in China, another centrally planned economy, are not binding in the Soviet context. Our study adds to Naumenko (2021), which documents a positive association between collectivization and famine mortality in a cross-section of districts in Ukraine.

This paper is organized as follows. Section 2 summarizes the historical background. Section 3 presents descriptive statistics. Section 4 presents the main results on famine mortality in ethnic Ukrainian areas. Section 5 presents additional results. Section 6 concludes.

2 Background

2.1 Basic Facts

Approximately half of Soviet GDP in 1928 comprised of agriculture, most of which was grain production (Wheatcroft and Davies, 1994). Grain was also one of the main exports. Boosting grain production was critical for the economic prosperity and political survival of the Bolshevik regime (1917–91). The main agricultural economic policy was collectivization of individual farms. Forced collectivization began in late 1929. Agriculturally productive regions, amongst which Ukraine was a focal point, were collectivized earlier and more intensively. By the summer of 1932, the collectivization rate exceeded 60% in the USSR and was almost 70% in Ukraine (Davies and Wheatcroft, 2004).

Collectivization aimed to remove private property and to organize peasants into large collective farms which were believed to be more productive than small individual farms and which the government could control directly. The government banned the trading of food and instead procured grain directly from collective farms (and the remaining individual peasants). In theory, peasants were meant to be left with enough for subsistence. Procured food was distributed to the urban industrial population or exported.

These policies were unpopular in rural areas. Peasants did not want to give up their property for free and resisted collectivization. They slaughtered, ate or simply neglected collectivized livestock. Between 1929 and 1932, the number of horses declined by 42%, cattle by 40% (Viola, 1996, p. 70).

[10] Li and Yang (2005) estimates the dynamic effects of China's Great Leap Forward policies on the Chinese Great Famine, 1959–61. Meng, Qian, and Yared (2015) documents that there was no aggregate food shortage during the Chinese Great Famine, mortality was positively associated with food production, and attribute part of the famine mortality to centralized food procurement policies. Sen (1981) argues that the Bengal famine was due to unequal food distribution between surplus producers, the failure of credit and insurance markets, and food hoarding by the British Colonial government. Burgess and Donaldson (2017) finds that access to railroads reduced famine severity in Colonial India. Ó Gráda (1999) provides a comprehensive study of the economic and political causes of Irish Famine of 1847. See Ó Gráda (2009) for a discussion of major famines in history.

De-classified secret police reports reveal much active resistance, mostly in the form of arson, killing communist officials in the rural areas, demonstrations, or the dissemination of anti-Soviet leaflets. Wealthier, more productive peasants, or those actively resisting collectivization, were persecuted as *kulaks*. In the *dekulakization* campaign, approximately two million peasants were exiled to Siberia and other remote areas, amongst whom approximately 500,000 perished (Viola, 2007).

The first news of possible famine began to circulate during the harvest of 1931. According to the official estimates, production was 17% lower than the previous year.[11] News of starvation and possible famine traveled to Moscow, but instead of relaxing the policies that, as peasants believed, had caused starvation, the government intensified them: it increased grain procurement targets by 20%, from 22.1 million tons in 1930 to 26.6 million in 1931 (Wheatcroft, 2001). Starving peasants often consumed seed stock. The lack of seed stock and a weakened labor force contributed to lower production in 1932. The procurement quotas for 1932 remained high, and the central government insisted on their fulfillment (Davies, Harrison, and Wheatcroft, 1994).

Deaths from starvation began to increase quickly towards the end of 1932 and peaked in the winter and spring of 1933. National mortality rates returned to trend in 1934, although some places took longer to recover. In total, approximately 5 to 10.8 million died, and mortality was concentrated in rural areas though there were some accounts of famine mortality in urban areas.[12]

Collectivization and the famine were accompanied by rapid migration out of the countryside to the cities where living standards were higher. More than 23 million peasants migrated to urban areas in the 1930s (Kessler, 2002). Together with shocks of Stalin's mass repressions and WWII, these large-scale population changes make it difficult to explore the long-run consequences of the famine. The Soviet government denied the existence of the 1932–33 famine until the late 1980s.

2.2 Soviet National [Ethnic] Policy

Bolshevik ideology did not discriminate against ethnic minorities, i.e., ethnic-delineated nationalities within the Soviet Union.[13] However, the regime was wary of nationalistic sentiments. The Civil War (1918–20) revealed the strength of separatist nationalist movements, many of which viewed the Soviet state as a Russian state. To secure their rule, the Bolsheviks gave equal rights to ethnic minorities. In 1923, the year following the establishment of the Soviet Union, the government

[11] Davies and Wheatcroft (2004) Table 1 reports the official 1930 harvest estimate to be 83.5 million tons, and the official 1931 harvest estimate to be 69.5 million tons.

[12] Conquest (1986) estimates total famine deaths to be 7 million. Davies and Wheatcroft (2004) estimates 5.5 to 6.5 million deaths. Ellman (2005) cites "'about eight and a half million' victims of famine and repression in 1930–33." Kondrashin (2008) gives a range between 5 and 7 million victims. Russian historical demographers estimate 7.2 to 10.8 million famine victims (Polyakov and Zhiromskaya, 2000). In 2008, the Russian State Duma postulated that within the territories of the Volga Region, the Central Black Earth Region, Caucasus, Ural, Crimea, Western Siberia, Kazakhstan, Ukraine and Belarus, the estimated famine death toll was 7 million people (State Duma, 2008).

[13] Martin (2001) goes further and argues that ethnic minorities had preferential treatment until the end of the indigenization policies and refers to the early Soviet Union as "the affirmative action empire."

launched a policy of indigenization (*korenizatsiya*). The policy aimed to neutralize nationalist separatist movements by providing legal forms of "nationhood". In regions where minorities constituted the local majority, it encouraged schooling and the publication of books in native languages, promoted native culture (national literature, theaters, museums, etc.), required running local government affairs in the native language, and promoted natives into leadership positions in the party, government and industry.

One of the byproducts of Soviet indigenization policy was to emphasize ethnicity. The regime established a hierarchy of national autonomous administrative units: republics — provinces — districts — village soviets. The system of smaller and smaller national administrative units together with the high local ethnic concentration (e.g., villages usually contained a dominant majority ethnic group) deepened ethnic delineations. For example, in Ukraine, ethnic Germans had preferential rights in "German" villages. Thus, access to land in the early Soviet era *de facto* depended on ethnicity. This further incentivized the already ethnically segregated population to live with co-ethnics, and forced individuals to explicitly and officially define their ethnicity (Martin, 2001, Chapter 2).

From the beginning of its realization, Bolshevik leaders worried that indigenization policy and the increasing salience of ethnicity might become problematic for the regime. They recalled their political difficulties during the Civil war in areas populated by non-Russian ethnicities, such as ethnic Ukrainians, where peasants supported national movements. As early as 1925, Stalin said "the national [ethnic nationalities] question [is], in essence, a peasant question" (Stalin, 15 April 1925 as quoted in Graziosi, 2015). This concern intensified when peasants, particularly Ukrainian peasants, strongly resisted collectivization. Common ethnic identity and residential concentration facilitated collective action among ethnic groups and made nationalism one of the key threats to collectivization. Concerns about nationalist opposition to the regime were so strong by the autumn of 1932, that the indigenization policy was *de facto* terminated (Graziosi, 2015; Martin, 2001).

2.3 Ukrainians

According to the 1926 Population Census, Ukrainians were the largest ethnic minority and constituted 21% of the Soviet population. Russians were the majority with 53% of the population. 23.2 million ethnic Ukrainians lived in Ukraine and an additional 7.9 million lived in Russia and Belarus.

Importantly, Ukrainians were the largest ethnic group in areas that were officially designated as "grain-surplus" areas (where production far exceeded subsistence levels during non-famine years).

Ukrainians had a strong group identity that included their own language and culture. During the Civil War, the Bolsheviks were forced to pay attention to the "national question" by strong political opposition from nationalists in Ukraine. This contributed to the introduction of indigenization policy. The Ukrainian communist party was the largest national branch of the Soviet communist party. Soviet officials of the Republic of Ukraine tended to view themselves as representatives of the interests of ethnic Ukrainians across the Soviet Union. In the countryside, ethnic Ukrainians

lived in concentrated communities both within and outside Ukraine (Martin, 2001). Thus, a region (e.g., province) with a large share of ethnic Ukrainians usually contains a large number of sub-units (e.g., villages) with ethnic Ukrainian majorities. This is important for interpreting the results we present later in the paper.

There are no systematic data on ethnic-specific mortality rates. One way to approximate ethnic Ukrainian mortality is to use the most cited total famine death toll for the USSR, 7 million (Conquest, 1986), and the death toll of 2.6 million (Meslé, Vallin, and Andreev, 2013) to 3.9 million (Rudnytskyi, Levchuk, Wolowyna, Shevchuk, and Kovbasiuk, 2015) for Ukraine. If famine deaths were equally distributed between ethnic Ukrainians (80% of Ukraine) and others, and assuming that no ethnic Ukrainians died outside Ukraine, then ethnic Ukrainian deaths constitute 30% ($.8 \times 2.6/7 = .3$) to 45% ($.8 \times 3.9/7 = .45$) of the total famine deaths.

Many historians argued that the strong resistance to collectivization among ethnic Ukrainians was the key reason of their systematic persecution.[14] Indeed, a common language and national identity, and experience in resisting the Bolsheviks during the Civil War facilitated the collective action of the Ukrainians. On the eve of the famine, when regional party officials began reporting food shortages to Stalin and asking for procurement reductions, the central leadership believed that the shortages resulted from intentional peasant resistance. The Stalin-led government believed that the peasants, including Ukrainian peasants, should be penalized for their subversion.[15]

In late summer of 1932, when it was obvious that enforcing procurement quotas would cause a severe famine, Stalin received multiple reports indicating the reluctance of Party leaders at all levels in Ukraine to facilitate the starvation of so many peasants.[16] Stalin responded by sending special commissions headed by his closest deputies, Vyacheslav Molotov and Lazar Kaganovich, neither of whom were ethnic Ukrainians, to implement the full force of Soviet policies in Ukraine and North Caucasus, the two key grain-producing regions where most ethnic Ukrainians lived (Kotkin, 2017).

On December 14, 1932, the Politburo of the Communist Party and the Soviet government issued a classified decree in which the government insisted on complete fulfillment of grain procurement in Ukraine, North Caucasus and the Western region and required the arrests of communists (e.g., party secretaries) and local officials who failed in this task. In the same decree, the communist leaders accused Ukrainian nationalists within the Communist Party and local bureaucracy of sabotaging grain procurement. The decree required regional authorities in Ukraine (as well as the North Caucasus and the Western region) to "crush" any resistance of "counter-revolutionaries" and nationalists and to fulfill procurement quotas (Danilov, Manning, and Viola, 1999–2006, Volume 3, Document 226).

[14] See, for example, Conquest (1986), Ellman (2007), Graziosi (2015), Mace (2004) and Snyder (2010).

[15] There are many documents showing that Stalin advocated for over-procurement —– leaving peasants with less than subsistence — as a method to discipline the peasants, whom he believed to have intentionally understated their production capacity (Danilov, Manning, and Viola, 1999–2006; Davies and Wheatcroft, 2004).

[16] For example, in a letter to his deputy Lazar Kaganovich from August 11, 1932, Stalin mentioned that the party district committees in about fifty districts in Ukraine had spoken out against state procurement quotas. He expressed his concerns that the Soviet government "could lose Ukraine" (Davies, Khlevniuk, Rees, Kosheleva, and Rogovaya, 2003).

3 Descriptive Statistics

3.1 Mortality

Our sample includes nineteen provinces from the three most populous republics of the Soviet Union: Belarus, Russia and Ukraine. Altogether, the sample includes 84% of the 1926 Soviet population and areas that contributed 88% of the 1928 Soviet grain production.[17] The average province has 6.5 million people in 1926. All data are mapped to the 1932 province borders. See Appendix Section G for a list of all data sources and a detailed discussion of the construction of our sample.

Figure 1a plots mortality rates (the number of deaths divided by total population) from 1923 to 1940. This is our main dependent variable for the analysis later in the paper. It shows that mortality rates are reasonably constant over time at approximately twenty per thousand, but spike in 1933 to nearly forty per thousand. Figure 2a plots yearly mean mortality across provinces and the standard deviation in mortality across provinces normalized by mean mortality. It shows that there is always variation in mortality across provinces, but it increases dramatically during the famine. This means that famine severity was very unequal across regions.[18]

Appendix Figure A.1a maps famine excess mortality, defined as mortality in the famine 1933 year minus mortality in the "normal" 1928 year for the provinces in our sample.[19] Ukraine along with the southern provinces of Russia suffer higher excess mortality than other regions.[20]

3.2 Ukrainian Population

The 1926 Population Census is commonly viewed as one of the highest quality Soviet censuses (Andreev, Darskij, and Kharkova, 1998). It is the latest census prior to agricultural collectivization. In 1926, the population share of ethnic Russians and Ukrainians were 53.1% and 21.3% in the Soviet Union, 57.2% and 23.1% in our sample, and 41.9 and 43.8% in "grain-producing" provinces. Grain-producing provinces are a subset of our sample. This is an official designation used by Soviet central planners and procurement agencies, it indicated the importance of a province for agricultural production. These statistics show that Ukrainians were the second largest ethnic group compared to

[17] Within Russia, our sample does not include Far East, Yakutia, and the ethnic territories of the North Caucasus region: Chechen Autonomous Province, Cherkess Autonomous Province, Dagestan Autonomous SSR, Ingush Autonomous Province, Kabardino-Balkarian Autonomous Province, Karachay Autonomous Province, North Ossetian Autonomous Province. The excluded regions comprise less than 3% of the 1926 population of Russia. For these regions, and for the Soviet territories outside of Belarus, Russia and Ukraine, there are no reliable mortality data until the mid-1930s.

[18] We conduct a caloric accounting exercise in the Appendix Section A. It shows that aggregate food production and rural retention after procurement (food delivered to the urban areas and for export) was far above the level required for maintaining population. This is true for the Soviet Union and for each of the republics in the sample. Thus, factors such as high grain exports and the degree to which food was transferred to urban populations to support industrialization, both of which are deducted when calculating rural retention, are not key to understanding overall famine mortality.

[19] Using other years in the 1920s produces similar spatial patterns.

[20] Appendix Figure A.1c maps excess mortality at the district level. Appendix Figure A.1e maps the excess mortality after demeaning by province fixed effects. It shows that there is significant variation within provinces.

Russians, but the largest group in grain-producing provinces. For understanding the importance of Ukrainians, it is worth noting that the next largest ethnic group was an order of a magnitude smaller. Belorussians were 3.2% of total Soviet Union population and 3.5% of our sample.[21]

Appendix Figure A.1b maps the share of ethnic Ukrainians in the rural population for each province as reported in the 1926 Census. It shows that the greatest concentration of Ukrainians is in Ukraine, but that there is also substantial variation outside of Ukraine. Agriculturally productive regions are shaded in crosses. Ukrainians are concentrated, but not exclusively residing in productive regions.[22]

3.3 Ukrainian Resistance to Collectivization

From declassified secret police reports, we have several measures of peasant resistance from January 1931 to March 1932, the period preceding the famine. The first is the number of anti-Soviet "violent acts" per 1,000 people. These acts include murders or attempted murders of local officials, arsons and the destruction of collective farm or state property. The second is the number of mass unrest demonstrations in the countryside. The third is the number of anti-Soviet leaflets uncovered by the secret police. For brevity, we examine the first principal component of the three indicators as the dependent variable.

Table 1 regresses this measure of peasant resistance on the population share of Ukrainians in rural areas (column 1), the share of households that are collectivized in 1931–32 (column 2), and then, in addition, the interaction of these two variables (column 3). The regressions use a cross-section of nineteen provinces and control for urban population share. The positive coefficients for collectivization in columns (2) and (3) show that peasant resistance was higher in provinces that experienced more collectivization. The positive interaction coefficient in column (3) shows that resistance to collectivization is increasing in the share of Ukrainians in rural areas.

In interpreting these results, it is important to recall the high degree of residential segregation across ethnic groups in rural areas of the Soviet Union. A higher share of rural ethnic Ukrainians in a province means a higher number of ethnic Ukrainian villages. The positive association between rural Ukrainian population share and per capita resistance is consistent with the findings by historians discussed in the background section and the conventional wisdom that strong group identity and local organization facilitate organizing resistance.

In columns (4)–(6), since both collectivization and resistance to it could have been driven by grain productivity of the province, we control for officially reported 1928 grain production per capita. These were the numbers used by central planners to determine regional production and procurement quotas. The estimate for resistance is unchanged.

[21] Appendix Table A.1 Panel A lists the ten largest ethnic groups in the Soviet Union, Panel B lists the ten largest ethnic groups in our sample, and Panel C lists the ten largest ethnic groups in the grain-producing provinces of our sample.

[22] Appendix Figure A.1d maps Ukrainians at the district level. Appendix Figure A.1f maps Ukrainians at the district level after demeaning by province fixed effects. It shows that there is significant variation within provinces.

4 Famine Mortality in Ethnic Ukrainian Areas

4.1 Baseline Estimates

To examine whether areas with higher share of ethnic Ukrainians suffered higher mortality rates than other ethnic groups, we estimate the following equation

$$mortality_{i,t+1} = \alpha + \beta Ukrainian_i \times Famine_t + \Gamma X_{it} + \eta_i + \delta_t + \varepsilon_{it}. \quad (1)$$

Mortality rate in province i during year $t+1$ is a function of: the interaction of the share of ethnic Ukrainians in the rural population of province i in 1926, $Ukrainian_i$, and a dummy variable that equals one in the famine year, $Famine_t$; province fixed effects η_i; and year fixed effects δ_t. Since $Ukrainian_i$ is a time-invariant measure, the uninteracted term is absorbed by the province fixed effects. The additional controls, X_{it}, include the per capita grain production in province i during year t, $Grain_{it}$, and its interaction with $Famine_t$; urban population share in province i during year t, and its interaction with $Famine_t$. Our baseline assumes that grain production in year t is used mostly to feed the population in year $t+1$. We define the famine dummy to equal one in 1932 because 1933 was the year with the highest mortality rates when the famine became apparent in all regions. We estimate standard errors that are adjusted for spatial correlation.[23]

All our estimates control for per capita grain production. Although there is no mention of measurement error in official regional grain production figures, we cautiously predict production using weather and natural conditions.[24] We use monthly temperature and precipitation data from Matsuura and Willmott (2014) together with province-level grain production for years prior to the establishment of the communist regime, 1901 to 1915, and weather data during the period of our study to predict weather-driven production.[25] Controlling for urban population share and its interaction with the famine accounts for the fact that Soviet food policies varied between urban and rural areas.[26]

Table 2 column (1) estimates the relationship between province grain production and subsequent mortality. If the famine was caused by local weather shocks and food shortages, the relationship between grain production and famine mortality should be negative (more food should lead to less deaths). However, inconsistent with the local weather shock explanation, the correlation between predicted grain production and famine mortality is positive, although not statistically significant.[27]

[23] We follow the recommendations by Colella, Lalive, Sakalli, and Thoenig (2019) in adjusting for spatial correlation within 1,500 kilometers (the mean province width in our sample is 1,300 km).

[24] Discussions about mismeasurement have focused exclusively on inflated official reports in aggregate production, which was one of public indicators of Soviet economic growth (Wheatcroft and Davies, 1994; Davies and Wheatcroft, 2004).

[25] See the Appendix Section C for a detailed discussion.

[26] We control for time-varying urbanization measured at the province and year level. The results are similar if we control for urbanization reported by the 1926 Census interacted with the famine dummy. They are available upon request.

[27] The correlation between famine mortality and official reports of grain production is positive and statistically signifi-

Column (2) is the baseline. The interaction of Ukrainian population share and the famine dummy is positive and statistically significant at the 1% level. Taken literally, column (2) implies that in a province that was 100% ethnic Ukrainian, famine mortality rate would have been higher than in a province with no ethnic Ukrainians by 51 per 1,000 individuals. To assess the magnitude of the result, note that one standard deviation in 1933 mortality rates in our sample is 0.013 and one standard deviation in Ukrainian population share is 0.216. Thus, during the famine, increasing Ukrainian population share by one standard deviation would result in a 0.825 standard deviation increase in mortality. This is a large effect.

The fact that we are controlling for weather-determined food production means that higher famine mortality in ethnic Ukrainian areas was not due to different weather conditions or food production across regions. Note that we can alternatively control for individual weather conditions instead of predicted grain. The interaction estimate of interest is very robust. See Appendix Table A.4.

In columns (3) and (4) of Table 2, we control for *dekulakization* and the depletion of livestock that resulted from collectivization and took place in the years just before the famine. The decline in the number of wealthy and productive peasants and livestock could have reduced production in a way that is not fully accounted for in our predicted grain measure. Moreover, the depletion of livestock meant that the traditional means of avoiding famine — slaughtering and eating the livestock — were unavailable to Soviet peasants. To examine the sensitivity of the interaction coefficient of interest, we control for the number of kulak households exiled from each region in 1930–31 divided by the 1930 population and the drop in per capita livestock between 1929 and July of 1931. Since these variables are time invariant, we control for their interactions with the famine indicator. The interaction of Ukrainian population share and the famine dummy variable in columns (3) and (4) are similar to the baseline.[28]

Column (5) replaces the province fixed effects in the baseline specification with an uninteracted Ukrainian population share variable. This allows us to observe the relationship between Ukrainian population share and mortality during non-famine years and to address the concern that province fixed effects over-control by absorbing relevant cross-sectional variation. The interaction coefficient is identical to the baseline in column (2), which implies that province fixed effects do not over-control in practice. Interestingly, the uninteracted Ukrainian coefficient is -0.007 and statistically significant at the 1% level. This means that in non-famine years, Ukrainian population share is *negatively* associated with mortality. It is only during the famine that mortality is *positively* associated with Ukrainian population share. The sum of the interaction coefficient and uninteracted coefficient presented at the bottom of the table is positive and statistically significant at the 1% level.

cant. For brevity and to be consistent through the paper, we do not present these results.

[28] Appendix Table A.5 presents estimates with alternative measures of the Soviet *dekulakization* campaign. We do not include *dekulakization* and the drop in livestock in our baseline controls. Since the famine and these variables are all outcomes of agricultural collectivization, including them in the baseline conceptually over-controls.

4.1.1 Dynamic Estimates

To observe the timing of differential mortality in and outside ethnic Ukrainian areas, we estimate an equation similar to the baseline, except that we interact Ukrainian population share (and all controls) with dummy variables for all years instead of only 1932. Each interaction coefficient is the difference in mortality rate in year $t + 1$ between regions with 100% Ukrainian population share and regions with zero Ukrainian population share relative to the mortality difference in the reference year, 1923. Figure 3a shows a sharp temporal pattern. Prior to the famine, Ukrainian population share was unassociated with mortality rates across regions. However, the correlation becomes positive in 1932 and peaks in 1933. This pattern is consistent with historical accounts of some starvation after the 1931 harvest, which then became a full-blown famine after the 1932 harvest. After 1933, regions with higher shares of Ukrainians had mortality rates similar to other regions.[29]

The sharp temporal pattern shows that higher Ukrainian mortality is specific to the famine. The dynamic estimates and their standard errors are presented in Appendix Table A.6.

4.2 Robustness

Alternative Measures of Ukrainian Population Share and Mortality Rates The baseline dependent variable is total mortality rate because this variable is available for a larger sample than rural or urban mortality rates.[30] The baseline uses rural Ukrainian population share as the explanatory variable because the famine was driven by agricultural policies targeted at the rural population. Table 3 examines the sensitivity of our estimates to alternative ways of measuring the left and the main right-hand side variables.

In Panel A, column (1) restates the baseline. Columns (2) and (3) replace total mortality with urban and rural mortality, respectively. The results confirm that higher famine mortality in regions with a larger share of ethnic Ukrainians was mostly a rural phenomenon. The estimate for urban mortality in column (2) is small in magnitude and statistically insignificant. The estimate in column (3) for rural mortality is large and statistically significant at the 1% level. Figure 3b presents the year-by-year estimates for rural mortality. As with total mortality, it shows a sharp increase in the association between rural mortality and Ukrainian population share during the famine years.

Columns (4) to (7) of Table 3 use different measures of our main independent variable. Our results are nearly identical if we use the total share of Ukrainians in column (4). In column (5), we use urban Ukrainian population share; the coefficient is positive, statistically significant and larger than the baseline. The increase in magnitude is mechanical because the share of urban Ukrainians

[29]The post-famine patterns could reflect the partial relaxation of the most extreme aspects of Soviet agricultural policies, and also positive selection for survival (e.g., if the weakest had perished during the famine, then the surviving population will have lower mortality rates than otherwise).

[30]Rural and urban mortality are available starting in 1926, while total mortality is available starting in 1923.

is smaller than the rural or total shares. The similarity of the standardized coefficients presented in italics in the table shows that the implied explanatory power of Ukrainian population on famine mortality is similar. Columns (6) and (7) use the share of people whose mother tongue is Ukrainian according to the 1926 and 1897 Population Censuses. The estimates are robust to these alternative measures. Henceforth, we use the 1926 rural Ukrainian population share as the explanatory variable.

Since the first signs of famine were documented after the 1931 harvest, we can alternatively define the famine dummy variable to be equal to one in 1931 and 1932. The interaction coefficient in column (8) is smaller in size, but still large, positive and statistically significant at the 1% level. The decrease in magnitude is due to there being less variation in mortality across regions in 1931 (recall Figure 2a).

Alternative Measures of Famine Severity We address the concerns that the mortality could be mismeasured by using natality as an alternative outcome variable. Live births typically decrease with the famine severity.[31] Figure 1b shows that the temporal and spatial patterns are similar to mortality. Average natality rates begin declining around 1928 and reach the lowest levels in 1933 and 1934. Note that national birth rates remained low in 1934, when mortality rates had already recovered. This is consistent with the fact that those who were starving were unable to become pregnant in 1933 and to give birth in 1934. The figure also plots the standard deviation of natality normalized by the mean over time. It shows that the variation increases dramatically during the famine.

Table 3 Panel B present the same specification as in Panel A with natality as the dependent variable. The estimates are all negative, mirroring those for mortality, and statistically significant at the 1% level.[32]

Demographic and Geographic Controls One may be concerned that young children are particularly vulnerable to famine, and higher mortality in ethnic Ukrainian areas may be due to differences in demographic composition across ethnic groups. Similarly, studies of famines have found that survival rates differ for men and women (Dyson and Ó Gráda, 2002; Mokyr and Ó Gráda, 2002). Table 4 column (2) controls for the population gender ratio and the share of individuals aged ten and younger (as reported by the 1926 Population Census), each interacted with the famine indicator. The Ukrainian interaction coefficient is 0.048 and is significant at the 1% level.

Our results are also robust to a large number of other demographic controls: e.g., the share of the elderly, etc. See Appendix Table A.7.

[31] Starvation is negatively associated with the probability of pregnancy (and marriage), and is positively associated with the probability of miscarrying and stillbirths (Dyson and Ó Gráda, 2002).

[32] Appendix Figures A.3a and A.3b plot the coefficients from the dynamic estimates. We see a decline in the interaction coefficients around and during the famine year. This means that Ukrainian population share was more negatively associated with the birth rates during the famine. See Appendix Table A.6 for the coefficients and standard errors.

To address the possibility that factors which can affect famine intensity such as social capital (e.g., Durante and Buggle, forthcoming) and Ukrainian population share may be correlated across provinces, column (3) controls for the triple interaction of latitude, longitude and the famine dummy and all lower-term interactions. With these controls, the interaction estimate of interest is similar to the baseline.

Omit Outliers and Specific Regions Next, we examine the sensitivity of the estimates to excluding outliers or particularly agriculturally productive regions. In column (4) and (5), we exclude Ukraine, where 75% of all Ukrainians in our sample reside, and three other regions where food production was particularly concentrated (Lower Volga, North Caucasus, and West Siberia). The estimate is similar to the baseline.[33]

We return to discuss column (6) later in the paper.

Other Controls It is possible that ethnic Ukrainian areas were wealthier or had higher levels of economic development and that the Soviet government targeted wealthier/more developed regions with its agricultural policies. Appendix Table A.8 controls for the interactions of various proxies of pre-Soviet regional wealth with the famine dummy variable. These proxies are the nominal regional income per capita in 1897, real regional income per capita in 1897, regional labor productivity in 1897, regional rural labor productivity in 1897 (upper and lower bound estimates) from Markevich (2019), the value of agricultural equipment in 1910, the number of horses in 1916, the number of cows in 1916 and livestock in 1916 (from Castañeda Dower and Markevich, 2018). Our estimate of the Ukrainian interaction coefficient is robust.

4.3 District-Level Analysis

The district-level panel consists of two years: 1928 and 1933. Almost all data are manually collected from former Soviet archives. Belarus is omitted because we were unable to collect 1928 mortality data for the republic. The increased granularity allows us to provide several additional pieces of evidence. First, these data allow us to examine the claim that there was a strong border effect and that the famine was notably more severe on the Ukrainian side of the border between Russia and Ukraine.[34] We define excess mortality as the difference between 1933 and 1928 mortality rates, and plot this excess mortality against the distance to the border between Ukraine and Russia.

Figure 4a shows that there is a jump downwards in mortality rates as one crosses the border from Ukraine to Russia. However, this jump disappears once we control for urbanization and the

[33] Note that the standardized coefficient is smaller in column (5). This is because the variation in Ukrainian population share declines with these omissions.

[34] The government introduced a ban on migration from Ukraine and from North Caucasus region in January 1933 (Danilov, Manning, and Viola, 1999–2006, Vol. 3). See, for example, Applebaum (2017) Chapters 10 and 11 for recollections of differences in famine intensity at the border.

rural population share of ethnic Ukrainians. This can be seen in Figure 4b, which plots the mortality residuals against distance to the border. These results imply that the Soviet policies which led to the famine targeted ethnic Ukrainians rather than Ukraine.

Second, the disaggregated data allow us to examine whether similar patterns exist across districts within provinces and across provinces. Soviet policies were centrally planned and implemented top-down by the bureaucracy. If collectivization or procurement targets were partly based on Ukrainian population share and implemented systematically, we would expect similar associations across smaller administrative units within the larger units as well as across the larger units. Table 5 column (1) replicates the baseline specification, where we include district and year fixed effects, with the exception that we also control for province-year fixed effects to isolate the within-province variation.[35] These interacted fixed effects isolate the within-province variation and control for factors that vary by province and year (e.g., regional political competition, leadership in specific provinces).[36] The results exhibit similar spatial patterns as the province-level estimates. This is consistent with the presence of a systematic and centrally planned policy.

Columns (2) to (10) show that the results are qualitatively similar when we subject the district-level estimates to the same sensitivity checks as the province-level estimates (to the extent that the data allow).

4.4 Alternative Explanations

This section discusses alternative explanations for higher famine mortality in ethnic Ukrainian areas that have arisen in the literature which do not require Soviet policy to have systematic bias against Ukrainians.

Weather Earlier studies have found that famine mortality was higher in regions that experienced bad weather (and therefore, lower harvests) (Davies and Wheatcroft, 2004; Rozenas and Zhukov, 2019).[37] Weather cannot be the driver of our findings because the baseline estimates control for contemporaneous per capita grain production as predicted by weather variables. In Appendix Table A.4, we replace the interaction of predicted grain production and the famine dummy with raw weather variables. The interaction of Ukrainian population share and the famine dummy variable is very robust.[38]

[35] Note that we use urbanization from 1926 and 1933 because urbanization at the district level is not available for 1928. We also use FAO GAEZ data base to construct a grain suitability index for each district because we cannot predict grain production at the district level.

[36] We estimate standard errors that are adjusted for spatial correlation. We follow the recommendations by Colella, Lalive, Sakalli, and Thoenig (2019) and adjust for spatial correlation within 400 kilometers (the mean district width in our sample is 76 km). Note that the distance of 400 km delivers the largest (most conservative) standard errors.

[37] Note that Rozenas and Zhukov (2019) argues that bad weather does not preclude the presence of bias against Ukrainians.

[38] See Appendix Section D for more details.

Inadequate Relief A common cause of famine mortality is inadequate relief. If harvests declined in some regions (because of pre-famine policies or natural factors) and the government did not deliver adequate relief, then a famine can occur. If lower production and inadequate relief were the sole causes of the famine, then famine mortality will be higher in regions that produced less food. Since our main estimates control for predicted per capita food production, this mechanism cannot explain our results for higher Ukrainian mortality. Moreover, Table 2 column (1) shows that the relationship between predicted per capita grain production and mortality is positive (though statistically insignificant) for both famine and non-famine years. This goes against the inadequate relief explanation.[39]

Central Planning Rigidities In the context of the Chinese Great Famine, Meng, Qian, and Yared (2015) provide evidence that a positive association between food productivity and famine mortality is a feature of the information rigidities in the centrally planned procurement system.[40] Since the design of the Chinese system was based on the Soviet one, similar patterns in the Soviet Famine would not be surprising. However, Table 2 column (2) shows that the positive interaction effect of grain and the famine year dummy on mortality is small in magnitude and statistically insignificant. The standardized coefficients for the Ukrainian interaction coefficient (0.825) is much larger than the one for the grain production interaction coefficient (0.017). These estimates imply that for the Soviet famine, Ukrainian bias dominates the problems of rigidity in central planning.

Culture, Social Capital, Informal Institutions, Historical Wealth Social capital can play an important role for surviving famines (Durante and Buggle, forthcoming). Thus, higher famine mortality in ethnic Ukrainian areas may be due to differences in social capital, other social norms or networks. To investigate this possibility, we study the 1892 famine, the last large famine in the Russian empire, using province-level mortality data from 1885 to 1913.[41] Table 4 column (6) estimates our baseline specification for this earlier famine and shows that 1892 famine mortality is not associated with Ukrainian population share. This shows that our main results are unlikely to be explained by slow-moving features of Ukrainian culture.

Another way to test the relevance of long-run cultural or institutional features of ethnic Ukrainian

[39] In fact, it goes against any "despite best intentions" explanations, since these predict higher mortality in regions that produce less food. For there to be no relationship, the government has to procure more food away from the productive regions so that mortality rates are unrelated to productivity. For example, consider the classical example of credit or insurance market failures. The argument is that harvest shocks lower the wages of peasants in stricken areas, so that they cannot buy food from those who produced surpluses. The lack of credit and insurance markets makes them unable to smooth food consumption during the shock and survive the famine. In these cases, mortality should always be higher in places that produce less food.

[40] They show that if there is a production drop that is proportional across regions, ambitious government procurement would have led to more over-procurement and famine in places that produced more food.

[41] We are grateful to Volha Charnysh for sharing 1885–1896 mortality and natality data from Charnysh and McElroy (2020).

communities is to control for these variables. We focus on institutions that would affect cooperative behavior, attitudes towards labor and property, and religion. One important historical institution in this context is the repartition commune. Living in one required a more cooperative behavior (than in a hereditary commune), and according to the 1905 Land Census, repartition communes were less widespread in Ukrainian-populated regions than in Russian-populated regions. If the values of cooperation were transmitted intergenerationally, this difference could contribute to the difference in mortality between the two ethnicities.

In addition, we control for other potentially important variables that could be correlated with cultural norms, institutional development and historical wealth: the share of serfs in 1858 (three years before the abolition of serfdom), the shares of Catholics and Orthodox Christians (the two major religion groups in Ukraine) from the 1897 Population Census, the land Gini estimated from the 1905 Land Census and peasant revolts per capita from 1895 to 1914. Appendix Table A.9 shows that our results are robust when we control for interactions of these variables with the famine dummy.[42]

4.5 Back-of-the-Envelope Calculation

We conduct a simple back-of-the-envelope calculation to understand what famine mortality would have been had there been no Ukrainian bias — i.e., if the interaction coefficient of Ukrainian population share and the famine dummy variable in equation (1) was zero. Using the estimates from equation (1) in Table 2 column (2), we predict that the number of deaths in non-famine years is on average 2.70 million, and in 1933 is 4.97 million.[43] The difference, 2.27 million ($4.97 - 2.70 = 2.27$ million) is the number of excess deaths due to the famine. If we assign the Ukrainian interaction coefficient to be zero, predicted deaths in 1933 would have been 3.22 million. The number of famine deaths without ethnic bias would have been the difference between this number and the number of deaths in non-famine years, 0.52 million ($3.22 - 2.70 = 0.52$ million). It follows that ethnic bias accounts for 77% ($1 - .52/2.27 = .77$) of famine deaths in our sample.[44]

To assess the plausibility of the back-of-the-envelope calculation, note that non-Ukrainian mortality rates in our sample are low. Although we lack data on ethnic-specific mortality, the large difference in mortality rates between ethnic Ukrainians and ethnic Russians is evident from comparing the mortality rates between Russia (where 78% are ethnic Russians) and Ukraine (where 80% are ethnic Ukrainians). For example, if we take total famine deaths to be seven million, and subtract the deaths in Kazakhstan (1 to 1.5 million) and Ukraine (2.6 to 3.9 million), we are left with approximately 1.6 to 3.4 million deaths for Russia (since there was little famine mortality in

[42] Note that early Soviet policies such as *dekulakization* could have significantly affected social norms. These differences are addressed earlier when we controlled for pre-famine Soviet policies.

[43] Note that this is close to 4.81 million 1933 deaths reported in our sample.

[44] See Appendix Table A.10.

other republics). This implies famine mortality rates of 14 to 30 per 1,000 for the 112 million residents of Russia. A similar calculation for Ukraine, which had a population of 32 million, yields a famine mortality rate of 81 to 122 per 1,000, which is around four to six times larger than the implied famine mortality rate in Russia. The large difference in mortality rates between the two republics suggests that total mortality should be much lower if ethnic Ukrainians died at the same rate as ethnic Russians.

We can repeat the exercise for Ukraine separately. We find that in Ukraine during non-famine years, predicted deaths are 0.52 million. Predicted deaths in 1933 are 2.03 million. The difference, 1.50 million ($2.03 - 0.52$ million, note that there is a small discrepancy due to rounding), is the number of excess deaths due to the famine. If we assign the Ukrainian interaction coefficient a value of zero, we predict deaths in 1933 to be 0.64 million. Famine excess deaths without ethnic bias would have been the difference between this number and mortality in non-famine years, 0.12 million ($0.64 - 0.52 = 0.12$). Thus, ethnic bias accounts for 92% ($1 - 0.12/1.50 = 0.92$) of famine excess deaths in Ukraine. Since approximately 80% of the population of Ukraine were ethnically Ukrainian, our estimates imply higher mortality rates for ethnic Ukrainians than other ethnicities (who were mostly Russians) in Ukraine.

These estimates should not be interpreted literally, but as illustrative of the importance of ethnic bias towards Ukrainians in explaining famine mortality.

5 Additional Results

This section provides additional descriptive facts that connect higher Ukrainian famine mortality to the political and economic motivations of the regime. It also connects these motivations to centrally planned policies known to have contributed to famine mortality.

5.1 Control over Grain Production

The most prominent political-economic explanation for the higher famine mortality in ethnic Ukrainian areas is the regime's need to control grain production. Since Ukrainians were the largest ethnic group in productive areas, had a stronger ethnic identity than other groups and were in sharp conflict with the Bolsheviks in 1917 and during the Civil war, the regime may have repressed Ukrainians more than other groups living in productive regions to overcome potentially stronger resistance (Graziosi, 2015). Consistent with this view is the earlier descriptive evidence that Ukrainian peasants resisted collectivization more than other peasants. To investigate the grain control hypothesis, we estimate the triple interaction of the importance of the region for grain production, the Ukrainian population share and the famine dummy variable on mortality. If the regime systematically repressed Ukrainians above and beyond other groups living in equally productive lands, the triple interaction effect should be positive.

As before, we measure a region's importance for grain production from the perspective of the central planners with official per capita grain production in 1928. Agriculturally productive regions were prioritized in collectivization efforts (e.g., Danilov, Manning, and Viola, 1999–2006).

We focus our discussion on the triple interaction estimates in Table 6 Panel B. For brevity, we do not discuss Panel A, which shows that the baseline estimates are robust to controlling for the additional double interaction terms.

In Panel B column (1), we estimate the triple interaction effect of 1928 grain production, Ukrainian population share and the famine dummy on mortality. To account for the possible correlation between urbanization and grain production, we also control for the triple interaction of urbanization, Ukrainian population share and famine dummy. For similar reasons, we add the triple interaction of predicted grain, Ukrainian population share and famine dummy. We control for all lower order interaction terms that are not absorbed by the fixed effects.

The triple interaction coefficient is positive and statistically significant at the 1% level. This means that during the famine, mortality in regions populated by Ukrainians was increasing in the amount of grain production. The double interaction coefficient of grain production in 1928 and the famine dummy is small and statistically insignificant. The precisely estimated zero implies that grain production does not increase famine mortality in regions with no Ukrainian population.

The double interaction coefficient of Ukrainian population share and the famine dummy is negative and statistically significant at the 1% level. We do not interpret the negative interaction of Ukrainian population share and the famine dummy literally since it is out-of-sample (i.e., there are no provinces with a large share of Ukrainians and zero grain production in 1928). However, the fact that the estimate is not positive implies that the disproportionally high famine mortality rates in regions populated by Ukrainians are specific to grain-producing areas.

The estimates in column (1) are consistent with the hypothesis that the regime repressed Ukrainians more than other ethnic groups living in agriculturally productive regions because of a stronger opposition of ethnic Ukrainians to the Bolshevik regime. The finding that grain production does not lead to higher famine mortality in regions without Ukrainians highlights the focus of the repression towards Ukrainians.

To examine the dynamic effects of the triple interaction, we estimate a similar specification except that we replace the famine dummy variable with year fixed effects. Figure 5a plots the triple interaction coefficients. The timing is very sharp. The triple interaction is zero in all years except during the famine, when it spikes up.[45]

Since we do not have 1928 grain output disaggregated by districts, we cannot replicate the specification from column (1) at the district level. Instead, we use the FAO GAEZ grain suitability index as a proxy for grain production potential of a district, and add the triple interaction of this measure with famine dummy and Ukrainian population share into the baseline for the district-level

[45]The triple interaction coefficients and their standard errors are presented in Appendix Table A.11.

estimates. The triple interaction coefficient in Panel B is positive and significant at the 1% level, and the lower order interactions are statistically zero. They are consistent with the province-level estimates.

5.2 Political Loyalty and State Capacity

The regime may also have had political motivations to repress Ukrainians during the famine (e.g., due to imagined or real fears of Ukrainian nationalist movement). To investigate this, we estimate the triple interaction effects of Ukrainian population share, the famine dummy variable, and proxies for regional political loyalty to the regime and state capacity on mortality. We examine three proxy variables (that are only available at the province level).

The first is the share of votes for the Bolshevik Party in the 1917 Constituency Assembly election.[46] This measure is a proxy for both political loyalty and state capacity as the Bolshevik regime recruited cadres for state and party apparatus from loyal population. Table 6 Panel B column (3) shows that the triple interaction effect is positive and statistically significant, which implies that Ukrainian famine mortality was increasing in political loyalty and state capacity. The double interaction coefficient of Ukrainian population share and the famine dummy variable is precisely zero, which implies that Ukrainians had similar famine mortality rates as other ethnic groups in provinces that were not loyal to the regime. The interaction coefficient of the Bolshevik vote share and the famine dummy is negative and statistically significant. This means that famine mortality was increasing with political loyalty and state capacity only in provinces with ethnic Ukrainians.[47]

The second proxy is the number of Communist Party Members (averaged over 1922, 1927 and 1931) per 1,000 individuals in each province. Party members were the key enforcers of state policy in the countryside and were responsible for grain procurement. The triple interaction coefficient is positive and statistically significant. The double interaction coefficient of the number of Party members and the famine dummy is a precise zero. Thus, in provinces with no Ukrainians, political loyalty and state capacity are unrelated to famine mortality. But the famine-mortality-Ukrainian-population-share gradient is increasing in political loyalty and state capacity. These results are consistent with the estimates for Bolshevik vote share.

The third proxy is the number of Party secretaries (at the province, district, city and, if the city was large, the borough level) who attended the 1930 Party Congress to vote formally for the policy of comprehensive collectivization. Since the Congress was a showcase of support for collectivization and all delegates voted in the affirmative, the number of voting delegates can be interpreted as a

[46]The 1917 election was a free and universal election, the first and only until the end of the Bolshevik rule. Approximately 60% of the eligible voters turned out to vote. We follow Castañeda Dower and Markevich (2021) and use disaggregated district-level data on votes for the Bolsheviks from Protasov, V.V. Zhuravlev, and Shelokhaev (2014). See the Data Appendix for details.

[47]The negative coefficient is also consistent with the fact that Stalin was known to reward group loyalty to the regime with better access to food for the group (Gregory, 2003, Ch. 4).

proxy for loyalty of the local elites to the regime or commitment to agricultural collectivization, as well as administrative capacity for implementing central policy.[48] We are able to identify the ethnicity of the delegates.[49] Thus, we can separately examine the triple interaction of the number of delegates according to whether they are ethnically Ukrainian or not. Panel B column (5) shows that both triple interaction coefficients are positive and statistically significant, but the coefficient is larger in magnitude for ethnically Ukrainian delegates. The difference between the two coefficients is almost statistically significant at the 15% level (the p-value for equality of the coefficients is 0.16 and shown at the bottom of the table).

These estimates imply that famine mortality in ethnic Ukrainian areas increased with the number of delegates regardless of the ethnicity of the latter. However, non-ethnic Ukrainian delegates had a larger effect on famine mortality in ethnic Ukrainian areas. These results are consistent with historical accounts of ethnic Ukrainian Party members opposing harsh state policies once the famine ensued (Kotkin, 2017). The double interaction coefficients are statistically zero.

The three proxy variables produce consistent results. The positive association between famine mortality and political loyalty and state capacity is increasing in Ukrainian population share. We observe no association between political loyalty and state capacity and famine mortality in regions without Ukrainians. As with the 1928 grain production analysis, this highlights the focus of the repression towards Ukrainians.

To parsimoniously capture the variation in the political proxies in one regression, we construct the principal component of these three proxy variables. The triple interaction effect of the principal component in Panel B column (6) is consistent with the estimates in columns (3) to (5).

To examine the dynamic effects of the triple interaction, we replace the famine dummy variable with year fixed effects. Figures 5b to 5f plot the dynamic triple interaction effects. The triple interaction estimates are zero in all years except during the famine, when it increases dramatically. The timing is sharp and shows that the effect manifests during the famine and is unlikely to be driven by spurious correlations.[50]

5.3 Grain versus Other Political Factors

The triple interaction estimates of 1928 grain production and the political proxy variables support the claim that the Soviet regime used the famine to systematically repress Ukrainians. The results are ostensibly consistent with the repression being a result of the regime's political-economic objectives

[48]The Sovietology literature (e.g., Frank, 1974) hypothesized that Party Congress delegates might be considered as a proxy for the importance or loyalty of a region. Recent archive-based studies on center-regional relations in the Soviet union do not usually challenge this interpretation (e.g., Khlevniuk and Gorlizki, 2020).

[49]Upon arriving to the Congress, each delegate had to fill a registration form which had a question on ethnicity, and these forms are available in the former Soviet archives. See the Data Appendix for exact references. There is insufficient variation to distinguish between non-Ukrainian ethnic minorities.

[50]The coefficients and their standard errors are presented in Appendix Table A.11.

(e.g., to control grain) as well as other political factors (e.g., to reduce the Ukrainian population for political reasons unrelated to controlling agriculture).

However, a closer examination of the evidence rules out the second hypothesis. First, we consider an indirect statistical test. If the famine was meant to reduce Ukrainians regardless of grain production, we should see higher famine mortality for ethnic Ukrainian areas everywhere. Yet, Table 6 Panel B columns (1) and (2) show that Ukrainian areas do not suffer higher famine mortality if they are not agriculturally productive.

Second, we conduct a direct horse race between the triple interaction of per capita grain production in 1928 and the first principal component of political proxies. If higher famine mortality in ethnic Ukrainian areas was driven by political motivations that are unrelated to grain, the triple interaction of political proxy will survive the horse race. Panel B column (7) presents the results. The triple interaction estimate of the political proxy is small in magnitude and statistically imprecise. In contrast, the triple interaction estimate of grain production is similar to column (1) in magnitude and remains statistically significant at the 1% level. These estimates go against the hypothesis that repression of Ukrainians was driven by political factors unrelated to grain. They are consistent with the main cause for repression being driven by the need to control grain production (or political factors highly correlated with 1928 grain production, but uncorrelated with the political proxy variables).[51]

5.4 Collectivization

This section connects the Ukrainian population share and regional importance to grain production to centrally planned policies known to have contributed to famine mortality: agricultural collectivization. Collectivization was the main Soviet economic policy for rural areas. It was supposed to increase procurement by strengthening state control over harvests, as well as boost production by increasing economies of scale and mechanization.

Table 7 Panel A documents the relationship between famine mortality and collectivization policies. We estimate the baseline, equation (1), with two departures. First, we replace the interaction of Ukrainian population share and the famine year dummy with the interaction of collectivization and the famine year dummy. Since collectivization varies over time, we also control for the uninteracted collectivization term. Second, analogous to Table 6 Panel A column (1), we control for

[51]The insights of Horowitz (1985) offer a complementary explanation to our preferred explanation that Ukrainian repression was a result of the regime's desire to control grain. Lacking precise information on the likelihood of subversion, the regime may have used Ukrainian population share, which we show to be more positively correlated with resistance against collectivization than other groups, as a crude marker on which it conditioned its policies. This is a complementary explanation for why we would find a positive triple interaction effect of grain production in 1928, Ukrainian population share and the famine dummy on mortality. However, Appendix Table A.12 shows a positive triple interaction effect of peasant resistance to collectivization prior to the famine, Ukrainian population share and the famine dummy on mortality. This implies that the policy-marker hypothesis is consistent with the data if the regime believes that observed resistance under-predicts future resistance for Ukrainians relative to other groups.

grain production in 1928 interacted with the famine dummy variable. We discuss this more when discussing the results for Panel B.

Columns (1) and (2) in Panel A examine two measures of collectivization: the share of households that belong to collective farms in column (1) and the cumulative sum of the annual rate of collectivization since 1927 in column (2). The interaction effects are positive in both cases. Thus, the intensity of collectivization is positively associated with famine mortality. At the district level, we have data on collectivization only for 1930.[52] In column (3), we adjust the specification accordingly and show that collectivization is positively associated with 1933 excess mortality rates across districts.

Columns (4) and (5) return to using the province-level panel. As we discussed earlier in the paper, collectivization is a bundle of policies. Amongst the policies that most directly contributed to low food availability in the year of the famine, we were able to obtain the most consistent data for food procurement.[53] Since food procurement is naturally higher in larger regions, we normalize grain procurement by production. Column (4) shows that the interaction effect of procurement and the famine dummy on mortality is unsurprisingly positive and statistically significant.

Column (5) examines tractor horsepower, a measure of mechanization. This is unrelated to mortality and we return to discuss the variable when we present the results in Panel B.

Panel B investigates whether these centrally planned policies were differentially implemented in regions with higher Ukrainian population shares. We estimate the baseline, equation (1), with the various aspects of collectivization as dependent variables. The only difference from the baseline is that we also control for grain production in 1928 interacted with famine, which distinguishes between the hypotheses that central planners targeted productive areas to collectivize versus that they targeted Ukrainian areas to collectivize. Columns (1) and (2) show that the interaction of Ukrainian population share and famine is positive for both collectivization measures. The estimates at the district level in column (3) are consistent. Column (4) shows that the interaction effect is positive for procurement. This means that during the famine, for two areas with the same degree of grain production as perceived by central planners in 1928, the one with a larger ethnic Ukrainian population share had been more intensively collectivized and suffered higher food procurement as a share of production.

Column (5) examines tractors, which were central to Soviet efforts to mechanize agriculture. Ukrainian communists had hoped that cooperation with the central authorities in Moscow would

[52] Collectivization is measured as the share of rural households in collective farms.

[53] Another direct contributor to food availability is regional production. But since the main results show higher famine mortality in ethnic Ukrainian areas while controlling for predicted production (see Table 2), regional production cannot play an important role in explaining higher famine mortality in ethnic Ukrainian areas.

In addition, collectivization reduced the traditional buffer savings of food, such as the backyard production of potatoes and the destruction of livestock, or deteriorated social networks by breaking traditional family/village units by forcing people to work in relatively artificial work teams and by removing family and friends who resisted collectivization. We do not have data to examine these potentially important channels.

help mechanize agriculture in Ukraine (Martin, 2001). Tractors were valuable commodities and centrally allocated by the highest levels of government (Lazarev and Gregory, 2003). Since tractors were allocated according to grain productivity as perceived by the central planner, we normalize the number by grain production in 1928. We find that the tractors are uncorrelated with mortality. We find that the estimates on tractors have the opposite sign as for mortality, collectivization and procurement. Central planners withheld tractors from areas with large Ukrainian populations.

Panel C examines the triple interaction of grain production in 1928, Ukrainian population share and the famine dummy on collectivization.[54] If higher Ukrainian famine mortality is driven by state policy, then the triple interaction effects on the intensity of collectivization and procurement should have the same signs as those shown earlier in Table 6 Panel B columns (1) and (2) for mortality. We find that this is true. Interestingly, we find that the triple interaction effect on tractor horsepower has the opposite sign. This is consistent with the state systematically withholding tractors from Ukrainians.

The number of observations is smaller for the estimates in Table 7 because of the limited availability of variables measuring collectivization and other aspects of Soviet agricultural policy. Thus, we do not provide year-by-year estimates for these outcomes.

To examine the extent to which Ukrainian bias in collectivization and procurement led to higher overall famine mortality, we instrument for the interaction of collectivization and the famine dummy variable with the interaction of Ukrainian population share and the famine year dummy variable. Table 8 Panel A shows that the instrumented effects of collectivization and procurement on mortality are positive and statistically significant. Panel B shows the first stage estimates. The first stage F-statistic presented at the bottom of the panel are mostly small. To address the problem of weak instruments, we present conditional instrumental variable confidence intervals at the bottom of the panel (Mikusheva and Poi, 2006; Mikusheva, 2010). The confidence intervals are all positive and do not include zero. Nevertheless, because Ukrainian bias can affect famine mortality through channels other than these policies, the 2SLS estimates should be interpreted as purely illustrative.[55]

6 Conclusion

The Soviet Great Famine was one of the largest and most controversial economic disasters in recent history. Within just two years, the ethnic Ukrainian population, the second largest ethnic group in the Soviet Union, was decimated. Between 1926 and 1939, Ukrainians declined from 21.3 to 16.5% of Soviet population. In grain-producing areas, it declined from 43.8 to 37.1%. To understand why

[54] As in the previous table, we also control for the lower order interactions, as well as on the triple interaction of urbanization, Ukrainian population share and famine dummy, and the triple interaction of predicted grain, Ukrainian population share and famine dummy.

[55] The total effect of Ukrainian bias on famine mortality is given by the back-of-the-envelope calculation in Section 4.5.

this happened, we construct a large new data set that allows us to distinguish between the hypotheses that have emerged in this controversial debate, and shed light on the underlying political-economic mechanisms.

Our findings show that higher Ukrainian famine mortality was due to state policy. That ethnic bias played such an important role is particularly interesting in the Soviet context because Bolshevik ideology did not contain an ethnic component. All ethnic groups were supposed to be treated equally.

It is beyond the scope of our empirical analysis to be conclusive about exactly why the regime repressed Ukrainians. However, the empirical results together with the historical facts form a coherent story. The problem stems from the regime's need to control agricultural production and the resistance from peasants towards its policies. In his letter to Sholokhov on May, 6 1933, Stalin claimed that peasants "sabotaged" his policy and accused them of engaging in a "silent war" against the Soviet state (Murin, 1997). As Graziosi (2015) explains, in Stalin's mind, the peasants required an "an unforgettable lesson".

Amongst the subversive peasants according to Stalin's view, ethnic Ukrainians were the most problematic. They were the largest ethnic group on agriculturally productive land, had a well-defined group identity, were relatively organized and had given stronger resistance to Soviet agricultural policy than other ethnic groups. Ukrainians had a history of conflict with the Bolsheviks going back to the Civil War. Thus, it is likely that the Soviets systematically repressed Ukrainians during the famine to strengthen their control over agriculture. This is an important avenue for future research.

Our study highlights two other subjects for future research. The first is to more fully understand the long-term ramifications of the famine in Eastern Europe. Recent studies have shown that the famine led to ethnic tensions between Ukrainians and Russians that affect current political (Rozenas and Zhukov, 2019) and economic outcomes in Ukraine (Korovkin and Makarin, 2019). There are likely many other effects that have not yet been documented. The second is to understand the Kazakh famine experience. Kazakhstan, where most ethnic Kazakhs lived at the time of the famine, may have lost up to 22% of its population to famine. We are unable to study this important event due to a lack of data.

References

ACEMOGLU, D., T. HASSAN, AND J. ROBINSON (2019): "Social Structure and Development: A Legacy of the Holocaust in Russia," *The Quarterly Journal of Economics*, 126, 895–946.

ADENA, M., R. ENIKOLOPOV, M. PETROVA, V. SANTAROSA, AND E. ZHURAVSKAYA (2015): "Radio and the Rise of The Nazis in Prewar Germany," *The Quarterly Journal of Economics*, 130(4), 1885–1939.

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

ANDREEV, E., L. DARSKIJ, AND T. KHARKOVA (1998): *Demographicheskaya Istroriya Rossii: 1927–1959*. Informatika, Moscow.

APPLEBAUM, A. (2017): *Red Famine: Stalin's War on Ukraine*. Penguin Press, New York.

BAUER, T. K., S. BRAUN, AND M. KVASNICKA (2013): "The Economic Integration of Forced Migrants: Evidence for Post-War Germany," *The Economic Journal*, 123(571), 998–1024.

BECKER, S. O., I. GROSFELD, P. GROSJEAN, N. VOIGTLANDER, AND E. ZHURAVSKAYA (2020): "Forced Migration and Human Capital: Evidence from Post-WWII Population Transfers," *American Economic Review*, 110(5), 1430–63.

BERELOWITCH, A., AND V. DANILOV (eds.) (2000–2012): *Les campagnes Soviétiques vues par la Tchéka–O.G.P.U.–N.K.V.D. 1918–1939. Recueil de documents et matériaux en 4 volumes. Sovetskaya derevnya glazami VChK–OGPU–NKVD. 1918–1939 gg. Dokumenty i materialy v 4 tomakh*. Rosspen, Moscow.

BUGGLE, J., AND S. NAFZIGER (2019): "The Long-Run Consequences of Labor Coercion: Evidence from Russian Serfdom," *The Review of Economics and Statistics*, 87, 217–234.

BURGESS, R., AND D. DONALDSON (2017): "Railroads and the Demise of Famine in Colonial India," Working paper, MIT.

CASELLI, F., AND W. J. COLEMAN II (2013): "On the Theory of Ethnic Conflict," *Journal of the European Economic Association*, 11(s1), 161–192.

CASTAÑEDA DOWER, P., E. FINKEL, S. GEHLBACH, AND S. NAFZIGER (2018): "Collective Action and Representation in Autocracies: Evidence from Russia's Great Reforms," *American Political Science Review*, 112(1), 125–47.

CASTAÑEDA DOWER, P., AND A. MARKEVICH (2018): "Labor Misallocation and Mass Mobilization: Russian Agriculture during the Great War," *The Review of Economics and Statistics*, 100(2), 245–59.

——— (2021): "Did Industrialization Increase Support for the Radical Left? Evidence from the 1917 Russian Revolution," *Working paper*.

CASTAÑEDA DOWER, P., A. MARKEVICH, AND S. WEBER (forthcoming): "The Value of a Statistical Life in a Dictatorship: Evidence From Stalin," *The European Economic Review*.

CHARNYSH, V., AND B. MCELROY (2020): "Explaining outgroup bias in weak states: religion and legibility in the 1891–92 Russian famine," project in progress.

CHEREMUKHIN, A., M. GOLOSOV, S. GURIEV, AND A. TSYVINSKI (2017): "The Industrialization and Economic Development of Russia through the Lens of a Neoclassical Growth Model," *The Review of Economic Studies*, 84(2), 613–649.

COLELLA, F., R. LALIVE, S. O. SAKALLI, AND M. THOENIG (2019): "Inference with Arbitrary Clustering," .

CONQUEST, R. (1986): *The Harvest of Sorrow: Soviet Collectivization and the Terror-Famine*. Oxford University Press, Oxford, UK.

DANILOV, V., R. MANNING, AND L. VIOLA (eds.) (1999–2006): *Tragediya Sovetskoj Derevni. Kollektivizatsiya i raskulachivanie. Dokumenti i materialy v 5 tomakh, 1927–1939*. Rosspen.

DASGUPTA, P., AND D. RAY (1986): "Inequality as a Determinant of Malnutrition and Unemployment: Theory," *The Economic Journal*, 96, 1011–1034.

DAVIES, R., M. HARRISON, AND S. WHEATCROFT (1994): *The Economic Transformation of the Soviet Union, 1913–1945*. Cambridge University Press.

DAVIES, R. W., O. V. KHLEVNIUK, E. A. REES, L. P. KOSHELEVA, AND L. A. ROGOVAYA (eds.) (2003): *The Stalin-Kaganovich Correspondence, 1931–36*. Yale University Press, New Haven.

DAVIES, R. W., AND S. G. WHEATCROFT (2004): *The Years of Hunger: Soviet Agriculture, 1931–1933*, vol. 5 of *The Industrialization of Soviet Russia*. Palgrave Macmillan, Basingstoke, UK.

DELLAVIGNA, S., R. ENIKOLOPOV, V. MIRONOVA, M. PETROVA, AND E. ZHURAVSKAYA (2014): "Cross-Border Media and Nationalism: Evidence from Serbian Radio in Croatia," *American Economic Journal: Applied Economics*, 6(3), 103–132.

DURANTE, R., AND J. BUGGLE (forthcoming): "Climatic Risk, Cooperation, and the Co-Evolution of Culture and Institutions," *Economic Journal*.

DYSON, T., AND C. Ó GRÁDA (eds.) (2002): *Famine Demography: Perspectives from the Past and Present*. Oxford University Press, Oxford, UK.

EGOROV, G., R. ENIKOLOPOV, A. MAKARIN, AND M. PETROVA (2020): "Divided We Stay Home: Social Distancing and Ethnic Diversity," NBER Working Papers 27277, National Bureau of Economic Research, Inc.

EGOROV, G., AND K. SONIN (2011): "Dictators and Their Viziers: Endogenizing the Loyalty-Competence Trade-off," *Journal of the European Economic Association*, 9(5), 903–930.

——— (2020): "The Political Economics of Non-democracy," *University of Chicago, Becker Friedman Institute for Economics Working Paper*, (2020-142).

ELLMAN, M. (2005): "The Role of Leadership Perceptions and of Intent in the Soviet Famine of 1931–1934," *Europe-Asia Studies*, 57(6), 823–841.

——— (2007): "Stalin and the Soviet famine of 1932–33 Revisited," *Europe-Asia Studies*, 59(4), 663–693.

ESTEBAN, J., M. MORELLI, AND D. ROHNER (2015): "Strategic Mass Killings," *Journal of Political Economy*, 123(5), 1087–1132.

FINKEL, E., AND S. GEHLBACH (2020): *Reform and Rebellion in Weak States*, Elements in Political Economy. Cambridge University Press.

FINKEL, E., S. GEHLBACH, AND D. KOFANOV (2017): "(Good) Land and Freedom (for Former Serfs): Determinants of Peasant Unrest in European Russia, March-October 1917," *Slavic Review*, 76(3), 710–721.

FRANK, P. (1974): "Constructing A Classified Ranking of Cpsu Provincial Committees," *British Journal of Political Science*, 4(2), 217–230.

GEHLBACH, S., K. SONIN, AND M. W. SVOLIK (2016): "Formal Models of Nondemocratic Politics," *Annual Review of Political Science*, 19(1), 565–584.

GOKMEN, G., AND D. KOFANOV (2020): "Career incentives in political hierarchy: evidence from Imperial Russia," *European Review of Economic History*, 24(2), 264–287.

GORODNICHENKO, Y., AND G. ROLAND (2017): "Culture, Institutions, and the Wealth of Nations," *The Review of Economics and Statistics*, 99(3), 402–416.

GRAZIOSI, A. (2015): "The uses of hunger Stalin's solution of the peasant and national questions in Soviet Ukraine, 1932 to 1933," in *Famines in European History. The Last Great European Famines Reconsidered*, ed. by L. L. Declan Curran, and A. G. Newby, pp. 223–260. Routledge.

GREGORY, P. (2003): *The Political Economy of Stalinism: Evidence from the Soviet Secret Archives*. Cambridge University Press.

GREGORY, P. R., P. J. SCHRÖDER, AND K. SONIN (2011): "Rational dictators and the killing of innocents: Data from Stalin's archives," *Journal of Comparative Economics*, 39(1), 34–42.

GROSFELD, I., A. RODNYANSKY, AND E. ZHURAVSKAYA (2013): "Persistent Antimarket Culture: A Legacy of the Pale of Settlement after the Holocaust," *American Economic Journal: Economic Policy*, 5(3), 189–226.

GROSFELD, I., S. O. SAKALLI, AND E. ZHURAVSKAYA (2020): "Middleman Minorities and Ethnic Violence: Anti-Jewish Pogroms in the Russian Empire," *The Review of Economic Studies*, 87(1), 289–342.

HOROWITZ, D. L. (1985): *Ethnic groups in conflict*. University of California Press, Berkeley.

KESSLER, G. (2002): *The Peasant and the Town. Rural-Urban Migration in the Soviet Union, 1929–40*. PhD Thesis. European University Institute.

KHLEVNIUK, O., AND Y. GORLIZKI (2020): *Substate Dictatorship: Networks, Loyalty, and Institutional Change in the Soviet Union*. Yale University Press, New Haven.

KONDRASHIN, V. (2008): *Golod 1932–1933 godov: Tragediya Sovetskoj derevni*. Rosspen, Moscow.

KOROVKIN, V., AND A. MAKARIN (2019): "Conflict and Inter-Group Trade: Evidence from the 2014 Russia-Ukraine Crisis," *EIEF Working paper*.

KOTKIN, S. (2017): *Stalin. Waiting for Hitler, 1929–1941*. Penguin Press, New York.

LAZAREV, V., AND P. GREGORY (2003): "Commissars and cars: A case study in the political economy of dictatorship," *Journal of Comparative Economics*, 31(1), 1–19.

LI, W., AND D. T. YANG (2005): "The Great Leap Forward: Anatomy of a Central Planning Disaster," *Journal of Political Economy*, 113(4), 840–877.

LOSITSKIJ, A. (1920): "Pishchevoe znachenie sovremennikh produktov pitaniya [Nutritive value of modern food products]," *Vestnik statistiki*, 1920(1–4), 102–121.

——— (1926): *Sostoyanie pitaniya gorodskogo naseleniya SSSR, 1919–1924 [The State of Nutrition of Urban Population of the USSR, 1919–1924]*. TsSU.

——— (ed.) (1928): *Sostoyanie pitaniya selskogo naseleniya SSSR v 1920–1924 [The State of Nutrition of Rural Population of the USSR in 1920–1924]*. TsSU.

MACE, J. E. (2004): "Soviet Man-Made Famine in Ukraine," in *Century of Genocide: Critical Essays and Eyewitness Accounts.*, ed. by W. S. P. Totten Samuel, and I. W. Charny. Routledge.

MARKEVICH, A. (2019): "A Regional Perspective on the Economic Development of the late Russian Empire," *Working paper*.

MARKEVICH, A., AND E. ZHURAVSKAYA (2018): "The Economic Effects of the Abolition of Serfdom: Evidence from the Russian Empire," *American Economic Review*, 108(4–5), 1074–1117.

MARTIN, T. (2001): *The Affirmative Action Empire: Nations and Nationalism in the Soviet Union, 1923–1939*. Cornell University Press.

MATSUURA, K., AND C. WILLMOTT (2014): "Terrestrial Air Temperature and Precipitation: 1900–2014 Gridded Monthly Time Series (Version 4.01)," *National Oceanic and Atmospheric Administration*.

MENG, X., N. QIAN, AND P. YARED (2015): "The Institutional Causes of China's Great Famine, 1959–1961," *The Review of Economic Studies*, 82(4), 1568–1611.

MESLÉ, F., J. VALLIN, AND E. ANDREEV (2013): "Demographic Consequences of the Great Famine: Then and Now," in *After the Holodomor: The Enduring Impact of the Great Famine on Ukraine*, ed. by A. Graziosi, L. A. Hajda, and H. Hryn. Harvard University Press.

MIKUSHEVA, A. (2010): "Robust confidence sets in the presence of weak instruments," *Journal of Econometrics*, 157(2), 236–247.

MIKUSHEVA, A., AND B. P. POI (2006): "Tests and Confidence Sets with Correct Size when Instruments are Potentially Weak," *The Stata Journal*, 6(3), 335–347.

MITRA, A., AND D. RAY (2014): "Implications of an Economic Theory of Conflict: Hindu-Muslim Violence in India," *Journal of Political Economy*, 122(4), 719–765.

MOKYR, J., AND C. Ó GRÁDA (2002): "What do people die of during famines: the Great Irish Famine in comparative perspective," *European Review of Economic History*, 6(3), 339–363.

MURIN, Y. (ed.) (1997): *Pisatel' i vozhd': perepiska M.A. Sholokhova s I.V. Stalinym 1931–1950 gody : sbornik dokumentov iz lichnogo arkhiva I.V. Stalina*. Raritet.

NAUMENKO, N. (2021): "The Political Economy of Famine: the Ukrainian Famine of 1933," *The Journal of Economic History*, 81(1), 156–197.

NOVE, A. (1992): *An Economic History of the U.S.S.R*. The Penguin Press.

Ó GRÁDA, C. (1999): *Black '47 and Beyond: The Great Irish Famine in History, Economy, and Memory*. Princeton University Press, Princeton, NJ.

——— (2009): *Famine: A Short History*. Princeton University Press, Princeton, NJ.

POLYAKOV, Y., AND V. ZHIROMSKAYA (eds.) (2000): *Naselenie Rossii v XX veke: istoricheskie ocherky. Vol. 1 1900–1939*. Rosspen.

PROTASOV, L., A. R. V.V. ZHURAVLEV, AND V. SHELOKHAEV (2014): *Vserossijskoe uchreditelnoe sobranie. Entsiklopedia. (All-Russian Constitutional Assembly. Encyclopedia)*. Rosspen, Moscow.

ROLAND, G. (2010): "The Long-Run Weight of Communism or the Weight of Long-Run History?," WIDER Working Paper Series wp-2010-083, World Institute for Development Economic Research (UNU-WIDER).

ROZENAS, A., AND Y. M. ZHUKOV (2019): "Mass Repression and Political Loyalty: Evidence from Stalin's 'Terror by Hunger'," *American Political Science Review*, 113(2), 569–583.

RUDNYTSKYI, O., N. LEVCHUK, O. WOLOWYNA, P. SHEVCHUK, AND A. KOVBASIUK (2015): "Demography of a man-made human catastrophe: The case of massive famine in Ukraine 1932–1933," *Canadian Studies in Population*, 42(1–2), 53–80.

SEN, A. (1981): *Poverty and Famines. An Essay on Entitlement and Deprivation*. Oxford University Press, Oxford, UK.

SNYDER, T. (2010): *Bloodlands: Europe Between Hitler and Stalin*. Basic Books, New York City, NY.

STALIN, I. (15 April 1925): "Concerning the National Question in Yugoslavia," *Bol'shevik*, 7.

STATE DUMA (2008): "Russian: Postanovleniye GD FS RF ot 02.04.2008 N 262-5 GD O Zayavlenii Gosudarstvennoy Dumy Federal'nogo Sobraniya Rossiyskoy Federatsii "Pamyati zhertv goloda 30-kh godov na territorii SSSR"," .

TALIBOVA, R., AND Y. M. ZHUKOV (2018): "Stalin's terror and the long-term political effects of mass repression," *Journal of Peace Research*, 55(2), 267–283.

TAUGER, M. (2001): "Natural Disaster and Human Actions in the Soviet Famine of 1931–1933," *The Carl Beck Papers in Russian and East European Studies*.

TAUGER, M. B. (1991): "The 1932 Harvest and the Famine of 1933," *Slavic Review*, 50(1), 70–89.

UKRAINIAN PARLIAMENT (2006): "About 1932-33 Holodomor in Ukraini," *Vedomosti Verkhovnoj radi Ukraini*, 50(504).

VIOLA, L. (1996): *Peasant Rebels Under Stalin: Collectivization and the Culture of Peasant Resistance*. Oxford University Press, Oxford, UK.

——— (2007): *The Unknown Gulag: The Lost World of Stalin's Special Settlements*. Oxford University Press, Oxford.

WHEATCROFT, S., AND R. DAVIES (1994): "Agriculture," in *The Economic Transformation of the Soviet Union, 1913–1945*, ed. by R. Davies, M. Harrison, and S. Wheatcroft. Cambridge University Press.

WHEATCROFT, S. G. (2001): "O zernovikh balansakh i otsenkakh urozhajnosti v SSSR v 1931–1933," in *Tragediya Sovetskoj Derevni. Kollektivizatsiya i raskulachivanie. Dokumenti i materialy v 5 tomakh, 1927–1939. Vol. 3. Konetz 1930–1933*, ed. by V. Danilov, R. Manning, and L. Viola. Rosspen.

Table 1: Ethnic Composition and Peasant Resistance

	Dependent Variable: Peasant Resistance					
	(1)	(2)	(3)	(4)	(5)	(6)
Ukrainians	0.065		-0.841***	0.007		-0.923***
	(0.213)		(0.231)	(0.153)		(0.263)
Collectivization		0.490**	0.795***		0.276	0.562**
		(0.183)	(0.189)		(0.203)	(0.207)
Ukrainians × Collectivization			0.788***			0.992***
			(0.261)			(0.311)
Urbanization	-0.358*	-0.378*	-0.473**	-0.143	-0.223	-0.310*
	(0.190)	(0.179)	(0.184)	(0.166)	(0.180)	(0.173)
Grain 1928				0.563**	0.382	0.446**
				(0.229)	(0.225)	(0.189)
Constant	0.000	0.000	-0.338	0.000	0.000	-0.425*
	(0.226)	(0.193)	(0.238)	(0.195)	(0.187)	(0.222)
Observations	19	19	19	19	19	19
R-squared	0.134	0.369	0.471	0.400	0.448	0.567

Notes: Observations are at the province level. This table reports standardized coefficients. The dependent variable and the uninteracted explanatory variables are normalized to have mean equal to zero and standard deviation equal to one. The dependent variable is the first principal component of three variables measured during January 1931 to March 1932 per 1,000 people: i) # violent acts against government officials; ii) # mass demonstrations; and iii) # episodes of anti-government leaflets being distributed among the population. The explanatory variables are the 1926 Ukrainian population share, the 1931–32 average share of households in collective farms, the interaction of these two variables, the 1931–32 average urbanization rate, and the 1928 grain production per capita. Huber-White robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 2: Famine Mortality in Ethnic Ukrainian Areas

	Dependent Variable: Mortality in Year t+1				
		Baseline			Omit Province FE
	(1)	(2)	(3)	(4)	(5)
Ukrainians × Famine [1]		0.051***	0.053***	0.053***	0.051***
		(0.006)	(0.005)	(0.005)	(0.005)
Standardized Coef.		*0.825*	*0.869*	*0.857*	*0.831*
Ukrainians [2]					-0.007***
					(0.002)
Grain	0.001	0.003*	0.003	0.003*	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)
Grain × Famine	0.079	0.003	-0.027	-0.014	-0.002
	(0.061)	(0.030)	(0.035)	(0.030)	(0.027)
Standardized Coef.	*0.416*	*0.017*	*-0.140*	*-0.073*	*-0.009*
Pre-famine Exiled Kulak HHs × Famine			1.771		
			(1.371)		
Pre-famine Drop in Livestock x Famine				0.016	
				(0.015)	
Controls:					
Province FE	Y	Y	Y	Y	N
Year FE	Y	Y	Y	Y	Y
Urbanization, Urbanization × Famine	Y	Y	Y	Y	Y
Observations	337	337	337	337	337
R-squared	0.658	0.785	0.799	0.792	0.433
[1] + [2]: Coef					0.044
p-val					<0.001

Notes: Observations are at the province and year level. Mortality is the number of deaths divided by the total population. Ukrainians is the share of ethnic Ukrainians in the rural population. Famine is an indicator that equals one in 1932 and zero otherwise. Grain production per capita is predicted by weather conditions and measured in 10s of kilograms per person per day. Column (3) controls for the number of kulak households exiled during 1930–31 per 1930 population interacted with the famine indicator. Column (4) controls for the drop in livestock (horses and cattle) per capita between 1929 and 1931. The standard errors in parentheses are adjusted for spatial correlation within 1,500 km. *** p<0.01, ** p<0.05, * p<0.1

Table 3: Famine Mortality and Natality in Ethnic Ukrainian Areas – Alternative Measures

	Baseline (1)	Urban Mortality/ Natality (2)	Rural Mortality/ Natality (3)	Total Ukrainians (4)	Urban Ukrainians (5)	Mother Tongue Ukrainian 1926 (6)	Mother Tongue Ukrainian 1897 (7)	Famine = 1931, 32 (8)
	A. Dependent Variable: Mortality in Year t+1							
Ukrainians × Famine	0.051***	0.013	0.063***	0.055***	0.090***	0.056***	0.058***	0.032***
	(0.006)	(0.008)	(0.005)	(0.006)	(0.010)	(0.007)	(0.007)	(0.004)
Standardized Coef.	*0.825*	*0.249*	*0.870*	*0.819*	*0.785*	*0.747*	*0.820*	*0.521*
Observations	337	285	285	337	337	337	337	337
R-squared	0.785	0.746	0.792	0.784	0.780	0.773	0.789	0.737
	B. Dependent Variable: Natality in Year t+1							
Ukrainians × Famine	-0.014***	-0.002***	-0.012***	-0.015***	-0.025***	-0.015***	-0.016***	-0.010***
	(0.003)	(0.0005)	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)	(0.002)
Standardized Coef.	*-0.432*	*-0.149*	*-0.347*	*-0.429*	*-0.409*	*-0.380*	*-0.425*	*-0.317*
Observations	337	285	285	337	337	337	337	337
R-squared	0.835	0.924	0.909	0.835	0.835	0.834	0.835	0.836
Ukrainians								
Mean	0.104	0.104	0.104	0.095	0.055	0.074	0.085	0.104
Std. Dev.	0.216	0.216	0.216	0.197	0.116	0.178	0.188	0.216

Notes: Observations are at the province and year level. The dependent variables are the number of deaths (Panel A) and the number of live births (Panel B) divided by the total population except in columns (2) and (3) (see column headings). Ukrainian population share is the share of self-reported ethnic Ukrainians in the rural population except in columns (4)–(7) (see column headings). In columns (6) and (7), Ukrainian population share is the share of people in the total population whose mother tongue is Ukrainian (see column headings). Famine is an indicator that equals one in 1932 and zero otherwise except in column (8) (see column heading). All regressions control for urbanization, urbanization × famine, predicted grain, predicted grain × famine, and province and year fixed effects. The standard errors in parentheses are adjusted for spatial correlation within 1,500 km. *** p<0.01, ** p<0.05, * p<0.1

Table 4: Famine Mortality and Natality in Ethnic Ukrainian Areas – Control for Demographic and Geographic Characteristics, Omitting Influential Observations

	Baseline (1)	Control for Demographic Structure × Famine (2)	Control for Latitude × Longitude × Famine (3)	Omit Ukraine (4)	Omit Ukraine, Lower Volga, North Caucasus, West Siberia (5)	1892 Famine (Mortality and Natality × 10) (6)
	A. Dependent Variable: Mortality in Year t+1					
Ukrainians × Famine	0.051***	0.048***	0.060***	0.086***	0.058***	-0.002
	(0.006)	(0.007)	(0.004)	(0.007)	(0.006)	(0.028)
Standardized Coef.	*0.825*	*0.786*	*0.971*	*0.839*	*0.405*	*-0.004*
Observations	337	337	337	319	268	1,297
R-squared	0.785	0.791	0.814	0.767	0.815	0.864
	B. Dependent Variable: Natality in Year t+1					
Ukrainians × Famine	-0.014***	-0.015***	-0.013***	-0.030***	-0.032***	0.036**
	(0.003)	(0.005)	(0.002)	(0.003)	(0.009)	(0.015)
Standardized Coef.	*-0.432*	*-0.457*	*-0.406*	*-0.519*	*-0.273*	*0.102*
Observations	337	337	337	319	268	1,297
R-squared	0.835	0.835	0.837	0.83	0.832	0.934
Ukrainians						
Mean	0.104	0.104	0.104	0.061	0.028	0.172
Std. Dev.	0.216	0.216	0.216	0.113	0.048	0.299

Notes: Observations are at the province and year level. All regressions control for urbanization, urbanization × famine, predicted grain, predicted grain × famine, and province and year fixed effects. Column (2) also controls for the share of people ages 10 and younger and the male/female ratio, each interacted with the famine indicator. Column (3) also controls for latitude × longitude × famine and all lower-order interactions. Column (4) omits Ukraine. Column (5) additionally omits the provinces of Lower Volga, North Caucasus and West Siberia. The standard errors in parentheses are adjusted for spatial correlation within 1,500 km. *** p<0.01, ** p<0.05, * p<0.1

Table 5: Famine Mortality in Ethnic Ukrainian Areas – District-level Analysis

	Dependent Variable: Mortality									
		I. Alternative Measures of Mortality		II. Alternative Measures of Ukrainian Population Share			III. Additional Robustness			
	Baseline with Province-Year FE	Urban Mortality	Rural Mortality	Total Ukrainians	Urban Ukrainians	Mother Tongue Ukrainian	Control for gender ratio	Control for Latitude × Longitude × Famine	Omit Ukraine	Omit Ukraine, Lower Volga, North Caucasus, West Siberia
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ukrainians × Famine	0.039***	0.008	0.029***	0.044***	0.043***	0.047***	0.040***	0.040***	0.022***	0.027***
	(0.010)	(0.006)	(0.007)	(0.011)	(0.008)	(0.010)	(0.010)	(0.009)	(0.007)	(0.010)
Standardized Coef.	*0.509*	*0.154*	*0.354*	*0.547*	*0.438*	*0.595*	*0.509*	*0.512*	*0.192*	*0.234*
Observations	3,376	1,698	2,915	3,376	2,002	3,366	3,376	3,376	2,600	2,098
R-squared	0.765	0.898	0.899	0.769	0.786	0.772	0.765	0.769	0.730	0.684
Mortality 1933										
Mean	0.039	0.032	0.039	0.039	0.039	0.039	0.039	0.039	0.031	0.027
Std. Dev.	0.029	0.019	0.030	0.029	0.029	0.029	0.029	0.029	0.020	0.014
Ukrainians										
Mean	0.248	0.248	0.248	0.237	0.223	0.229	0.248	0.248	0.069	0.035
Std. Dev.	0.370	0.370	0.370	0.355	0.293	0.364	0.370	0.370	0.168	0.122

Notes: Observations are at the district and year level. Mortality is the number of deaths divided by total population unless otherwise stated in the column headings. Ukrainians is the share of ethnic Ukrainians in the rural population unless if otherwise stated in the column headings. All regressions control for urbanization, urbanization × famine, grain suitability × famine, and district and province-year fixed effects. Column (7) also controls for the male/female ratio × famine. Column (8) also controls for latitude × longitude × famine and all lower-order interactions. Column (9) omits Ukraine from the sample. Column (10) omits Ukraine and the provinces of Lower Volga, North Caucasus and West Siberia. Grain suitability is the FAO GAEZ wheat suitability index for low-input rain-fed agriculture. The standard errors in parentheses are adjusted for spatial correlation within 400 km. *** p<0.01, ** p<0.05, * p<0.1

Table 6: Heterogeneous Effects of Political Factors on Famine Mortality in Ethnic Ukrainian Areas

	Dependent Variable: Mortality in Year t+1[+]						
	I. Grain		II. Political Loyalty and State Capacity				III. Horse race
	X1 = Grain 1928 (1)	X1 = Grain suitability ([+]Dependent Variable is Mortality, District-Level Panel) (2)	X1 = Bolshevik Votes 1917 (3)	X1 = Communist Party Members 1922, 27, 31 (4)	X1 (X2) = Ethnic Ukrainian (non-Ukrainian) Delegates in 1930 Congress (5)	X1 = Loyalty Principal Component (6)	X1 (X2) = Grain 1928 (Loyalty PC) (7)
	A. Ukrainian Population Share and Famine Mortality						
Ukrainians × Famine	0.055***	0.039***	0.050***	0.051***	0.050***	0.051***	0.055***
	(0.006)	(0.010)	(0.006)	(0.005)	(0.016)	(0.006)	(0.006)
X1 (Col Heading) × Famine	0.092*	0.022***	-0.013**	-0.0001	0.030	0.001	0.091*
	(0.047)	(0.009)	(0.005)	(0.001)	(0.169)	(0.002)	(0.048)
X2 (Col Heading) × Famine					0.033*		0.001
					(0.018)		(0.002)
Observations	337	3,376	337	337	337	337	337
R-squared	0.806	0.765	0.789	0.785	0.792	0.785	0.807
	B. Ukrainian Population Share, Regional Political and Economic Importance, and Famine Mortality						
Ukr × X1 (Col Heading) × Famine [1]	2.974***	0.071***	1.038***	0.043***	1.802***	0.128***	2.640***
	(0.519)	(0.022)	(0.390)	(0.013)	(0.542)	(0.030)	(0.822)
Ukr × X2 (Col Heading) × Famine [2]					2.229***		0.020
					(0.336)		(0.029)
Ukrainians × Famine	-0.172***	-0.011	0.002	0.259**	-0.035	0.512***	-0.073
	(0.036)	(0.017)	(0.025)	(0.106)	(0.033)	(0.137)	(0.163)
X1 (Col Heading) × Famine	0.003	0.004	-0.023***	-0.001	0.331	-0.001	0.007
	(0.018)	(0.005)	(0.008)	(0.001)	(0.223)	(0.001)	(0.017)
X2 (Col Heading) × Famine					-0.024		-0.001
					(0.021)		(0.001)
Observations	337	3,376	337	337	337	337	337
R-squared	0.852	0.783	0.821	0.823	0.855	0.838	0.852
[1] - [2]: p-value					0.161		0.002

Notes: Observations are at the province and year level, except for column (2), which is at the district and year level. [+]In column (2), the dependent variable is mortality in year t. The double and triple interaction explanatory variables, X1 and X2, are stated in the column headings. In Panel A, the regressions control for urbanization, urbanization × famine, predicted grain, predicted grain × famine, and province and year fixed effects. Panel B also controls for ukrainians × urbanization × famine, ukrainians × predicted grain × famine and their lower-order interactions; and province and year fixed effects. Panel A column (2) controls for urbanization, urbanization × famine, and district and province-year fixed effects. Panel B also controls for ukrainians × urbanization × famine and all lower-order interactions; and district and province-year fixed effects. The standard errors in parentheses are adjusted for spatial correlation within 1,500 km (columns 1 and 3–7) or within 400 km (column 2). *** p<0.01, ** p<0.05, * p<0.1

Table 7: Heterogeneous Effects of Political Factors on Collectivization, Mechanization and Grain Procurement in Ethnic Ukrainian Areas

	X = Share of Rural HHs in Collective Farms (1)	X = Cumulative Sum of Collectivization Rate Since 1927 (2)	X = Share of Rural HHs in Collective Farms in 1930 (District-Level Cross-Section)$^{++}$ (3)	X = Procurement Share (4)	X = Mechanization (Tractors' Horse Power/Grain 1928) (5)
	A. Dependent Variable: Mortality in Year t+1 (1933 Excess Mortality in Column 3)				
X (column heading) × Famine	0.057***	0.022***		0.106***	0.005
	(0.016)	(0.004)		(0.031)	(0.004)
X (column heading)	0.004	-0.001*	0.022**	-0.001	0.000
	(0.003)	(0.0004)	(0.009)	(0.004)	(0.0003)
Grain 1928 × Famine	-0.037	-0.042	0.025***	-0.186***	0.041
	(0.043)	(0.030)	(0.008)	(0.070)	(0.034)
Observations	228	228	1,491	184	247
R-squared	0.729	0.764	0.488	0.749	0.672
	B. Dependent Variable: Collectivization Policy X (column heading)				
Ukrainians × Famine	0.107**	0.363**	0.268***	0.056***	-0.743**
	(0.048)	(0.166)	(0.092)	(0.020)	(0.358)
Grain 1928 × Famine	1.048**	1.466***	0.055	0.899***	-1.513
	(0.496)	(0.263)	(0.076)	(0.190)	(6.336)
Observations	228	228	1,491	186	247
R-squared	0.968	0.985	0.481	0.879	0.873
	C. Dependent Variable: Collectivization Policy X (column heading)				
Ukrainians × Grain 1928 × Famine	13.293***	17.067***	0.374*	10.508***	-352.084***
	(4.759)	(5.466)	(0.191)	(3.280)	(56.273)
Ukrainians × Famine	-0.792*	-3.791***	-0.025	-0.244	21.536***
	(0.445)	(0.582)	(0.180)	(0.258)	(4.887)
Grain 1928 × Famine	0.619	1.092***	-0.050	0.614***	8.678
	(0.457)	(0.381)	(0.043)	(0.171)	(6.460)
Observations	228	228	1,491	186	247
R-squared	0.968	0.986	0.492	0.883	0.875
Sample Mean of X	0.532	2.271	0.233	0.173	3.417
Sample Mean of X in 1932	0.594	1.375		0.243	1.245

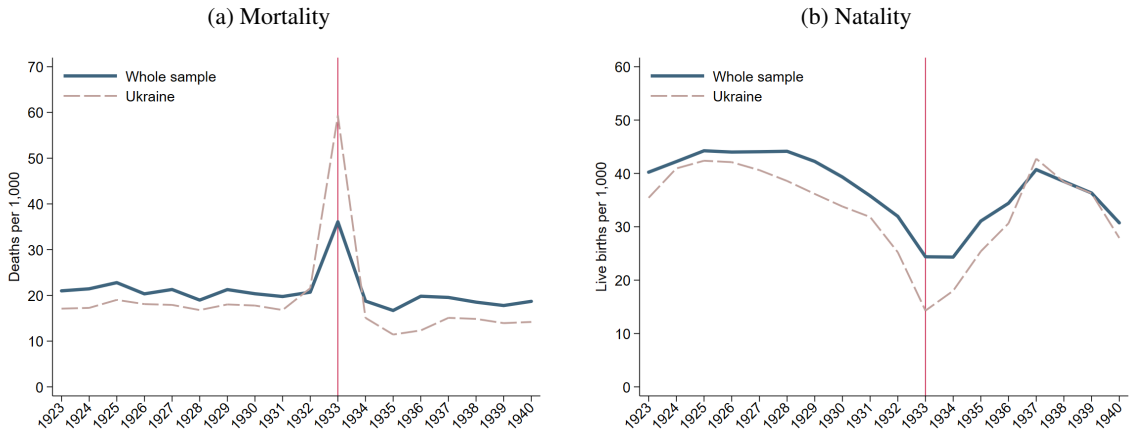
Notes: Observations are at the province and year level, except for column (3), which is at the district level. In Panels A and B, the regressions control for urbanization, urbanization × famine, predicted grain, predicted grain × famine, and province and year fixed effects. Panel C also controls for ukrainians × urbanization × famine, ukrainians × predicted grain × famine and their lower-order interactions; and province and year fixed effects. $^{++}$Column (3) uses a cross-section of districts. Panels A–B control for urbanization, grain suitability and province fixed effects. Panel D also controls for ukrainians × urbanization, urbanization, and province fixed effects. The standard errors in parentheses are adjusted for spatial correlation within 1,500 km (columns 1–2 and 4–5) or within 400 km (column 3). *** p<0.01, ** p<0.05, * p<0.1 *** p<0.01, ** p<0.05, * p<0.1

Table 8: 2SLS Estimates of the Effects of Collectivization on Famine Mortality

	X = Share of Rural HHs in Collective Farms (1)	X = Cumulative Sum of Collectivization Rate Since 1927 (2)	X = Share of Rural HHs in Collective Farms in 1930 (District-Level Cross-Section)$^{++}$ (3)	X = Procurement Share (4)
	A. 2SLS – Dependent Variable: Mortality in Year t+1			
X × Famine	0.280***	0.055***		0.254***
	(0.090)	(0.018)		(0.051)
X	-0.031**	-0.002***	0.147**	-0.014**
	(0.014)	(0.001)	(0.070)	(0.006)
Grain 1928 × Famine	-0.286*	-0.169**	0.019*	-0.483***
	(0.153)	(0.083)	(0.010)	(0.089)
Observations	228	228	1,491	184
X × Famine Cond IV CI	[0.200, 0.468]	[0.044, 0.073]	[0.110, 0.196]	[0.200, 0.334]
	B. First Stage – Dependent Variable: X × Famine			
Ukrainians × Famine	0.192***	0.999**	0.268***	0.211***
	(0.075)	(0.414)	(0.092)	(0.059)
Grain 1928 × Famine	1.301**	4.693***	0.055	2.232***
	(0.562)	(1.323)	(0.076)	(0.304)
X	0.145***	0.027***		0.072***
	(0.052)	(0.008)		(0.021)
Kleibergen-Paap rk Wald F statistic	6.171	5.426	8.440	11.719
Observations	228	228	1,491	184
R-squared	0.972	0.951	0.481	0.958

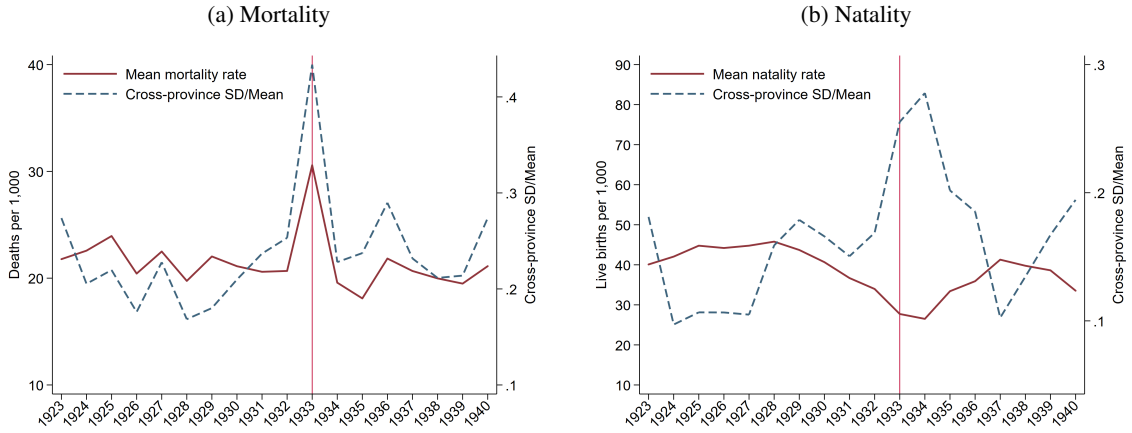
Notes: Observations are at the province and year level, except for column (3), which is at the district level. All regressions control for urbanization, urbanization × famine, predicted grain, predicted grain × famine, and province and year fixed effects. $^{++}$Estimates in column (3) use a cross-section of districts and control for urbanization, grain suitability and province fixed effects. The confidence intervals for the conditional IV estimates at the bottom of Panel A are for the share of rural HHs in collective farms in 1930. In Panel B, the dependent variable for the first stage is the share of rural HHs in collective farms in 1930. The standard errors in parentheses are adjusted for spatial correlation within 1,500 km (columns 1–2 and 4) or within 400 km (column 3). *** p<0.01, ** p<0.05, * p<0.1

Figure 1: Mortality and Natality Rates over Time



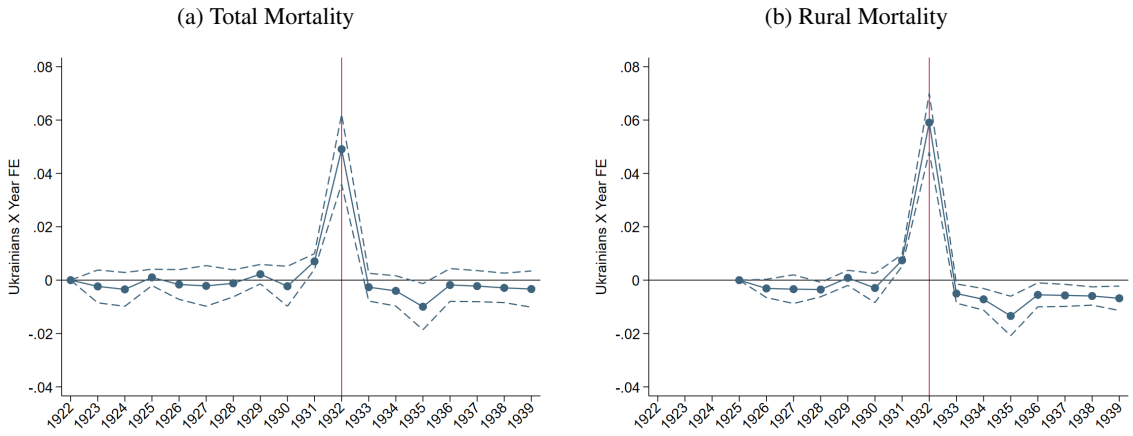
Notes: Mortality is the number of deaths per 1,000 individuals. Natality is the number of live births per 1,000 individuals.

Figure 2: Cross-Province Mean and Standard Deviation of Mortality and Natality Rates



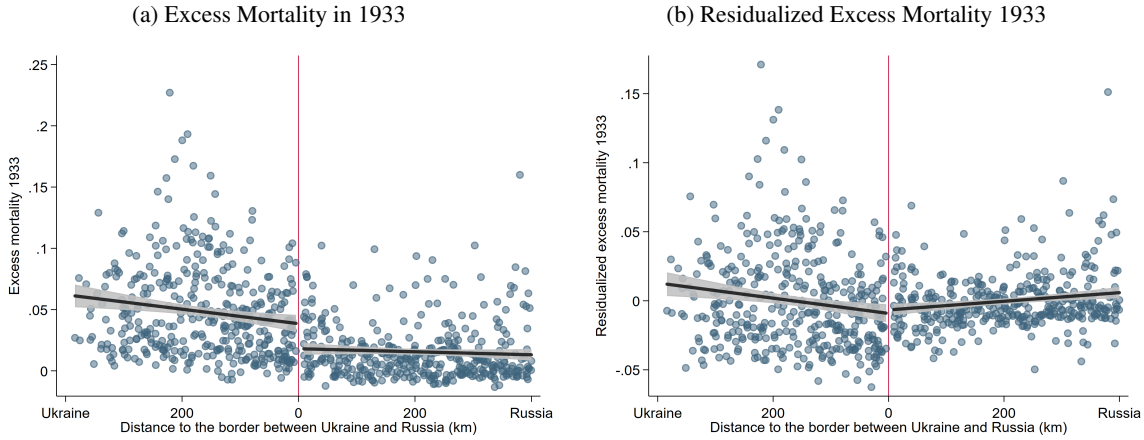
Notes: Mean mortality (natality) rate is the average mortality (natality) rate across provinces in each year. Cross-province SD/Mean is the standard deviation in mortality (natality) rates across provinces in year t divided by the mean mortality (natality) rate in year t. *Source:* See the Data Appendix.

Figure 3: The Dynamic Relationship between Ukrainian Population Share and Mortality



Notes: The figures show the interaction coefficients of Ukrainian population share and year dummy variables with their 95% confidence intervals. Figures 3a and 3b plot estimates from two regressions. The estimates and their standard errors are presented in Appendix Table A.6.

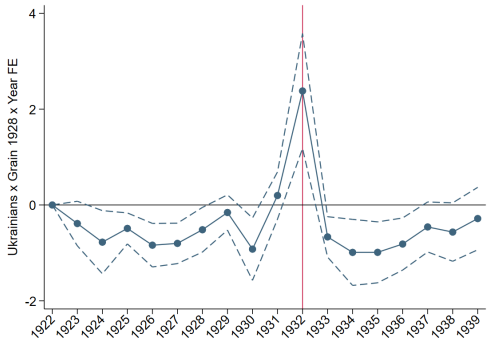
Figure 4: District-Level Excess Mortality in 1933 and Distance from the Ukrainian-Russian Border



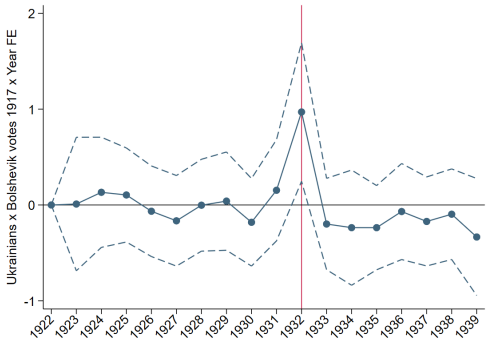
Notes: In Figure 4a, excess mortality 1933 is mortality in 1933 minus mortality in 1928. In Figure 4b, excess mortality is demeaned by urbanization and the rural share of ethnic Ukrainians in each district. Distance to the border is measured in kilometers.

Figure 5: The Dynamic Relationship between Political Factors and Mortality in Ethnic Ukrainian Areas

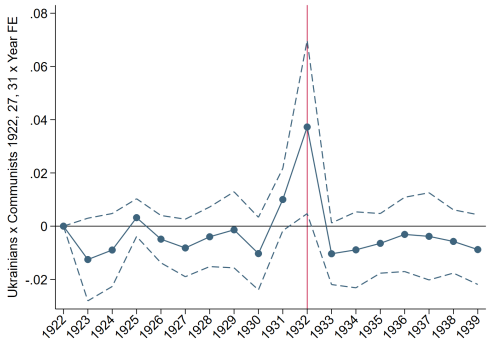
(a) Ukrainians × Grain 1928 × Year FE



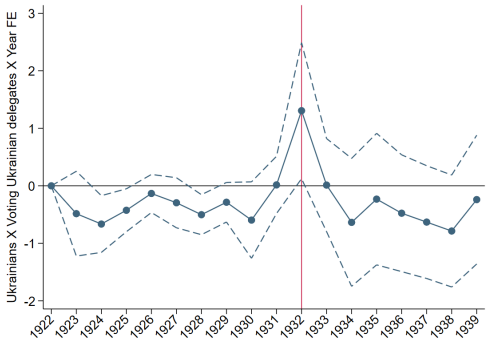
(b) Ukrainians × Bolshevik votes 1917 × Year FE



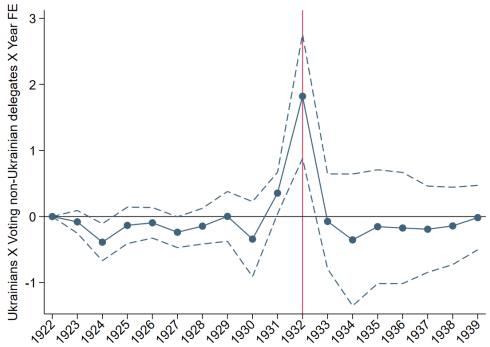
(c) Ukrainians × Communists 1922, 27, 31 × Year FE



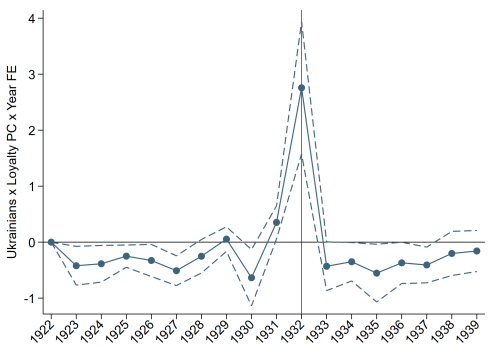
(d) Ukrainians × Ethnic Ukrainian Delegates in 1930 Congress × Year FE



(e) Ukrainians × Ethnic non- Ukrainian Delegates in 1930 Congress × Year FE



(f) Ukrainians × Political Principal Component × Year FE



Notes: Figures 5a - 5c and Figure 5f plot coefficients and their 95% confidence intervals estimated from four separate regressions. Figures 5d and 5e are estimated from one regression. The estimates and their standard errors are presented in Appendix Table A.11.

Online Appendix (Not for Publication)

A Food Accounting

The goal of this exercise is to estimate per capita food production and per capita food requirements for the Soviet Union and to examine whether production was sufficient to avoid the famine. The most important source of food, which was also the main target of government procurement, was grain.

We start with official data on population, production and procurement (rows (1) to (3) and (5) in Appendix Table A.2, Panel I). Row (6) presents reported procurement as a share of production and shows that it increased over time from 14.9% in 1927 to 30.7% in 1939, with the peak during the famine years, when procurement share was 32.9% and 27.2% in 1931 and 1932, respectively. Note that food produced in a given year is used to feed the population in the following year. Thus, we focus on production in 1932 to study mortality in 1933.

Row (7) shows that per capita grain production in 1931 and 1932 were 433kg and 428kg, respectively, lower than the previous four and subsequent three years. However, production in 1929, when there was no famine, was only slightly higher at 465kg. Row (8) converts grain from kilograms to calories per day using calories per one kilogram of Russian grain estimated by Lositskij (1920).

Rows (12) and (13) present two levels for caloric requirements. The first is the "business as usual" measure that maximizes labor productivity and healthy child development. This measure assumes that all rural prime age males do heavy labor and all urban prime age males do light work. We use official Soviet estimates for caloric requirements from Lositskij (1928), which are higher than the estimates for other countries or international standards. They are 3,750 and 2,750 calories per day for the two types of labor. We adjust the requirements by the demographic composition (age and gender) using Soviet official data on relative requirements (Lositskij, 1926) and the 1926 Population Census data on demographic composition.

The second caloric requirement is the "staying alive" measure. For this, we use 900 calories required for prime age males provided by Dasgupta and Ray (1986). We adjust it in the same way as the first threshold to account for demographic composition.

Row (12) shows that for "business as usual," the USSR required 2,439 to 2,427 calories per capita during 1931 and 1932. Per capita grain production in row (8) for these years, 3,716 and 3,675 calories, are 152% and 151% higher than these requirements. Row (13) shows that to avoid mortality, the USSR required 621 and 622 calories on average. In 1931 and 1932, grain production was 599% and 591% higher than these requirements.

To address potential over-reporting of aggregate grain production, we use Davis and Wheatcroft's (2004) adjusted estimates as a lower bound for production in rows (4) and (9). They are lower

than official estimates, but do not overturn the point of sufficient aggregate production for avoiding famine.[56]

In the centrally planned food distribution system, food is procured from rural areas to urban areas and for export, and it is known that famine mortality rates were lower in urban areas.[57] To investigate whether aggregate grain procurement is sufficient for explaining famine mortality without additional inequality in food distribution across the rural population, we calculate average rural grain retention (row 10). We use data on the reported amount of grain procured by the central government. We convert retention into calories in row (11). These calculations show that average rural grain retention was 128% and 141% of the "business as usual" threshold and 503% and 553% of the "staying alive" threshold. Thus, aggregate procurement of food to supply urban areas and exports cannot explain the famine. For the famine to have occurred, there must have been unequal food distribution across the rural population.

Table A.2, Panel II repeats the exercise for Ukraine. Rural per capita grain retention during the famine is always higher than the food required to avoid famine.

Some of the production may be wasted (e.g., due to poor storage). Lositskij (1920) estimates waste for wheat and rye to be approximately 5% in Russia. We do not know of estimates for the early 1930s. While these factors may be relevant, we have not heard any reliable estimates of mis-reporting or waste that are large enough in magnitude to overturn the main point that the famine would not have occurred if food were equally distributed across the population, or the rural population.

B Province-level Sample

The province-level panel includes 1922 to 1940 and 19 provinces within the republics of Belarus, Russia and Ukraine. These provinces correspond to the 1932 administrative division. Belarus and Ukraine were a single province each. 84% of the 1926 Soviet population and 88% of the 1928 grain production come from the provinces in our sample. The omitted territories are those with no reliable mortality data: Far Eastern Province, Yakut Autonomous SSR, and the North Caucasus ethnic territories: Chechen Autonomous Province, Cherkess Autonomous Province, Dagestan Autonomous SSR., Ingush Autonomous Province, Kabardino-Balkarian Autonomous Province, Karachay Autonomous Province, North Ossetian Autonomous Province. Figure A.1a maps the provinces in our sample. Omitted territories are in white. See Appendix Section G for a list of data sources.

[56] Tauger (2001) argues that the true 1932 grain harvest was a meager 50 million tons which is the most conservative estimate in the literature. This transforms into 2,630 calories per day that is still above our estimate of the "business as usual" caloric requirement.

[57] Grain exports during 1931–32 were approximately five million metric tons, 7% of the total production (Nove, 1992).

C Predicted Grain

To estimate the grain production function, we use a sample from 1901–15. We regress log grain production (total harvests) on log province area, log FAO GAEZ grain suitability index, their interaction, temperature and precipitation for each of the four seasons, their pairwise interactions and square terms (without a constant). The seasons are: fall (October, November, and December of the previous calendar year), winter (January, February, March), spring (April, May, June), summer (July, August, September). Appendix Table A.3 presents the estimated grain production function. We then use this production function to predict grain harvest from 1922 to 1940. The predicted grain and actual grain are closely correlated, with two exceptions: Karelia and East Siberia provinces. The in-sample R-squared is 0.90. The out-of-sample R-squared is 0.77, see Appendix Figure A.2. The high out-of-sample predictive power is consistent with the lack of major technological changes in Soviet agriculture before the 1930s (e.g., Allen, 2003).

D Weather

Appendix Table A.4 controls for weather directly instead of grain production predicted by weather (and other natural conditions). Column (1) presents the baseline without controlling for predicted grain and its interaction. Column (2) controls for spring and summer temperature and precipitation, since weather in the spring and summer of 1931 and 1932 is discussed most often as a cause of poor harvests during the famine (e.g., Davies and Wheatcroft, 2004; Tauger, 1991). It also controls for the following year's winter temperature and precipitation since 1933 winter weather conditions may have directly affected mortality. Column (3) controls for monthly temperature and precipitation and their squared terms (48 additional controls). Column (4) controls for monthly temperature and precipitation and their interactions (36 additional controls). Column (5) controls for monthly weather shock indicators following the standard in the literature, where the weather shock indicator is equal to one if the month's temperature or precipitation is more than one standard deviation away from the long-term (1900–50) mean (12 additional controls). Column (6) controls for the deviations from the long-term median of monthly temperature and precipitation (24 additional controls). Finally, following Rozenas and Zhukov (2019), column (7) controls for monthly deviations in temperature and precipitation from the long-term median over two years (48 additional controls). The main interaction coefficient of the rural share of ethnic Ukrainians and the famine indicator changes little with these controls.

E *Dekulakization*

Appendix Table A.5 shows that our main result is robust to different ways of controlling for the extent of *dekulakization* in the region. These measures are the number of exiled kulak households during 1930–31 according to Davies and Wheatcroft (2004, Table 28), the number of exiled kulak households during 1930–31 according to a secret police report in Berelowitch and Danilov (2000–2012, Document 253), *ex ante* 1930 quotas for kulak exile, secret police estimates of total number of kulaks in countryside, and the number of arrested peasants.

F District-Level Data

There is substantial variation in famine mortality across districts, even those within the same province. Appendix Figure A.4 presents the mean and normalized standard deviation in district-level mortality for Russia and Ukraine. District-level analysis do not include the republic of Belarus because we were not yet able to collect 1928 mortality data for Belarus. It shows that mean mortality and the variation across districts increase in 1933, for the full sample and for each republic. These results show that the spatial patterns which exist at the province level for the full sample also exist across districts within republics. See Appendix Section G for a list of data sources.

G Data Sources

G.1 Province-level Panel

Total and Urban Population 1920: Tsentralnoye Statisticheskoye Upravleniye [Central Statistical Office] (1926) *"Statisticheskiy yezhegodnik 1924 god (Vypusk pervyy) [Statistical Yearbook 1924 (First Issue)]"*, Volume VIII, Issue 7 of Trudy Tsentralnogo Statisticheskogo Upravleniya [Proceedings of the Central Statistical Office], Part I, Table 1.B. 1922: total population is interpolated between 1920 and 1923; urban population is interpolated between 1920 and 1925. 1923: total population is calculated using the total number of deaths and deaths per 10,000 from Tsentralnoye Statisticheskoye Upravleniye [Central Statistical Office] (1926) *"Statisticheskiy yezhegodnik 1924 god (Vypusk pervyy) [Statistical Yearbook 1924 (First Issue)]"*, Volume VIII, Issue 7 of Trudy Tsentralnogo Statisticheskogo Upravleniya [Proceedings of the Central Statistical Office], Part I, Table 5; urban population is interpolated between 1920 and 1925. 1924: total population is calculated using the total number of deaths and deaths per 10,000 from Tsentralnoye Statisticheskoye Upravleniye [Central Statistical Office] (1926) *"Statisticheskiy yezhegodnik 1924 god (Vypusk pervyy) [Statistical Yearbook 1924 (First Issue)]"*, Volume VIII, Issue 7 of Trudy Tsentralnogo Statisticheskogo Upravleniya [Proceedings of the Central Statistical Office], Part I, Table 8; urban population is interpolated between 1920 and 1925. 1925: Tsentralnoye Statisticheskoye Upravleniye [Central Statistical Office] (1926) *"Statisticheskiy yezhegodnik 1924 god (Vypusk pervyy) [Statistical Yearbook 1924 (First Issue)]"*, Volume VIII, Issue 7 of Trudy Tsentralnogo Statisticheskogo Up-

ravleniya [Proceedings of the Central Statistical Office], Part I, Table 1.B. 1926: is interpolated between 1925 and 1927. 1927: December 17, 1926 Population Census. 1928–1932: is interpolated between 1927 and 1933. 1933: Russian state archive of economy (hereafter, RGAE) 1562/329/19 p. 1–12. 1934–1936: is interpolated between 1933 and 1937. 1937: the 1937 Population Census from Zhiromskaya, V.B. and Kiselev, I.N. and Polyakov, Yu.A. (1996) *"Polveka pod grifom "sekretno": Vsesoyuznaya perepis naseleniya 1937 goda [Classified for half a century: All-Union population census of 1937]"*, Moscow: Nauka. 1938: is interpolated between 1937 and 1939. 1939: the 1939 Population Census corrected for the centralized additions (*pripiski*) from Demoscope.ru. 1940: used 1939 value.

Data for each year are reported for different administrative boundaries, at more disaggregated levels than the province boundaries we construct. For consistency, we use ArcGIS and manually aggregate the population data to 1932 province borders. One issue is that small changes in borders that occur over time lead to large changes in population if we assume that the population is uniformly distributed across space in sparsely populated provinces such as Ural, and West and East Siberia. To address this, we use the 1897 Population Census (the most recent available census prior to the start of our sample), which can be disaggregated to the *Uezd* level (of which there are 817 for the Russian Empire). These data allow us to calculate population density, which we use to attribute population to the 1932 province borders.

Births and Deaths 1923: Tsentralnoye Statisticheskoye Upravleniye [Central Statistical Office] (1926) *"Statisticheskiy yezhegodnik 1924 god (Vypusk pervyy) [Statistical Yearbook 1924 (First Issue)]"*, Volume VIII, Issue 7 of Trudy Tsentralnogo Statisticheskogo Upravleniya [Proceedings of the Central Statistical Office], Part I, Table 5. 1924: Tsentralnoye Statisticheskoye Upravleniye [Central Statistical Office] (1926) *"Statisticheskiy yezhegodnik 1924 god (Vypusk pervyy) [Statistical Yearbook 1924 (First Issue)]"*, Volume VIII, Issue 7 of Trudy Tsentralnogo Statisticheskogo Upravleniya [Proceedings of the Central Statistical Office], Part I, Table 8. 1925: Tsentralnoye Statisticheskoye Upravleniye S.S.S.R. [Central Statistical Office of the USSR] (1928) *"Yestestvennoye dvizheniye naseleniya Soyuza S.S.R. 1923–1925 [Natural movement of the population of the USSR]"*, Volume I, Issue 1, Table 1. 1926: Yestestvennoye dvizheniye naseleniya Soyuza S.S.R. v 1926 g, Izdaniye TsSU SS.S.R. (1929), Table 1. 1927–1932: Belarus, Ukraine – RGAE 1562/329/256; Russia – Demoscope.ru. 1933–1940: Demoscope.ru.

We assign these data into 1932 province boundaries following the same procedure as for population. The rural-urban decomposition of deaths and births is available since 1926.

Natality and Mortality Natality is the number of live births divided by population (crude birth rate). Mortality is the total number of deaths divided by population (crude death rate).

Ethnic Composition Ethnic composition comes from the 1897 and the 1926 Population Censuses. The 1897 Census reports population by mother tongue. We use the share of people whose mother tongue is Belorussian, Russian (*Velikorusskiy*), and Ukrainian (*Malorusskiy*). The 1926 Census reports population by self-proclaimed ethnicity and by mother tongue, we use both. Data are calculated in our province borders using 1897 and hand-created district (*volost*)-level 1926 maps. The 1897 map is from Kessler, Gijs and Andrei Markevich, Electronic Repository of Russian Historical Statistics, 18th - 21st centuries, https://ristat.org/, Version I (2020).

Age Structure Region (*okrug*)-level population by 1-year age groups from the 1926 Population Census is reported by Demoscope.ru. We calculated the share of people aged 10 and younger using hand-created region (*okrug*)-level map. This procedure is legitimate because regions (*okruga*) are smaller than our provinces.

Gender Ratio Male to female ratio is from the 1926 Population Census. We calculated it in our province borders using hand-created district (*volost*)-level 1926 map. This procedure is legitimate because districts (*volosty*) are smaller than our provinces.

Grain Harvest, Sown Area, and Yield 1901–1914: Obukhov V.M. (1927) *"Dvizheniye urozhayev zernovykh kultur v Yevropeyskoy Rossii v period 1883–1915 g.g. [Movement of grain crops in European Russia in the period 1883–1915]"* and *Yezhegodnik Rossii* 1904–1916. 1922: Tsentralnoye Statisticheskoye Upravleniye [Central Statistical Office] (1924) *"Sbornik statisticheskikh svedeniy po Soyuzu S.S.R. 1918–1923. Za pyat let raboty Tsentralnogo Statisticheskogo Upravleniya [A collection of statistical information on the USSR 1918–1923. Five years of work of the Central Statistical Office.]"*, Volume XVIII of Trudy Tsentralnogo Statisticheskogo Upravleniya [Proceedings of the Central Statistical Office], Part VI, Tables 7 and 8. 1923: Tsentralnoye Statisticheskoye Upravleniye [Central Statistical Office] (1924) *"Statisticheskiy yezhegodnik 1922 i 1923 g. (Vypusk pervyy) [Statistical Yearbook 1922 and 1923 (First Issue)]"*, Volume VIII, Issue 5 of Trudy Tsentralnogo Statisticheskogo Upravleniya [Proceedings of the Central Statistical Office], Part III, Tables 3 and 4. 1924: Tsentralnoye Statisticheskoye Upravleniye [Central Statistical Office] (1926) *"Statisticheskiy yezhegodnik 1924 god (Vypusk pervyy) [Statistical Yearbook 1924 (First Issue)]"*, Volume VIII, Issue 7 of Trudy Tsentralnogo Statisticheskogo Upravleniya [Proceedings of the Central Statistical Office], Part III, Tables 6 and 7. 1925–1927: Statisticheskoye izdatelstvo TsSU SS.S.R. [Statistical Publishing House of the Central Statistical Office of the USSR] (1929) *"Selskoye khozyaystvo SS.S.R. 1925–1928. Sbornik statisticheskikh svedeniy k XVI Vsesoyuznoy partkonferentsii [Agriculture of the USSR 1925–1928. A collection of statistical information for the XVI All-Union Party Congress]"*, Part III. 1928: RGAE 1562/329/1409. 1929–1930: Gosudarstvennoye sotsialno-ekonomicheskoye izdatelstvo [State Socio-Economic Publishing House] (1932) *"Narodnoye khozyaystvo SS.S.R.. Statisticheskiy spravochnik 1932 [The national economy of the USSR. Statistical Handbook 1932]"*, Part II.3.A, Tables 30 and 33. 1931: Gosudarstvennoye izdatelstvo kolkhoznoy i sovkhoznoy literatury "Selkhozgiz" [State publishing house of collective and state farm literature "Selkhozgiz"] (1936) *"Selskoye khozyaystvo SS.S.R.. Yezhegodnik 1935 [Agriculture of the USSR. Yearbook 1935]"*, p. 269, Tables 106 and 107. 1932–1940: RGAE 1562/329/1409.

We map the grain data into 1932 provinces borders following the same procedure as for population. The years 1922, 1924–27 are reported for larger units than our provinces. Thus, we map them into the province borders proportional to the 1913 *Uezd* sown area data.

Procurement 1924: Tsentralnoye Konventsionnoye Byuro Khlebozagotoviteley [Central Conventional Bureau of Grain Procurers] (1928) *"Yezhegodnik khlebnoy torgovli N1 [Yearbook of grain trade N 1]"*, Table 6. 1925: Tsentralnoye Konventsionnoye Byuro Khlebozagotoviteley [Central Conventional Bureau of Grain Procurers] (1928) *"Yezhegodnik khlebnoy torgovli N1 [Yearbook of grain trade N 1]"*, Table 14. 1926: Tsentralnoye Konventsionnoye Byuro Khlebozagotoviteley [Central Conventional Bureau of Grain Procurers] (1928) *"Yezhegodnik khlebnoy torgovli N1*

[Yearbook of grain trade N 1]", Table 22. 1927: Statisticheskoye izdatelstvo TsSU SS.S.R. [Statistical Publishing House of the Central Statistical Office of the USSR] (1929) *"Selskoye khozyaystvo SS.S.R. 1925–1928. Sbornik statisticheskikh svedeniy k XVI Vsesoyuznoy partkonferentsii [Agriculture of the USSR 1925–1928. A collection of statistical information for the XVI All-Union Party Congress]", Part V.* 1928: calculated from the 1928 grain harvest and procurement as a share of harvest from RGAE 4372/30/871 p. 30. 1929: Narodnyy Komissariat Snabzheniya SS.S.R. [People's Commissariat of Supply of the USSR] (1932) *"Yezhegodnik khlebooborota N4 [Yearbook of grain turnover N 4]"*, Tables 3 and 10. 1930: Narodnyy Komissariat Snabzheniya SS.S.R. [People's Commissariat of Supply of the USSR] (1932) *"Yezhegodnik khlebooborota N4 [Yearbook of grain turnover N 4]"*, Table 29 and Table 36. 1931: Komitet po zagotovkam S.-Kh produktov pri SNK SS.S.R. [Committee for Procurement of Agricultural Products under the Council of People's Commissars of the USSR] (1934) *"Yezhegodnik khlebooborota za 1931-32, 1932-33 i predvaritelnyye itogi zagotovok 1933 g. [Yearbook of grain turnover for 1931-32, 1932-33 and preliminary results of procurement in 1933]"*, Table 21. 1932: Komitet po zagotovkam S.-Kh produktov pri SNK SS.S.R. [Committee for Procurement of Agricultural Products under the Council of People's Commissars of the USSR] (1934) *"Yezhegodnik khlebooborota za 1931-32, 1932-33 i predvaritelnyye itogi zagotovok 1933 g. [Yearbook of grain turnover for 1931-32, 1932-33 and preliminary results of procurement in 1933]",* Table 33. 1933: Komitet po zagotovkam S.-Kh produktov pri SNK SS.S.R. [Committee for Procurement of Agricultural Products under the Council of People's Commissars of the USSR] (1934) *"Yezhegodnik khlebooborota za 1931-32, 1932-33 i predvaritelnyye itogi zagotovok 1933 g. [Yearbook of grain turnover for 1931-32, 1932-33 and preliminary results of procurement in 1933]",* Table 53.

We calculated 1925–27 procurement data in administrative borders corresponding to our provinces using hand-created ArcGIS maps (each year is reported using a different administrative division). This operation is legitimate because reported data are more disaggregated than our provinces. 1928–33 data is used as reported.

Collectivization 1927: Statizdat TSSU SS.S.R. [Statistical publishing house of the Central Statistical Office of the USSR] (1929) *"Kollektivizatsiya Sovetskoy derevni. Predvaritelnyye itogi sploshnykh obsledovaniy 1928 i 1929 gg. [Collectivization of the Soviet countryside. Preliminary results of comprehensive surveys in 1928 and 1929]"*, Table 10. 1928: RGAE 1562/82/271. 1929: Gosplan S.S.S.R. i RSFSR. Ekonomiko-statisticheskiy sektor [State Planning Committee of the USSR and the RSFSR. Economic and statistical sector] (1931) *"Kolkhozy v 1929 g. Itogi sploshnogo obsledovaniya kolkhozov [Collective farms in 1929. Results of a comprehensivy survey of collective farms]"*. 1930: Gosplan S.S.S.R.. Upravleniye Narodnokhozyaystvennogo Ucheta [State Planning Committee of the USSR. Department of National Economic Accounting] (1931) *"Kolkhozy v 1930 g. Itogi raportov kolkhozov k XVI s'yezdu VKP(b) [Collective farms in 1930. Resume of the collective farms' reports to the XVI Congress of the CPSU(b)]"*. 1931: Izd. Kolkhoztsentra SS.S.R. i RSFSR [Publishing House of the Collective Farm Center of the USSR and the RSFSR] (1931) *"Kolkhoznoye stroitelstvo v SS.S.R. [Collective farms building in the USSR]"*, p. 15 and Davies and Wheatcroft (2004), Table 27. 1932: RGAE 1562/82/271. 1933: *"Plan. Zhurnal Gosplana i TsUNKhU SS.S.R. [Plan. Journal of the State Planning Committee and TsUNKhU USSR]"*, 2-1933. 1934–1936: RGAE 1562/82/271. 1937: interpolated between 1936 and 1938. 1938: Gosplanizdat (1939) *"Selskoye khozyaystvo Soyuza S.S.R. 1939 (Statictícheskiy spravochnik) [Agriculture of the USSR 1939 (Statistical handbook)]"*, Part IV.

Collectivization is the share of rural households in collective farms.

Dekulakization The baseline measure of kulak households exiled during 1930--31 per 1930 population is estimated as the average between Exiled kulaks (DW) and Exiled kulaks (OGPU) defined below. Exiled kulaks (DW) is the number of *dekulakized* and exiled households in Category II of kulaks in 1930--31 according to Davies and Wheatcroft (2004) (Table 28) per 1930 population. Exiled kulaks (OGPU) is the number of *dekulakized* and exiled households of all categories between 01.01.1930 and 01.07.1931 according to an OGPU (secret police) 1931 report per 1930 population. The report is published in Berelovich A. and V. Danilov (2003). *"Sovetskaya derevnya glazami VChk-OGPU-NKVD. 1918—1939. Documents i materialy"* [Soviet Countryside from the Perspective of VChK-OGPU-NKVD]. Moscow: Rosspen. Vol. 3 "1930—1934 gg.", Book 1. "1930—1931 gg.", document 253. Planned kulaks (lower bound) and Planned kulaks (upper bound) is the OGPU (secret police) planned number of *dekulakizations* by as of February, 1930 per 1930 population. The planned figures are published in Danilov, Victor, Robert Manning and Lynne Viola (Eds.). (1999-2006). *"Tragediya Sovetskoj Derevni. Kollektivizatsiya i raskulachivanie. Dokumenti i materialy v 5 tomakh, 1927-1939"* [Tragedy of the Soviet Countryside. Collectivization and Dekulakization. Documents and Materials. 5 volumes]. Moscow: Rosspen. Volume 2 "November 1929 — December 1930", Document 69. Total kulaks (OGPU estimate) is the total number of kulaks in the rural population according to the OGPU (secret police) estimate published in Berelovich A. and V. Danilov (2003). *"Sovetskaya derevnya glazami VChk-OGPU-NKVD. 1918—1939. Documents i materialy"* [Soviet Countryside from the Perspective of VChK-OGPU-NKVD]. Moscow: Rosspen. Vol. 3 "1930—1934 gg.", Book 1. "1930—1931 gg.", document 253. Arrested kulaks 1930 is the number of peasants processed by "troiki" in 1930 per 1930 population according to the OGPU (secret police) estimate published in Berelovich A. and V. Danilov (2003). *"Sovetskaya derevnya glazami VChk-OGPU-NKVD. 1918—1939. Documents i materialy"* [Soviet Countryside from the Perspective of VChK-OGPU-NKVD]. Moscow: Rosspen. Vol. 3 "1930—1934 gg.", Book 1. "1930—1931 gg.", document 279.

Peasant Resistance to the Soviet Regime "Terrorist acts", unrest demonstrations, and anti-Soviet leaflets registered by the OGPU (secret police) between 01.01.1932 and 01.04.1932 per 1,000 1930 population are according to two OGPU reports. The reports are published in Berelovich A. and V. Danilov (2003). *"Sovetskaya derevnya glazami VChk-OGPU-NKVD. 1918—1939. Documents i materialy"* [Soviet Countryside from the Perspective of VChK-OGPU-NKVD]. Moscow: Rosspen. Vol. 3 "1930—1934 gg.", Book 1. "1930—1931 gg.", document 272, and Danilov, Victor, Robert Manning and Lynne Viola (Eds.). (1999-2006). *"Tragediya Sovetskoj Derevni. Kollektivizatsiya i raskulachivanie. Dokumenti i materialy v 5 tomakh, 1927-1939"* [Tragedy of the Soviet Countryside. Collectivization and Dekulakization. Documents and Materials. 5 volumes]. Moscow: Rosspen. Volume 3 "Late 1930 — 1933", Document 118.

Peasant Resistance to the Tsarist Regime Peasant revolts in 1895—1914 are from Gokmen and Kofanov (2020).

Bolshevik Votes 1917 Bolshevik vote share is from Protasov, V.V. Zhuravlev, and Shelokhaev (2014). Data is calculated in our province borders using district (*uezd*)-level 1917 map from Cas-

tañeda Dower and Markevich (2021).

Communists Communists is the average number of Communist Party members and candidates over 1922, 1927, and 1931. 1922: Izdatelskoye otdeleniye TsK RKP [Publishing Department of the Central Committee of the RCP] (1922) *"Vserosssiyskaya perepis chlenov RKP 1922 goda [All-Russian census of the members of the RCP in 1922]"*, Issue 3, Table 6. 1927: Statisticheskiy otdel TsK VKP(b) [Statistical Department of the Central Committee of the CPSU(b)] (1927) *"Vsesoyuznaya partiynaya perepis 1927 goda. Chislennyy sostav VKP(b) na 10 yanvarya 1927 g. [All-Union Party Census of 1927. The composition of the CPSU(b) on January 10, 1927]"*, Issue 1. 1931: Tsentralnyy Komitet VKP(b). Organizatsionno-instruktorskiy otdel [Central Committee of the CPSU(b). Organizational and instructor department] (1932) *"Sostav VKP(b) v tsifrakh. Dinamika osnovnykh pokazateley rosta parti za 1930 i pervoye polugodiye 1931 g. [Composition of the CPSU(b) in numbers. Dynamics of the main indicators of the growth of the party for 1930 and the first half of 1931]"*

We calculated 1922 and 1927 data in administrative borders corresponding to our provinces using hand-created ArcGIS maps (each year is reported using a different administrative division). The reported data are more disaggregated than our provinces. For 1931, we use the reported data.

Voting Delegates 1930 We collected location and ethnicity of all 1930 Party Congress delegates that served as province-, district-, city-, or borough-level Party secretary from Rossiyskiy Gosudarstvennyy Arkhiv Sotsial'no-Politicheskoy Istorii (Russian State Archive of Socio-Political History, RGASPI), Fund 58, Register 1, Files 1–16.

Province Latitude and Longitude The latitude and longitude of the province centroid, calculated using ArcGIS.

Tractors 1927–1928: the number of collective farms' tractors times 13 (the average tractor horse power in 1929) from Vsesoyuznyy Sovet Kolkhozov [All-Union Council of Collective Farms] (1929) "Kolkhozy SS.S.R. (Statisticheskiy spravochnik) [Collective farms of the USSR (Statistical handbook)]. 1929: horse power of tractors belonging to collective farms and to machine-tractor stations from Gosplan SS.S.R. i RSFSR. Ekonomiko-statisticheskiy sektor [State Planning Committee of the USSR and the RSFSR. Economic and statistical sector] (1931) *"Kolkhozy v 1929 g. Itogi sploshnogo obsledovaniya kolkhozov [Collective farms in 1929. Results of a comprehensivy survey of collective farms]"*, Tables 1 and 2. 1930: horse power of tractors belonging to collective farms is from Gosplan SS.S.R.. Upravleniye Narodnokhozyaystvennogo Ucheta [State Planning Committee of the USSR. Department of National Economic Accounting] (1931) *"Kolkhozy v 1930 g. Itogi raportov kolkhozov k XVI s'yezdu VKP(b) [Collective farms in 1930. Resume of the collective farms' reports to the XVI Congress of the CPSU(b)]";* horse power of tractors belonging to machine-tractor stations is from Tsentralnoye Upravleniye Narodnokhozyaystvennogo Ucheta Gosplana SS.S.R. [The Central Statistical Administration of Gosplan] (1935) *"Sotsialisticheskoye stroitelstvo SS.S.R. (Statisticheskiy yezhegodnik), 1935 g. [Socialist construction of the USSR (Statistical Yearbook), 1935]"*, Part II.6, Table 3. 1931–1934: Tsentralnoye Upravleniye Narodnokhozyaystvennogo Ucheta Gosplana SS.S.R. [The Central Statistical Administration of Gosplan] (1935) *"Sotsialisticheskoye stroitelstvo SS.S.R. (Statisticheskiy yezhegodnik), 1935 g. [Social-*

ist construction of the USSR (Statistical Yearbook), 1935]", Part II.6, Table 3. 1935–1936: RGAE 1562/79/275 p. 26–30. 1937: RGAE 1562/81/276a. 1937: RGAE 1562/81/269. 1937: RGAE 1562/83/222.

In 1929–30, 87% of tractors belonged to collective farms. In 1931, a shift occurred – the majority of tractors moved to machine-tractor stations (MTS) that served collective farms but formally were a state property. Therefore, we use collective farms' and machine-tractor stations' tractors in 1927–30, and use tractors belonging to machine-tractors stations from 1931 onward. The raw data are reported for different administrative boundaries each year. However, these are at a more desegregated level than the province boundaries we use. Thus, we are able to manually map the reported data into our province boundaries.

Grain Suitability Each province's average FAO GAEZ wheat suitability index for rain-fed low-input agriculture.

Weather Land surface temperature and precipitation are from Matsuura and Willmott (2014). For each province, we calculated the province's average monthly temperature and precipitation using ArcGIS.

Religious Composition Religious composition is from the 1897 Population Census, available at Kessler, Gijs and Andrei Markevich, Electronic Repository of Russian Historical Statistics, 18th - 21st centuries, https://ristat.org/, Version I (2020).

Shares of Repartition Commune and Private Land Data on commune and private land ownership are originally from the 1905 Land Census. We calculate province shares from district (*uezd*)-level figures taken from Castañeda Dower and Markevich (2018), using manually constructed ArcGIS district (*uezd*)-level maps.

Pre-Soviet Wealth Measures Nominal regional income per capita in 1897, real regional income per capita in 1897, regional labor productivity in 1897, regional rural labor productivity in 1897 (upper and lower estimates) are calculated from corresponding measures for imperial provinces, using hand-created ArcGIS district (*uezd*)-level maps. Imperial province estimates are from Markevich (2019). We estimate the value of agricultural machines by multiplying the number of agricultural machines of different types by their prices and taking the sum. Agricultural machines data are originally from the 1910 Census of Agricultural Machines. We calculate province shares from district (*uezd*)-level figures taken from Castañeda Dower and Markevich (2018), using hand-created ArcGIS district (*uezd*)-level maps. Prices are from Ministerstvo Zemledeliya [Ministry of Agriculture] (1917). *"Sbornik statistiko-ekonomicheskikh svedenij po sel'skomu khozyajstvu Rossii i inostrannikh gosudarstv. [A collection of statistical and economic information about agriculture in Russian and foerign countries]"*, Volume X. Horses, cows, and livestock in 1916 are originally from the 1916 Agricultural Census. We calculate province shares from district (*uezd*)-level figures taken from Castañeda Dower and Markevich (2018), using hand-created ArcGIS district (*uezd*)-level maps.

The 1892 Famine The sample includes the 50 European provinces of the Russian Empire.

Population 1885–1896: kindly shared by Volha Charnysh from an ongoing project (Charnysh and McElroy, 2020). 1897: Census. 1898: interpolated between 1897 and 1899. 1899–1914: *Yezhegodnik Rossii* 1904–1916.

Births and Deaths 1885–1896: kindly shared by Volha Charnysh from an ongoing project (Charnysh and McElroy, 2020). 1899–1914: *Yezhegodnik Rossii* 1904–1916.

Ethnic Composition 1897 Population Census.

Grain, Sown area, Yield Obukhov V.M. (1927) *"Dvizheniye urozhayev zernovykh kultur v Yevropeyskoy Rossii v period 1883–1915 g.g. [Movement of grain crops in European Russia in the period 1883–1915]"*.

G.2 District-level Panel

District-level dataset spans two years, 1928 and 1933, and covers some 1,600 districts of the republics of Russia and Ukraine. These districts correspond to the 1934 administrative division. Omitted are territories for which no 1933 mortality data are available. Figure A.1c shows our districts on the map (omitted territories are in white).

Mortality 1928: Russia: State archive of the Russian federation (GARF) 374/23/7, 13, 31–32, 67, 72–91, 132, 158; Ukraine: Tsentralna Statistichna Uprava USRR [Central Statistical Office of Ukraine] (1929) "Ukraina: Statisticheskiy Schorichnik 1929 [Ukraine: Statistical Yearbook 1929]." 1933: RGAE 1562/329/18–19.

Ethnic Composition Ethnic composition comes from the 1926 Population Census. This census reports population by self-proclaimed ethnicity and by mother tongue, we use both. Data is calculated in our district borders using hand-created district (*volost*)-level 1926 map.

Urbanization 1928: used value from December 1926 Population Census. This census reports district (*volost*)-level rural population and, separately, the population of each urban settlement. To calculate rural and urban population in 1934 administrative borders, we hand-created district (*volost*)-level 1926 map and located all urban settlements on the map. 1933: RGAE 1562/329/18–19.

Grain Suitability District's average FAO GAEZ wheat suitability index for rain-fed low-input agriculture.

Gender Ratio Gender ratio is a ratio of males to females according to the 1926 Population Census. To calculate data in 1934 administrative borders, we hand-created district (*volost*)-level 1926 map.

District Latitude and Longitude The latitude and longitude of the district centroid, calculated using ArcGIS.

Collectivization Gosplan S.S.S.R.. Upravleniye Narodnokhozyaystvennogo Ucheta [State Planning Committee of the USSR. Department of National Economic Accounting] (1931) "Kolkhozy v 1930 g. Itogi raportov kolkhozov k XVI s'yezdu VKP(b) [Collective farms in 1930. Resume of the collective farms' reports to the XVI Congress of the CPSU(b)]." 1930 districts matched to 1933 districts by name.

Table A.1: Ethnic Composition in the USSR

	1926 census						1939 census	
	Total		Urban		Rural		Total	
	mil.	%	mil.	%	mil.	%	mil.	%
	A. USSR							
Russians	77.8	53.1	16.6	63.5	61.2	50.8	99.6	58.4
Ukrainians	**31.2**	**21.3**	**3.3**	**12.6**	**27.9**	**23.2**	**28.1**	**16.5**
Belorussians	4.7	3.2	0.5	1.9	4.2	3.5	5.3	3.1
Kazakhs	4.0	2.7	0.1	0.3	3.9	3.2	3.1	1.8
Uzbeks	3.9	2.7	0.7	2.8	3.2	2.6	4.8	2.8
Tatars	2.9	2.0	0.5	1.7	2.5	2.1	4.3	2.5
Jews	2.6	1.8	2.1	8.2	0.5	0.4	3.0	1.8
Georgians	1.8	1.2	0.3	1.2	1.5	1.3	2.2	1.3
Azerbaijanis	1.7	1.2	0.3	1.0	1.4	1.2	2.3	1.3
Armenians	1.6	1.1	0.6	2.1	1.0	0.8	2.2	1.3
	B. Regression Sample (Subset of A)							
Russians	77.1	57.2	16.1	67.9	61.1	54.9	94.8	65.0
Ukrainians	**31.1**	**23.1**	**3.2**	**13.7**	**27.9**	**25.1**	**27.1**	**18.6**
Belorussians	4.7	3.5	0.5	2.0	4.2	3.8	5.2	3.6
Tatars	2.9	2.1	0.4	1.8	2.5	2.2	4.0	2.7
Jews	2.5	1.9	2.1	8.8	0.5	0.4	2.9	2.0
Mordvins	1.3	1.0	0.0	0.1	1.3	1.2	1.4	1.0
Germans	1.2	0.9	0.2	0.7	1.0	0.9	1.3	0.9
Chuvashs	1.1	0.8	0.0	0.1	1.1	1.0	1.4	0.9
Poles	0.8	0.6	0.2	1.0	0.5	0.5	0.6	0.4
Bashkirs	0.7	0.6	0.0	0.1	0.7	0.7	0.8	0.6
	C. "Grain-producing" Provinces (Subset of B)							
Ukrainians	**28.5**	**43.8**	**3.0**	**29.2**	**25.5**	**46.6**	**25.3**	**37.1**
Russians	27.3	41.9	5.2	50.0	22.0	40.3	32.8	48.1
Tatars	2.2	3.4	0.2	2.0	2.0	3.6	2.9	4.3
Jews	1.7	2.6	1.3	12.8	0.4	0.7	1.7	2.5
Mordvins	1.1	1.6	0.01	0.1	1.1	1.9	1.0	1.5
Germans	1.0	1.5	0.1	1.0	0.9	1.6	1.0	1.5
Bashkirs	0.6	0.9	0.01	0.1	0.6	1.1	0.7	1.0
Poles	0.5	0.7	0.1	1.0	0.4	0.7	0.4	0.6
Chuvashs	0.4	0.6	0.004	0.04	0.4	0.7	0.4	0.6
Moldovans	0.3	0.4	0.01	0.1	0.3	0.5	0.2	0.4

Notes: These data are reported by the 1926 and 1939 Population Censuses. Panel C includes Bashkir ASSR, Central Black-Earth region, Crimea, Lower Volga, Middle Volga, North Caucasus, Tatar ASSR, and Ukraine.

Table A.2: Per Capita Food Production and Requirements for the USSR

	1927	1928	1929	1930	1931	1932	1933	1937	1939
I. USSR									
A. Production and Procurement									
(1) Total population (mil.)	147.0	150.5	154.2	157.5	160.5	163.3	165.8	162.0	165.5
(2) Rural population (mil.)	120.7	124.3	126.6	128.0	128.3	127.0	127.1	110.1	110.6
(3) Production (mt)	74.1	73.3	71.7	83.5	69.5	69.9	89.8	120.3	100.9
(4) DW (mt)	.	.	.	75.0	61.0	57.5	73.5	.	.
(5) Procurement (mt)	11.1	10.8	16.1	22.2	22.8	19.0	23.7	31.9	30.9
(6) Procurement rate	14.9%	14.7%	22.4%	26.6%	32.9%	27.2%	26.3%	26.5%	30.7%
B. Implied Food Availability									
(7) Production pc (kg per year)	504	487	465	530	433	428	542	742	609
(8) Production pc (cal. per day)	4,329	4,183	3,994	4,555	3,716	3,675	4,651	6,373	5,231
(9) DW (cal. per day)	.	.	.	4,089	3,263	3,024	3,807	.	.
(10) Rural retention pc (kg per year)	523	503	440	479	364	400	521	803	632
(11) Rural retention pc (cal. per day)	4,486	4,318	3,775	4,113	3,122	3,436	4,469	6,890	5,425
(12) *Cal. needs pc – heavy labor*	*2,450*	*2,453*	*2,450*	*2,446*	*2,439*	*2,427*	*2,421*	*2,375*	*2,369*
(13) *Cal. needs pc – avoid mortality*	*619*	*619*	*620*	*620*	*621*	*622*	*622*	*626*	*627*
II. Ukraine									
A. Production and Procurement									
(1) Total population (mil.)	29.0	29.6	30.3	30.8	31.3	31.7	31.9	28.4	29.6
(2) Rural population (mil.)	23.6	24.6	24.9	25.1	25.0	24.8	25.0	18.8	18.7
(3) Production (mt)	18.6	13.9	18.7	22.7	18.3	14.5	22.0	22.5	23.8
(4) Procurement (mt)		1.9	5.3	7.7	7.3	4.2	6.1		
(5) Procurement rate	22.9%	13.6%	28.3%	33.8%	39.5%	29.2%	27.8%	.	.
B. Implied Food Availability									
(6) Production pc (kg per year)	641	469	618	739	587	457	689	792	805
(7) Production pc (cal. per day)	5,506	4,023	5,307	6,342	5,039	3,927	5,919	6,797	6,912
(8) Rural retention pc (kg per year)	607	488	538	600	444	415	637	.	.
(9) Rural retention pc (cal. per day)	5,213	4,189	4,620	5,149	3,815	3,559	5,467	.	.
(10) *Cal. needs pc – heavy labor*	*2,455*	*2,462*	*2,459*	*2,455*	*2,446*	*2,437*	*2,437*	*2,374*	*2,357*
(11) *Cal. needs pc – avoid mortality*	*622*	*621*	*621*	*622*	*623*	*623*	*623*	*629*	*631*

Notes: Data for population, production and procurement are official statistics. DW is the amount reported by Davis and Wheatcroft (2004). Conversion from grain to calories is based on estimates from Lositskij (1920). Population caloric requirements reported at the bottom of the table adjust for demographic composition (e.g., age, gender, rural/urban). Caloric needs for heavy labor use official Soviet estimates for adult males doing heavy labor (rural) – 3,750 per day – and doing light work (urban) – 2,750 per day (Lositskij 1928), for relative caloric needs of other groups are based on Lositskij (1926). Caloric needs for avoiding mortality are based on the 900 calories per day for prime-age adult males (Dasgupta and Ray, 1986).

Table A.3: The Effect of Weather and Natural Conditions on Grain Production

	Dependent Variable: Log Grain Production		
	(1)		(2)
Log area	0.352***	Fall temperature × Fall precipitation	0.0005*
	(0.067)		(0.0002)
Log grain suitability	-4.643***	Winter temperature × Winter precipitation	0.001*
	(0.640)		(0.0003)
Log area × Log grain suitability	0.278***	Spring temperature × Spring precipitation	0.0004
	(0.023)		(0.0003)
Fall temperature	0.015	Summer temperature × Summer precipitation	0.001***
	(0.037)		(0.0003)
Winter temperature	0.027	Fall temperature^2	0.004**
	(0.043)		(0.002)
Spring temperature	-0.169**	Winter temperature^2	0.0003
	(0.079)		(0.002)
Summer temperature	-0.978***	Spring temperature^2	-0.001
	(0.194)		(0.003)
Fall precipitation	-0.006	Summer temperature^2	0.028***
	(0.006)		(0.005)
Winter precipitation	-0.005	Fall precipitation^2	0.00002
	(0.007)		(0.00002)
Spring precipitation	0.010	Winter precipitation^2	0.00004
	(0.007)		(0.00003)
Summer precipitation	-0.025***	Spring precipitation^2	-0.00003**
	(0.009)		(0.00002)
		Summer precipitation^2	0.00003**
			(0.00001)
Observations		220	
R-squared		0.998	

Notes: Observations are at the province and year level. Log grain is the logarithm of the grain harvest. Log area is the logarithm of province area. Log grain suitability is the logarithm of the province's FAO GAEZ wheat suitability index for rain-fed low-input agriculture. Fall is October, November, December of the previous calendar year; Winter is January, February, March; Spring is April, May, June; Summer is July, August, September. *** p<0.01, ** p<0.05, * p<0.1

Table A.4: Ukrainian Population Share and Famine Mortality – Controlling for Weather

	Dependent Variable: Mortality in year t+1						
	Baseline (without controlling for predicted grain)	Spring Temp, Rain Summer Temp, Rain; Winter Temp, Rain	Monthly Temp, Rain, and Quadratics	Monthly Temp, Rain, Temp × Rain	Montly Weather Shock (= 1 if temp or rain is one std dev or more different from historical province mean)	Deviations from median monthly temp and rain for 12 months	Deviations from median monthly temp and rain for 24 months (Rozenas and Zhukov, 2019)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ukrainians × Famine	0.051***	0.051***	0.051***	0.048***	0.050***	0.048***	0.048***
	(0.004)	(0.004)	(0.003)	(0.002)	(0.004)	(0.003)	(0.002)
Observations	337	337	337	337	337	337	337
R-squared	0.784	0.791	0.833	0.819	0.791	0.812	0.829

Notes: Observations are at the province and year level. All estimates control for urbanization, urbanization × famine, province and year fixed effects. Additional controls are stated in the column headings. The standard errors in parentheses are adjusted for spatial correlation within 1,500 km. *** p<0.01, ** p<0.05, * p<0.1

Table A.5: Ukrainian Population Share and Famine Mortality – Controlling for *Dekulakization*

	Dependent Variable: Mortality in Year t+1						
	Baseline	Exiled kulaks (DW) × Famine	Exiled kulaks (OGPU) × Famine	Planned kulaks 1930 × Famine	Total kulaks (OGPU estimate) × Famine	Arrested kulaks 1930 × Famine	First principal component of Kulak variables × Famine
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ukrainians × Famine	0.051***	0.054***	0.053***	0.044***	0.058***	0.051***	0.053***
	(0.006)	(0.005)	(0.006)	(0.006)	(0.007)	(0.006)	(0.005)
Observations	337	337	337	337	267	302	249
R-squared	0.785	0.8	0.797	0.815	0.788	0.795	0.808

Notes: Observations are at the province and year level. All regressions control for urbanization, urbanization × famine, predicted grain, predicted grain × famine, and province and year fixed effects. Additional controls are stated in the column headings. Exiled kulaks (DW) is the number of dekulakized and exiled households in 1930–31 per 1930 population according to Davies and Wheatcroft (2004), Table 28. Exiled kulaks (OGPU) is the number of dekulakized and exiled households in 1930–31 according to an OGPU report (Soviet Countryside from the Perspective of VChK-OGPU-NKVD, Document 253) per 1930 population. Planned kulaks are the planned number of dekulakizations per capita in February 1930 (the average between lower and upper bounds). Total kulaks (OGPU estimate) is the total number of kulaks in the rural population according to the OGPU estimate (Soviet Countryside from the Perspective of VChK-OGPU-NKVD, Document 253). Arrested kulaks is the number of peasants processed by "troiki" per capita in 1930 according to the OGPU estimate (Soviet Countryside from the Perspective of VChK-OGPU-NKVD, Document 279). The standard errors in parentheses are adjusted for spatial correlation within 1,500 km. *** p<0.01, ** p<0.05, * p<0.1

Table A.6: The Dynamic Relationship between Ukrainian Population Share and Famine Intensity

	Dependent Variable:			
	Mortality in Year t+1	Rural Mortality in Year t+1	Natality in Year t+1	Rural Natality in Year t+1
	(1)	(2)	(3)	(4)
Ukrainians × 1923	-0.002		-0.002	
	(0.003)		(0.006)	
Ukrainians × 1924	-0.003		-0.007	
	(0.003)		(0.007)	
Ukrainians × 1925	0.001		-0.003	
	(0.002)		(0.005)	
Ukrainians × 1926	-0.002	-0.003*	-0.003	0.000
	(0.003)	(0.002)	(0.006)	(0.002)
Ukrainians × 1927	-0.002	-0.003	-0.012	-0.008**
	(0.004)	(0.003)	(0.008)	(0.004)
Ukrainians × 1928	-0.001	-0.004**	-0.011**	-0.007***
	(0.003)	(0.001)	(0.005)	(0.002)
Ukrainians × 1929	0.002	0.001	-0.010***	-0.006***
	(0.002)	(0.001)	(0.004)	(0.001)
Ukrainians × 1930	-0.002	-0.003	-0.007	-0.003
	(0.004)	(0.003)	(0.007)	(0.003)
Ukrainians × 1931	0.007***	0.007***	-0.012**	-0.007***
	(0.001)	(0.001)	(0.006)	(0.002)
Ukrainians × 1932	**0.049*** **	**0.059*** **	**-0.021*** **	**-0.017*** **
	(0.007)	**(0.006)**	**(0.006)**	**(0.003)**
Ukrainians × 1933	-0.003	-0.005***	-0.016**	-0.012***
	(0.003)	(0.002)	(0.007)	(0.004)
Ukrainians × 1934	-0.004	-0.007***	-0.011	-0.007**
	(0.003)	(0.002)	(0.007)	(0.003)
Ukrainians × 1935	-0.010**	-0.013***	-0.008	-0.005
	(0.004)	(0.004)	(0.008)	(0.004)
Ukrainians × 1936	-0.002	-0.006**	0.002	0.003
	(0.003)	(0.002)	(0.007)	(0.003)
Ukrainians × 1937	-0.002	-0.006***	-0.003	-0.001
	(0.003)	(0.002)	(0.007)	(0.003)
Ukrainians × 1938	-0.003	-0.006***	-0.004	-0.002
	(0.003)	(0.002)	(0.006)	(0.003)
Ukrainians × 1939	-0.003	-0.007***	-0.005	-0.002
	(0.003)	(0.002)	(0.006)	(0.002)
Observations	337	285	337	285
R-squared	0.817	0.823	0.876	0.931

Notes: Observations are at the province and year level. All estimates control for urbanization interacted with year indicators, predicted grain interacted with year indicators, and province and year fixed effects. The standard errors in parentheses are adjusted for spatial correlation within 1,500 km. *** p<0.01, ** p<0.05, * p<0.1

Table A.7: Ukrainian Population Share and Famine Mortality – Controlling for Demographic Structure

	Dependent Variable: Mortality in Year t+1					
	Baseline	Share of infants × Famine, Gender ratio × Famine	Share of children 5 and younger × Famine, Gender ratio × Famine	Share of children 10 and younger × Famine, Gender ratio × Famine	Share of adults 50 and older × Famine, Gender ratio × Famine	Share of adults 70 and older × Famine, Gender ratio × Famine
	(1)	(2)	(3)	(4)	(5)	(6)
Ukrainians × Famine	0.051***	0.056***	0.047***	0.048***	0.051***	0.052***
	(0.006)	(0.006)	(0.007)	(0.007)	(0.005)	(0.005)
Observations	337	337	337	337	337	337
R-squared	0.785	0.789	0.793	0.791	0.793	0.793

Notes: Observations are at the province and year level. All estimates control for urbanization, urbanization × famine, predicted grain, predicted grain × famine, and province and year fixed effects. Additional controls are stated in the column headings. The standard errors in parentheses are adjusted for spatial correlation within 1,500 km. *** p<0.01, ** p<0.05, * p<0.1

Table A.8: Ukrainian Population Share and Famine Mortality – Controlling for Historical Economic Indicators

	Dependent Variable: Mortality in Year t+1									
	Baseline	Nominal income 1897 × Famine	Real income 1897 × Famine	Labor productivity 1897 × Famine	Rural labor productivity 1897 (lower bound) × Famine	Rural labor productivity 1897 (upper bound) × Famine	Value of agricultural equipment 1910 × Famine	Horses 1916 × Famine	Cattle 1916 × Famine	Livestock 1916 × Famine
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ukrainians × Famine	0.051***	0.052***	0.051***	0.051***	0.050***	0.050***	0.046***	0.050***	0.051***	0.051***
	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)	(0.004)	(0.006)	(0.005)	(0.005)
Observations	337	337	337	337	337	337	337	337	337	337
R-squared	0.785	0.788	0.785	0.785	0.785	0.786	0.817	0.785	0.786	0.785

Notes: Observations are at the province and year level. All estimates control for urbanization, urbanization × famine, predicted grain, predicted grain × famine, and province and year fixed effects. Additional controls are stated in the column headings. All income proxies are measured in per capita terms. The standard errors in parentheses are adjusted for spatial correlation within 1,500 km. *** p<0.01, ** p<0.05, * p<0.1

Table A.9: Ukrainian Population Share and Famine Mortality – Controlling for Historical Institutions

	Dependent Variable: Mortality in Year t+1							
	Baseline	Share of catholics 1897 × Famine, Share of orthodox christians 1897 × Famine	Share of serfs 1858 × Famine	Peasant revolts 1895–1914 × Famine	Baseline with info on land 1905	Share of peasant land in repartition commune 1905 × Famine	Share of peasant households in repartition commune 1905 × Famine	Peasant and private land gini 1905 × Famine
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ukrainians × Famine	0.051***	0.053***	0.052***	0.050***	0.043***	0.053***	0.057***	0.040***
	(0.006)	(0.006)	(0.005)	(0.006)	(0.005)	(0.007)	(0.008)	(0.006)
Observations	337	337	337	337	286	286	286	286
R-squared	0.785	0.791	0.787	0.805	0.796	0.803	0.805	0.803

Notes: Observations are at the province and year level. All estimates control for urbanization, urbanization × famine, predicted grain, predicted grain × famine, and province and year fixed effects. Additional controls are stated in the column headings. The standard errors in parentheses are adjusted for spatial correlation within 1,500 km. *** p<0.01, ** p<0.05, * p<0.1

Table A.10: Back-of-the-Envelope Calculation

	Full Sample	Ukraine	Russia	Belarus
		A. Deaths		
(1) 1933 deaths if no famine (famine dummy = 0), mln	2.70	0.52	2.09	0.08
(2) Reported 1933 deaths, mln	4.81	1.86	2.88	0.07
(3) Predicted 1933 deaths (famine dummy = 1, Ukrainian = as reported), mln	4.97	2.03	2.84	0.10
(4) if no bias (famine dummy = 1, Ukrainian = 0), mln	3.22	0.64	2.48	0.10
(5) Total famine deaths: (3) - (1), mln	2.27	1.50	0.74	0.02
(6) if no bias: (4) - (1), mln	0.52	0.12	0.38	0.02
(7) Famine deaths due to bias: 1 - (6) / (5)	0.77	0.92	0.48	0.11
		B. Births		
(1) 1933 births if no famine (famine dummy = 0), mln	4.81	1.02	3.61	0.19
(2) Reported 1933 births, mln	3.25	0.45	2.68	0.12
(3) Predicted 1933 births (famine dummy = 1, Ukrainian = as reported), mln	3.22	0.38	2.70	0.14
(4) if no bias (famine dummy = 1, Ukrainian = 0), mln	3.71	0.76	2.80	0.14
(5) Total missing births: (1) - (3), mln	1.60	0.65	0.90	0.05
(6) if no bias: (1) - (4), mln	1.11	0.26	0.80	0.05
(7) Missing births due to bias: 1 - (6) / (5)	0.31	0.60	0.11	0.02

Panel A uses the estimates from equation (1), Table 2 column (2). Row (1) predicts the number of deaths if there was no famine (if the famine dummy was zero). Row (2) shows reported deaths in our sample. Row (3) predicts the number of deaths in our sample (with the famine dummy equal to one and the share of Ukrainians as reported). Row (4) predicts the number of deaths if there was famine but no Ukrainian bias (if the famine dummy was equal to one, but Ukrainians were zero). Row (5) calculates total famine deaths: the difference between predicted deaths in row 3 and predicted deaths without famine in row 1. Row (6) calculates famine deaths if there were no Ukrainian bias: the difference between predicted deaths in row 4 and predicted deaths without famine in row 1. Row (7) shows the share of famine deaths attributed to Ukrainian bias: one minus the famine deaths without bias from Row (6) divided by total famine deaths from Row (5). Panel B uses the estimates from equation (1), Table 3 Panel B column (1); the calculations are similar to the ones in Panel A.

Table A.11: Heterogenous Effects of Political Factors on Mortality in Ukrainian Areas

	Dependent Variable: Mortality in Year t+1						
	X1 = Grain 1928	X1 = Bolshevik Votes 1917	X1 = Communist Party Members 1922, 27, 31	X1 (X2) = Ethnic Ukrainian (non-Ukrainian) Delegates in 1930 Congress			X1 = Loyalty Principal Component
	(1)	(2)	(3)	(4)		(5)	(6)
Ukrainians × X1 × 1923	-0.387	0.010	-0.013	-0.626**	Ukrainians × X2 × 1923	-0.154*	-0.421**
	(0.237)	(0.355)	(0.008)	(0.316)		(0.087)	(0.176)
Ukrainians × X1 × 1924	-0.776**	0.132	-0.009	-0.827***	Ukrainians × X2 × 1924	-0.510***	-0.386**
	(0.336)	(0.293)	(0.007)	(0.229)		(0.144)	(0.167)
Ukrainians × X1 × 1925	-0.489***	0.104	0.003	-0.478***	Ukrainians × X2 × 1925	-0.197	-0.250**
	(0.165)	(0.250)	(0.004)	(0.150)		(0.167)	(0.102)
Ukrainians × X1 × 1926	-0.839***	-0.065	-0.005	-0.203	Ukrainians × X2 × 1926	-0.135	-0.327**
	(0.232)	(0.241)	(0.005)	(0.189)		(0.131)	(0.146)
Ukrainians × X1 × 1927	-0.802***	-0.165	-0.008	-0.405*	Ukrainians × X2 × 1927	-0.306**	-0.510***
	(0.215)	(0.241)	(0.006)	(0.234)		(0.150)	(0.135)
Ukrainians × X1 × 1928	-0.517**	-0.003	-0.004	-0.592***	Ukrainians × X2 × 1928	-0.211	-0.252*
	(0.238)	(0.245)	(0.006)	(0.226)		(0.173)	(0.153)
Ukrainians × X1 × 1929	-0.157	0.040	-0.001	-0.365	Ukrainians × X2 × 1929	-0.038	0.054
	(0.188)	(0.262)	(0.007)	(0.245)		(0.241)	(0.112)
Ukrainians × X1 × 1930	-0.922***	-0.181	-0.010	-0.757*	Ukrainians × X2 × 1930	-0.468	-0.636**
	(0.332)	(0.233)	(0.007)	(0.419)		(0.349)	(0.257)
Ukrainians × X1 × 1931	0.198	0.154	0.010*	-0.152	Ukrainians × X2 × 1931	0.315	0.353**
	(0.251)	(0.269)	(0.006)	(0.303)		(0.246)	(0.151)
Ukrainians × X1 × 1932	**2.379*** **	**0.970*** **	**0.037** **	**1.303***	**Ukrainians × X2 × 1932**	**2.012*** **	**2.757*** **
	(0.612)	**(0.369)**	**(0.017)**	**(0.768)**		**(0.616)**	**(0.603)**
Ukrainians × X1 × 1933	-0.666***	-0.199	-0.010*	-0.195	Ukrainians × X2 × 1933	-0.204	-0.431*
	(0.215)	(0.243)	(0.006)	(0.572)		(0.487)	(0.222)
Ukrainians × X1 × 1934	-0.989***	-0.237	-0.009	-0.910	Ukrainians × X2 × 1934	-0.595	-0.350**
	(0.352)	(0.307)	(0.007)	(0.785)		(0.671)	(0.175)
Ukrainians × X1 × 1935	-0.989***	-0.237	-0.006	-0.537	Ukrainians × X2 × 1935	-0.362	-0.553**
	(0.324)	(0.224)	(0.006)	(0.797)		(0.591)	(0.263)
Ukrainians × X1 × 1936	-0.815***	-0.068	-0.003	-0.705	Ukrainians × X2 × 1936	-0.322	-0.370**
	(0.277)	(0.256)	(0.007)	(0.720)		(0.556)	(0.188)
Ukrainians × X1 × 1937	-0.459*	-0.172	-0.004	-0.880	Ukrainians × X2 × 1937	-0.348	-0.408**
	(0.266)	(0.237)	(0.008)	(0.702)		(0.450)	(0.163)
Ukrainians × X1 × 1938	-0.565*	-0.096	-0.006	-1.055	Ukrainians × X2 × 1938	-0.281	-0.202
	(0.311)	(0.241)	(0.006)	(0.700)		(0.404)	(0.201)
Ukrainians × X1 × 1939	-0.284	-0.334	-0.009	-0.457	Ukrainians × X2 × 1939	-0.102	-0.158
	(0.332)	(0.311)	(0.007)	(0.851)		(0.379)	(0.187)
Observations	337	337	337			337	337
R-squared	0.918	0.882	0.889			0.932	0.917

Notes: Observations are at the province and year level. The table presents the variable stated in the column heading × Ukrainian population share × year indicators (1922 is omitted for comparison). The regressions control for urbanization × Ukrainians × year indicators, predicted grain × Ukrainians × year indicators and all lower-order interaction terms; and province and year fixed effects. Columns 4 and 5 show coefficients from one regression. The standard errors in parentheses are adjusted for spatial correlation within 1,500 km. *** p<0.01, ** p<0.05, * p<0.1

Table A.12: Heterogenous Relationship of Peasant Resistance and Various Outcomes in Ukrainian Areas

	Dependent Variable:					
	Mortality in year t+1	Natality in year t+1	Collectivization (Share of HHs in Collective Farms)	Exposure to Collectivization (Cumulative sum of Collectivization rate since 1927)	Procurement Share (Procurement/Production)	Mechanization (Tractors' Horse Power/Grain 1928)
	(1)	(2)	(3)	(4)	(5)	(6)
Ukrainians × Resistance × Famine	0.049***	-0.019***	0.197**	0.583***	0.235***	-5.497***
	(0.007)	(0.003)	(0.082)	(0.116)	(0.056)	(1.091)
Resistance × Famine	0.002***	-0.0001	0.031*	0.012	0.010	0.122
	(0.001)	(0.0003)	(0.019)	(0.009)	(0.009)	(0.195)
Ukrainians × Famine	0.310***	-0.110***	1.589**	0.734	1.875***	-27.785***
	(0.073)	(0.017)	(0.691)	(0.670)	(0.312)	(7.631)
Observations	337	337	228	228	186	247
R-squared	0.854	0.839	0.968	0.986	0.878	0.874

Notes: Observations are at the province and year level. All estimates control for Ukrainians × predicted grain × famine, Ukrainians × urbanization × famine, all lower-level terms, and province and year fixed effects. Standard errors are adjusted for spatial correlation within 1,500 km. *** p<0.01, ** p<0.05, * p<0.1

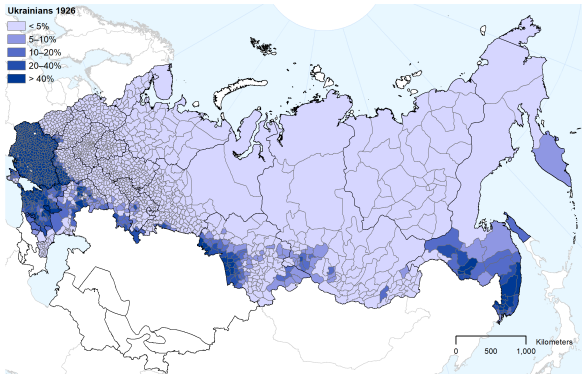
Figure A.1: Maps

(a) Province Excess Mortality 1933 and Grain-Producing Regions

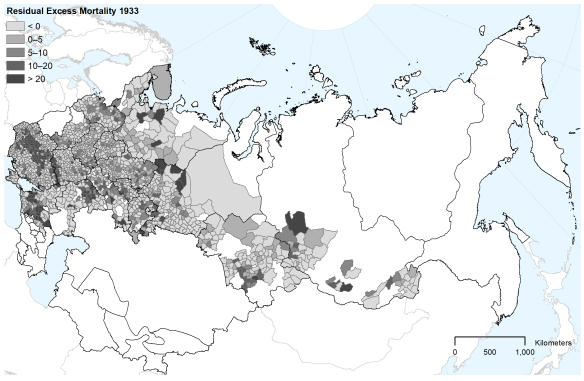
(b) Province Ethnic Ukrainians (1926) and Grain-Producing Regions

(c) District Excess Mortality 1933

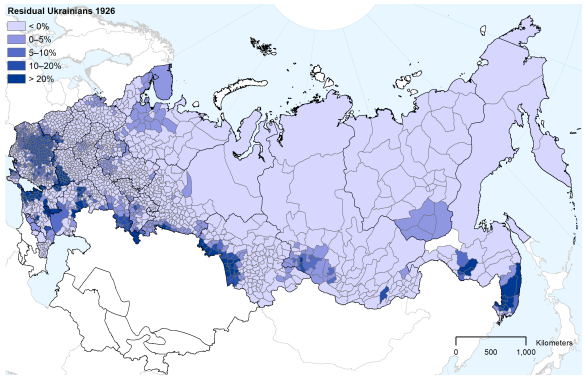
(d) District Ethnic Ukrainians 1926



(e) District Excess Mortality 1933 Demeaned by Province Fixed Effects



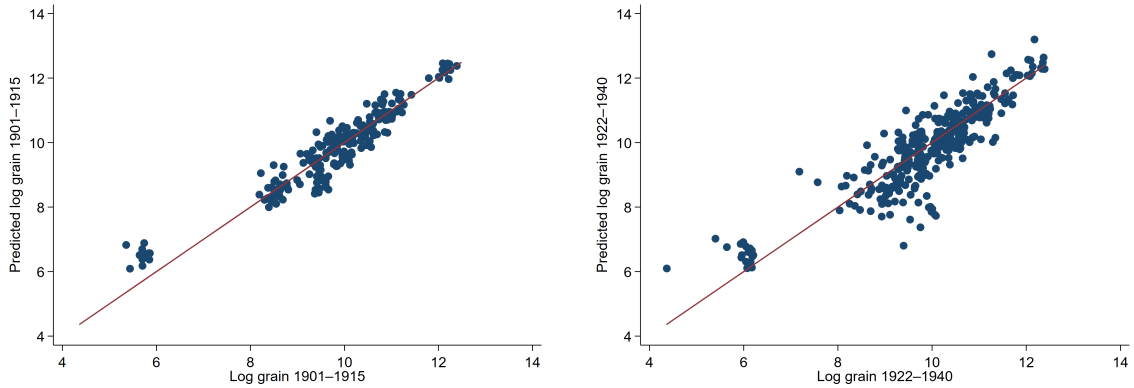
(f) District Ethnic Ukrainians 1926 Demeaned by Province Fixed Effects



Notes: Excess mortality 1933 is mortality in 1933 minus mortality in 1928. Ethnic Ukrainians 1926 is the share of ethnic Ukrainians in the rural population according to the 1926 Population Census.

Figure A.2: Reported and Predicted Grain

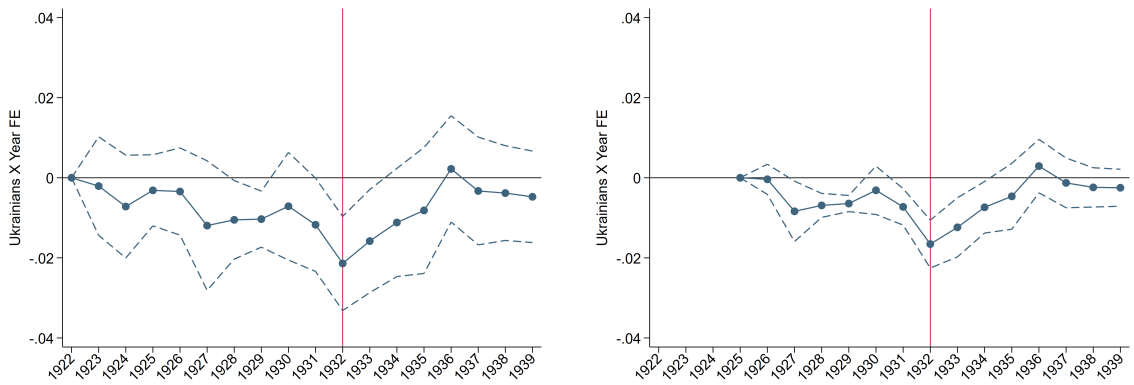
(a) In-Sample Fit, $R^2 = 0.90$ (b) Out-of-Sample Fit, $R^2 = 0.77$



Notes: Log reported grain is plotted against log predicted grain with a 45-degree line for 1901–1915, a sample on which grain production function is estimated (in-sample fit) in Figure A.2, and for 1922–1940 (out-of-sample fit) in Figure A.2a. See Appendix section C for details.

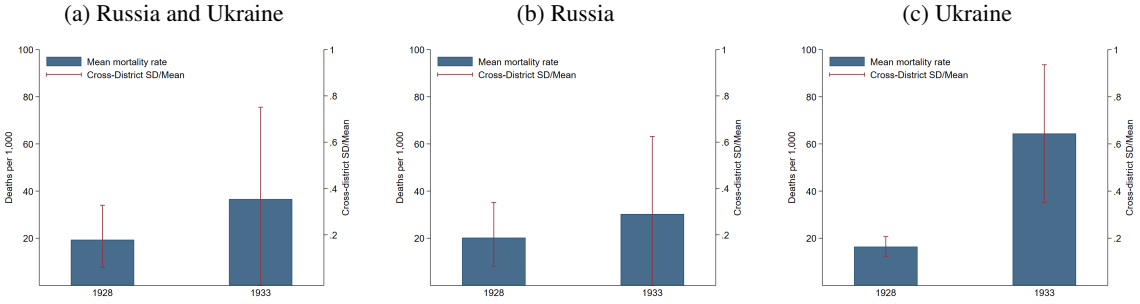
Figure A.3: The Dynamic Relationship Between Ukrainian Population Share and Natality

(a) Total Natality (b) Rural Natality



Notes: The figures show the interaction coefficients of Ukrainian population share and year dummy variables with their 95% confidence intervals. Figures A.3a and A.3b plot estimates from two regressions. The estimates and their standard errors are presented in Appendix Table A.6.

Figure A.4: Cross-District Mean and Standard Deviation of Mortality Rates



Notes: Mean mortality rate is the average mortality rate across districts in each year. Cross-district SD/Mean is the standard deviation in mortality rates across districts in year t divided by the mean mortality rate in year t.