# *The Political Economy of Famine: The Ukrainian Famine of 1933*

NATALYA NAUMENKO

The 1933 Ukrainian famine killed as many as 2.6 million people out of a population of 32 million. Historians offer three main explanations: weather, economic policies, genocide. This paper documents that (1) available data do not support weather as the main explanation: 1931 and 1932 weather predicts harvest roughly equal to the 1924–1929 average; weather explains up to 8.1 percent of excess deaths. (2) Policies (collectivization of agriculture and the lack of favored industries) significantly increased famine mortality; collectivization explains up to 52 percent of excess deaths. (3) There is some evidence that ethnic Ukrainians and Germans were discriminated against.

By the beginning of the twentieth century, Europe was largely free from peacetime famine (Alfani and Ó Gráda 2017). One major exception was the 1933 Soviet famine, which killed six to eight million people; at least 40 percent of the deaths occurred in the Soviet Ukraine.[1,2]

*The Journal of Economic History*, Vol. 81, No. 1 (March 2021).  doi: 10.1017/S0022050720000625

Natalya Naumenko is Assistant Professor, Department of Economics, George Mason University, 4500 Roberts Rd, Carow Hall, Office 10, Fairfax, VA, 22032. E-mail: nnaumenk@gmu.edu.

For helpful comments and support, I thank Maxim Ananyev, Dan Bogart, Joseph Ferrie, Carola Frydman, Andrei Markevich, Cormac Ó Gráda, Yannay Spitzer, two anonymous referees, seminar participants and conference audiences at Northwestern University, Oxford Graduate Workshop in Economic and Social History (2016), LSE Workshop in Economic History "Command Economies and State Intervention in Economic History" (2016), Economic History Society Annual Conference 2017 in London, the World Congress of Cliometrics 2017 in Strasbourg, "The Greatest Economic Experiment Ever: The Economic Consequences of the October Revolution" conference at Northwestern University 2017, and the NES 25th Anniversary Conference in Moscow 2017. I express my most profound gratitude to my mentors Joel Mokyr and Nancy Qian. This research is supported by the Balzan Foundation and by the Economic History Center at Northwestern University.

[1] The famine spanned several years. According to historical reports, some areas of Ukraine had already begun starving in 1932, and some excess mortality occurred as late as 1934. However, the famine peaked in the winter and spring of 1933; for simplicity, I refer to it as the 1933 famine.

[2] Conquest estimates population losses due to collectivization, arrests, and deportations, and famine to be 14.5 million, of which 7 million were directly due to the famine (Conquest 1986, ch. 16, p. 306). Andreyev, Darskiy, and Khar'kova (1990) measure excess mortality due to the famine at 8.5 million. Davies and Wheatcroft argue that projections in Andreyev, Darskiy, and Khar'kova (1990) do not account for under-registration of infant mortality and of mortality in less-developed Soviet republics; they estimate excess mortality to be 5.7 million (Davies and Wheatcroft 2004, ch. 13, p. 415). In 2008 the Russian Parliament issued a special decree stating that 7 million people perished in the Soviet Union during this famine (State Duma of the Russian Federation 2008). In Ukraine, a team of researchers from the Institute for Demography and Social Studies headed by Ella Libanova, estimated direct losses for Ukraine alone to be 3.4 million (Libanova 2008). More recently, Meslé, Vallin, and Andreev (2013) argued that Ukraine was "missing" 4.6 million people by the 1939 census, including 2.6 million due to excess mortality. A team of researchers associated with the Harvard Ukrainian Research Institute estimated direct population losses in Ukraine to be 4.5 million, including 3.9 million excess deaths and 0.6 million lost births (Rudnytskyi et al. 2015).

In 1928, the Soviet Union was one of the 30 richest countries in the world (Maddison 1995, Appendix D), and the Soviet economy was rapidly growing (Markevich and Harrison 2011). How, then, could almost 10 percent of the population die of starvation and hunger-induced diseases in Ukraine, a territory famous for its grain production and known as the "grain basket" of the Soviet Union?

Three main explanations have been offered: weather, government policies, and genocide. Davies and Wheatcroft (2004), while documenting the imbalances and atrocities of the Soviet government policies, argue that the draught of 1931 was the main cause of the famine. Tauger (2001) claims that an unusually high number of pests and widespread grain diseases destroyed the 1932 harvest. Proponents of the genocide theory claim that bad weather could not have caused a disaster of such magnitude, and therefore, the famine must have been a result of the government intentionally targeting ethnic Ukrainians. This is essentially the argument in Conquest (1986), in Graziosi (2015), and in popular books by Snyder (2010) and Applebaum (2017).[3]

The main limitation of previous studies is the lack of systematic disaggregated data that are large enough for rigorous statistical analysis. This is the principal contribution of my paper. I use hand-collected data on the course of the 1933 famine in Ukraine. My dataset combines 1933 mortality from the archives in Moscow with prefamine characteristics from published sources found in libraries in Kiev, Kharkov, the United States, and Canada.[4]

In short, this paper documents three conclusions. (1) Available data do not support weather as the main explanation: in 1931 and 1932, weather predicts harvests roughly equal to the 1924–1929 average; weather explains up to 8.1 percent of excess deaths. (2) Government policies (collectivization of agriculture and the lack of favored industries) significantly increased famine mortality; collectivization explains up to 52 percent of excess deaths. (3) There is some evidence that ethnic Ukrainians and Germans were discriminated against: they were more likely to die than other ethnic groups, even when exposure to economic policies is controlled for (although this result is not statistically significant), and ethnic Ukrainians were more collectivized in 1930.

[3] According to Stephen Wheatcroft, Robert Conquest later changed his opinion about the genocide theory. See Wheatcroft's speech at the roundtable, "The scale and causes of the 1931–33 famine and whether the Holodomor should be classified as a genocide," 21 March 2009, http://www.famine.unimelb.edu.au/21mar2009.php (accessed 13 August 2019).

[4] A team of researchers affiliated with the Harvard Ukrainian Research Institute's Mapa project reported 1933 mortality and 1927 ethnic composition but did not have much information on the state of the Ukrainian economy before the famine: http://gis.huri.harvard.edu/ (accessed 11 August 2019).

My study proceeds as follows. First, I consider aggregate data for the whole of Ukraine. I show that officially reported harvests and procurement are inconsistent with the severity of the 1933 famine—rural grain retention is too high in 1931 and 1932, the two crucial years before the famine peaked in the winter and spring of 1933. Historians argue that official harvest figures are inflated and that weather (drought in June 1931 and severe rains in July 1932 (Davies and Wheatcroft 2004) or grain diseases and pests (Tauger 2001) destroyed the harvest. I demonstrate that there was no drought in Ukraine in 1931 and that although there were severe rains in June (not July) 1932, heavy rains also occurred in June 1933, and the harvest that year was reportedly good. I also demonstrate that, in the years preceding the 1933 famine, published archival documents do not discuss the weather, grain diseases, or pests more than usual. I then estimate grain production function using pre-1917 data and predict how much grain should have been produced. The predicted harvest is close to the officially reported harvest, so if a gap existed between the officially reported and the true harvest (and there must have been, because otherwise, rural retention is too high), in Ukraine, this gap is not predicted by the weather.

Next, I turn to policies specific to the 1933 famine. In 1929, the government launched a comprehensive collectivization campaign. Peasants were forced to give up their land, implements, and livestock and to join collective farms where they were supposed to work together. The government banned private trading of food; instead, it procured food from the countryside and rationed it in urban areas. Motivated by the historical context, I focus on three related policies that affected food production, procurement, and distribution: collectivization, measured as a share of rural households in collective farms in 1930; procurement, proxied by distance to a railroad (presumably, the farther an area was from a railroad, the more expensive it was to procure grain from it), and the presence of industries that received preferential treatment (important for the implementation of the five-year plan the so-called Group A industries which received better food supply).

I study the relationship between local weather, government policies, and famine mortality, using both cross-sectional (on smaller units) and difference-in-differences (on larger units) approaches. In all estimates, I control for prefamine characteristics, capturing wealth, economic development, grain productivity, and alternative food sources. To compare the impact of policies with the impact of weather, I include local weather in the controls (de-meaned June 1931 temperature and de-meaned June 1932 precipitation). I show that a higher share of rural households in collective farms in 1930 is associated with higher 1933 mortality and argue that the relationship is causal. I demonstrate that, consistent with historical accounts, collectivization of agriculture led to a drop in livestock and that the larger the collective farms were, the higher the famine mortality was, presumably because of higher managerial and monitoring costs in larger collectives. These findings, combined with historical accounts of poor harvests, are consistent with collectivization decreasing agricultural productivity. In addition, although the magnitude of the effect is much smaller than the impact of collectivization, I show that areas with favored industries experienced lower mortality in 1933, consistent with the accounts that these areas were better supplied. And, surprisingly, I find no strong evidence that access to railroads affected mortality. My calculations show that rainfall in June 1932 explains up to 8.1 percent of excess deaths and that collectivization explains up to 52 percent of excess deaths.[5] I conclude that the weather cannot be the main explanation for the famine in Ukraine.

Finally, I use the variation in rural ethnic composition within Ukraine to see how famine mortality changed with ethnic composition. I show that there is a positive, although statistically weak relationship, between ethnic Ukrainians and Germans and 1933 mortality rates, even after controlling for government policies. I also demonstrate that *exposure* to the above policies varied with ethnic composition: ethnic Ukrainians were more collectivized, and ethnic Ukrainians and Germans both had fewer favored industries.[6] However, I find no evidence that *enforcement* of the government policies varied with ethnic composition: the interactions between the share of Ukrainians (or Germans) in rural population and policy proxies are not associated with increased famine mortality. The finding that Ukrainians were more likely to be collectivized and less likely to have favored industries, together with the finding that both of these policies affected famine mortality, suggests that higher Ukrainian famine mortality is partly a product of higher Ukrainian exposure to bad Soviet policies. Ethnic composition varies little across Ukraine (more than 80 percent of rural population are ethnic Ukrainians), and in my sample, the positive relationship between ethnic Ukrainians, Germans, and 1933 mortality is statistically weak. More work is needed before making strong claims about the role of ethnicity in this famine.

[5] The warmer June 1931 is associated with *lower* 1933 mortality in Ukraine, so to give the weather the maximum possible effect, I calculate only the impact of 1932 rainfall.

[6] This is *not* proof of genocide. The location of industries was, to a large extent, determined by resource endowments or by historical factors predating the famine; for example, coal mining in the Donbass area.

There is a large historical literature on the course and causes of the 1933 Soviet famine.[7] My paper is the first to use detailed microdata and to systematically test and quantify the main explanations offered by historians. It also contributes to an economics literature on collectivization of agriculture and famines in command economies. Most studies concentrate on the Great Chinese Famine of 1959–1961: Li and Yang (2005) attribute 61 percent of the drop in agricultural output to the government policies of collectivization and grain procurement; Meng, Qian, and Yared (2015) argue that an inflexible procurement system significantly contributed to famine mortality; Chen and Lan (2017) study the killing of draft animals during collectivization in China and its impact on grain production; Lin (1990) offers a theoretical model arguing that after exiting from collectives was banned in China, peasants lost the incentives to discipline themselves, and the resulting drop in production contributed to the famine. My paper is the first to study Soviet collectivization, which predated and, to some extent, informed later Chinese collectivization efforts. Finally, this paper adds to the literature on the economic transformation and industrialization of the Soviet economy: Allen (2003) claims that the "big push" policies launched in 1928 made the Soviet economy one of the most successful developing economies in the twentieth century; Cheremukhin et al. (2017) argue instead that the reduction of entry barriers in manufacturing and not the "big push" was the main driver behind rapid Soviet industrialization; Rozenas and Zhukov (2019) study short- and long-term political implications of the 1933 famine. My paper complements these studies by improving our understanding of collectivization, an integral part of the history of Stalin's industrialization efforts.

## BACKGROUND

This section presents a stylized, truncated summary of events preceding the 1933 famine, its course, and subsequent institutional changes. Litoshenko (2001), Lewin (1968), Shanin (1972), and Danilov (2011) study peasantry and the state of Soviet agriculture in the 1920s, before

[7] Tauger (1991, 2001) discusses the 1931 and 1932 harvests, weather, and environmental conditions. Davies and Wheatcroft (2004) give a detailed account of grain production and procurement and argue that the drought of 1931 triggered the famine. Hunter (1988) and Viola (1996) document that collectivization resulted in a significant drop in the amount of livestock and discuss the resulting negative effects. Conquest (1986) notes that killing and deportation of the richest and most productive peasants must have harmed grain production. Graziosi (2015) and Snyder (2010), along with many Ukrainian historians, argue that the famine in Ukraine was a genocide against ethnic Ukrainians. Ellman (2007) claims that starvation was a cheap substitute for deportations and mass killings and that Stalin starved the disloyal rural population to death instead of deporting and shooting more peasants.

collectivization.[8] Davies (1980) describes early Soviet collective farms. Davies and Wheatcroft (2004) present a detailed history of the famine. Ó Gráda (2009) and Alfani and Ó Gráda (2017) put the 1933 famine in the context of famines in world history. Cameron (2018) studies the 1930–1933 famine in Kazakhstan. Kotkin (2017) explores Stalin's role in this historical episode.

In 1914, the Russian Empire entered into WWI. Amid a series of military disasters, the government's popularity plummeted culminating in the revolution of 1917. After a period of civil war, the Communist Party seized control over the newly created Soviet Union and then attempted to introduce "communism." It abolished money and private property, prohibited private trade, and relied on arbitrary and unpredictable requisitions of "surplus" grain from peasants to feed the urban population.[9] Grain requisitions (*prodrazverstka*) led to a disastrous decrease in sown area and grain production, and, possibly exacerbated by poor weather, to the rural famine of 1921–1923, which was especially severe in Russia's Volga region (Adamets 2002).

Unable to organize production in the nationalized factories and desperately trying to recover the ruined economy, Lenin declared a temporary retreat from pure socialist ideals and introduced the New Economic Policy (NEP) in 1921. Under NEP, small industrial enterprises were denationalized, allowing firms to make their own decisions. In the countryside, an agricultural tax (*prodnalog*) replaced arbitrary food requisitions. After paying taxes, peasants were free to sell their produce to several competing government procurement organizations or to deliver it directly to markets in the cities. This resulted in rapid economic growth. Paul Gregory estimates that by 1928 agricultural output was 111 percent of the 1913 level, and industrial output was 129 percent of the 1913 level (Gregory 1994, ch. 5, table 5.2). Markevich and Harrison (2011) estimate that in 1927 net national income per capita was 96.9 percent of the 1913 level (Markevich and Harrison 2011, table 6).[10]

In 1927 and 1928, the government reduced the procurement price of grain while maintaining high prices of industrial goods. In response,

[8] Lev Litoshenko (1886–1943) was a Russian economist and a specialist in agricultural markets. In 1926–1927, he visited Stanford University, where he worked on a manuscript on Russian peasantry. In 1930, he was arrested, together with Alexander Chayanov, Nikolai Kondratiev, and others. Litoshenko perished in one of the Gulag camps in 1943. His manuscript was rediscovered in the Hoover Institution Archives and was published in 2001.

[9] To supply the army, grain requisitions were introduced in 1916 by the Imperial government but were expanded and became the main food policy in the early Communist regime.

[10] Despite WWI, civil war, and famine losses, the total population residing in the Soviet territory increased from 1913 to 1927, so, consistent with Gregory (1994), total net national income increased, but per capita numbers did not grow.

peasants started substituting away from grain to more favorably priced animal products and industrial crops or keeping harvested grain to themselves, either waiting for prices to rise again or using the grain as fodder. A crisis followed: procurement numbers were much lower than planned, and the urban food supply was in danger. Thus, to guarantee grain supply at below-market prices, the government had to seize control of production (Gregory and Mokhtari 1993; Kotkin 2014, ch. 14).

By the late 1920s, Stalin consolidated power within the Communist Party. In 1928, he launched the first five-year plan for the economic development of the Soviet Union. A year later, comprehensive collectivization and dekulakization (the liquidation of "kulaks," relatively well-off peasants) campaigns were launched.[11] The Communist Party sent a massive number of Communists and Komsomol members to the countryside.[12] There, they employed all available methods to induce peasants to join collective farms, from promises of future prosperity, agronomists, and tractors, to open threats and coercion.[13] Peasants, attracted by the promises or scared by the threat of dekulakization, started joining collective farms. In Ukraine, the collectivization rate increased from a mere 3.8 percent in June 1928 to 8.5 percent in June 1929, to 16 percent in October 1929, and to 45 percent in May 1930 (see Figure 1). By 1932, 69 percent of rural households had joined collective farms, and 80 percent of the sown area was collectivized.

In collective farms, most of the land, livestock, and implements belonged to the collectives. Members did not decide what and when to plant—the government sent plans. Harvested grain was put directly into the collective farms' storage. After the government took its share, the remaining produce was divided among the members. Often it was divided in proportion to the members' family sizes, not to the amount

[11] An often repeated but outdated view is that Stalin started the collectivization campaign to defeat his political opponents Bukharin, Rykov, and Tomsky, who were against radical collectivization. Allen (2003) argues that collectivization of agriculture was necessary to extract resources from the countryside to pay for rapid industrialization. Cheremukhin et al. (2017) indirectly oppose this view by arguing that reducing entry barriers and monopoly power in the nonagricultural sector was the main driver of Soviet industrialization. Kontorovich (2015) argues that industrialization was rushed due to military considerations. Kotkin (2014) states that Stalin was a true communist believer and could not allow capitalism in the countryside for ideological reasons; therefore, Stalin started collectivization as soon as he got rid of vocal opponents and cemented his dictatorship within the Party.

[12] Komsomol was a political youth organization controlled by the Communist Party.

[13] A Komsomol member talking to a young peasant: "Just think about it [. . . ] All the land will be collectivized, so the kolkhoz will have plenty of it; all the horses will be in the same stable in the large collective farm yard; all the machines – harvesting, sowing, and threshing – will stand next to each other in the same collective farm yard. With all that land and all those horses and machines – if you just work hard, you will be well-fed and well-dressed" (Solovieva 2000, p. 237).

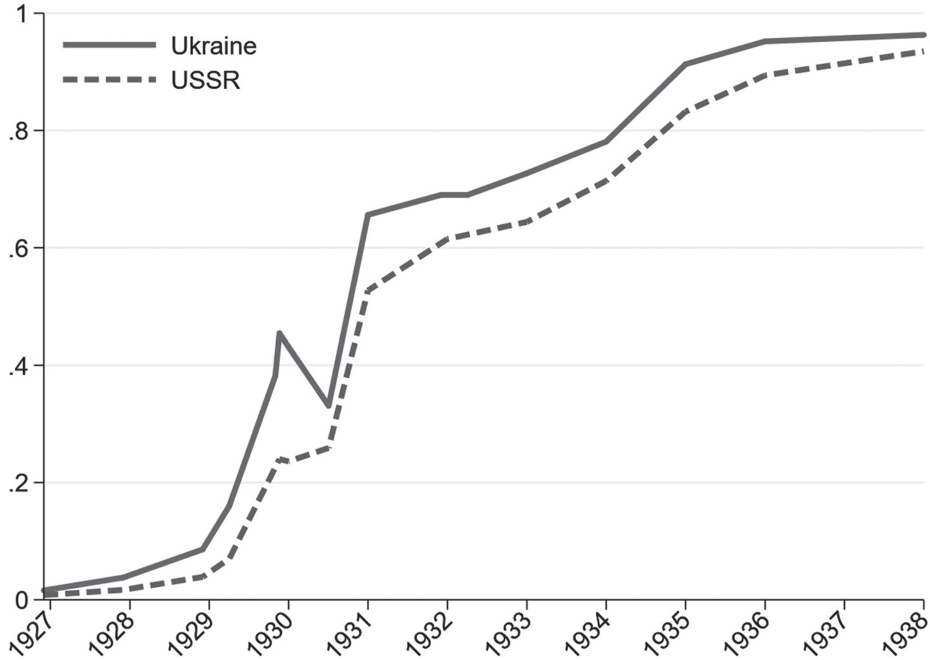



FIGURE 1
COLLECTIVIZATION RATE

*Note*: Share or rural households in collective farms.
*Source:* See notes to Appendix Table E1.

of work done. Some private plots existed, but they were insufficient for subsistence. The remaining individual peasants were given the worst land, received extremely high procurement quotas, were in constant danger of being declared a "kulak" or a "kulak henchman," and were generally harassed and abused by local officials. Private trade of foodstuffs was banned, and the government introduced a rationing system in the cities (Davies 1980).

Economic policies of the late 1920s affected all aspects of food production and distribution in society. Production might have been impaired because the plans were often late and inconsistent with local conditions. Since government procurement was unpredictable, and the remaining collective produce was often divided according to the members' family size, collective farm members' wages depended less on effort and marginal productivity. Peasants sometimes slaughtered their livestock over giving it to the collectives, thus decreasing draught power.[14] Collective farm

[14] From 1929 to 1932, the number of horses in the Soviet Union declined by 42 percent, cattle by 40 percent (Viola 1996, p. 70).

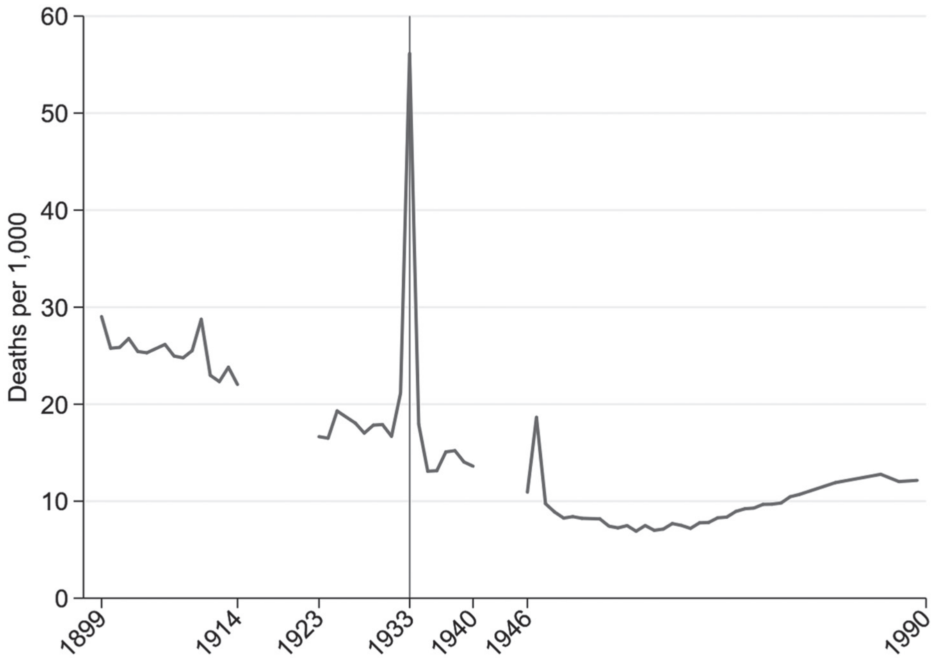



FIGURE 2
MORTALITY IN UKRAINE

*Note*: Constant administrative borders.
*Source:* Author's calculations.

chairmen were punished for poor results and might have had incentives to over-report production.[15] Finally, since food distribution was mostly under government control, the government could have better supplied sectors of the economy it deemed more important.

1930, the first year when the collectivized sector was a substantial share of agriculture, was a good year—the harvest was above average, and grain collection went smoothly. However, trouble followed in 1931 and 1932. By anecdotal accounts, the harvest was below expectations, and grain collection was difficult. The government was not willing to accept the low harvest estimates and made an extreme effort to procure as much grain as planned (Davies and Wheatcroft 2004). People in the countryside started to starve. The famine peaked in the winter and spring of 1933, after the 1932 harvest. Figure 2 shows the average death rate in Ukraine from 1899 to 1990.[16] During the 1933 famine, the average

[15] Liu and Zhou (2019) study the bureaucrats' incentives during the Great Chinese Famine and argue that the higher gap between planned and realized yield was associated with higher over-reporting of production.

[16] Unfortunately, no reliable data are available for the crisis periods of 1917–1922 and 1941–1945.

https://doi.org/10.1017/S0022050720000625 Published online by Cambridge University Press

mortality was more than triple the 1923–1931 level, spiking from roughly 18 per thousand to 56 per thousand.

In 1933, the government changed the system.[17] Procurement quotas would now be based on the sown area of the collective farm, and local officials were banned from imposing additional quotas. The collectivization campaign continued, and by 1939 almost all Soviet peasants had to work in collective farms. But while earlier government efforts aimed to collectivize all land and livestock, now collective farm members were allowed to keep a small private plot and some livestock, and, after paying taxes, to sell their private produce in the cities on "kolkhoz markets" with free prices. Thus, a subsidiary private economy was created, guaranteeing peasants subsistence. In 1934, in a direct reversal of early collectivization policies, the government launched a campaign to ensure that every collectivized household had a private cow. For decades to come, these small private holdings produced most of the vegetables and animal products available to Soviet citizens.[18,19]

[17] Officially the changes were introduced in August 1932, but they did not take effect until after the famine.

[18] Fedor Belov was a collective farm chairman from 1947 to 1949 in Ukraine who later defected to the West. His detailed account of the life and operations of a collective farm is a fascinating read for anyone interested in the topic. In particular, Belov says that (italics mine) "By law, the individual household consists of a house, a homestead plot, implements, and livestock. The right to this property is contingent on membership in the kolkhoz and on participation in its labor by the members of the household. The household does not have the right to transfer ownership of its plot. *Persistent slacking by members of the household is punished by the loss of the homestead plot which forces individual peasants to participate in the collective work of the kolkhoz, even though such work is very unrewarding.*" (Belov 1956, p. 176), and "Under the regulations of the kolkhoz this [income paid to the members by the collective farm] is regarded as the principal income, and what is earned from the homestead plots is regarded as entirely subsidiary. In fact, however, *it was the plots which saved the majority of households from starvation*. The homestead plot of a typical household consisted of about half a hectare, of which perhaps 10 per cent would be occupied by the house and farm buildings and an equal amount by the orchard. The remainder would be planted with cereal grains, including corn, and with potatoes, hemp or flax, oil seeds, and vegetables. The homestead plot was intensively cultivated. If a peasant grew corn, he would also plant beans on the same area, and perhaps sunflowers and pumpkins as well, while on the potato plot he would plant beets, beans and other vegetables. If the household owned a cow or a calf, the area under grain would be plowed up immediately after the harvest and planted with millet; the millet did not have time to ripen, but it made a good hay which was used for fodder. Most kolkhoz members spent a great deal of time on their plots, weeding and watering late in the evening if they had no time during the day" (Belov 1956, p. 179).

[19] Later agriculture was collectivized following variations of this reformed model in the countries occupied by the Soviet Union and the Soviet satellites: Albania, Bulgaria, Czechoslovakia, East Germany, Estonia, Hungary, Latvia, Lithuania, and Romania (Iordachi and Bauerkämper 2014). Cambodia implemented its version of collectivization under the Red Khmers with disastrous consequences. North Korea collectivized agriculture and suffered from famines well into the 1990s. Cuba, Laos, and Tanzania all attempted their versions of forced collectivization. In each country, the institutional details of collectivization were different, and specific studies of the consequences are necessary. Interestingly, according to Dikötter (2010), Stalin urged Mao not to push collectivization, so the reforms proceeded in China only after Stalin's death.

## DATA

I use three data sources: famine mortality from the archives in Moscow, historical weather reported by climatologists, and government policy proxies and prefamine economic characteristics from published statistical books, including the 1927 Soviet census.[20] Appendix Table E3 shows the exact source of every variable.

I collected 1933 district mortality data in the Russian State Archive of the Economy (RSAE).[21] These data were recently discovered by Stephen Wheatcroft in a secret part of the TsUNKhU[22] archives. In Belarus, Russia, and Ukraine, an elaborate system of civil acts registration was in place. Wheatcroft and Garnaut (2013) explain that, possibly due to unbelievably high provincial mortality figures, TsUNKhU demographers in Moscow requested original district data from province statisticians. Consequently, very fine disaggregated data survived in the archives in Moscow. While the crisis must have affected the quality of registration, Wheatcroft (2013) argues that the data are still sufficiently reliable.

The 1933 district-level demographic data include average 1933 population; number of deaths, births, and the deaths of children younger than one year; and number of marriages and divorces. As a rule, whenever possible, deaths were attributed to the district where the person resided, not where they died, so mortality figures reflect the geographic distribution of the crisis. For Ukraine, there are two slightly different versions of the demographic data: the first includes in death figures only residents of the area, while the second adds all the dead with an unknown residence to the rural deaths of the district where they died.[23] I use the first version (RSAE 1562/329/18, p. 1–16), as the correlation between the two versions is 0.995.[24] I calculate mortality as the number of deaths divided by the average population and natality as the number of live births divided by the average population; Figure 3a maps 1933 mortality. It shows that within Ukraine, famine severity varied substantially and that traditionally grain-producing south-east (steppe) areas were not the ones hit the most.[25]

Historical weather data are from professional climatologists Matsuura and Willmott (2014). They use raw weather station reports to provide

[20] The census took place on 17 December 1926. Since all other Soviet censuses occurred in January, I refer to it as the 1927 census.

[21] Districts were the smallest administrative units in the Soviet Union, similar to U.S. counties.

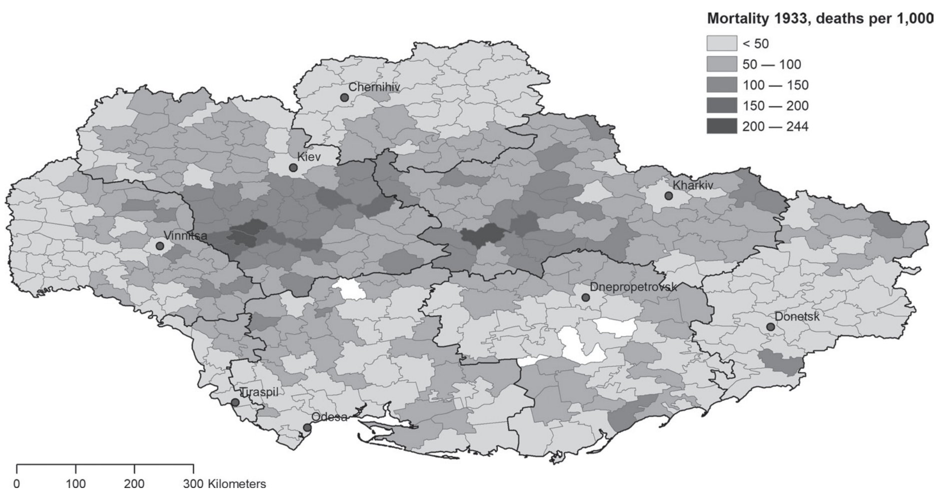
[22] The Central Statistical Administration of Gosplan; Russian, Tsentral'noye Upravleniye Narodnokhozyaystvennogo Ucheta Gosplana SSSR (TsUNKhU).

[23] See comment in RSAE 1562/329/18, p. 77–80.

[24] Estimates using the second version are available upon request.

[25] Appendix Figure A1b shows 1925 grain production per capita.

(a) Mortality 1933




(b) Collectivization 1930

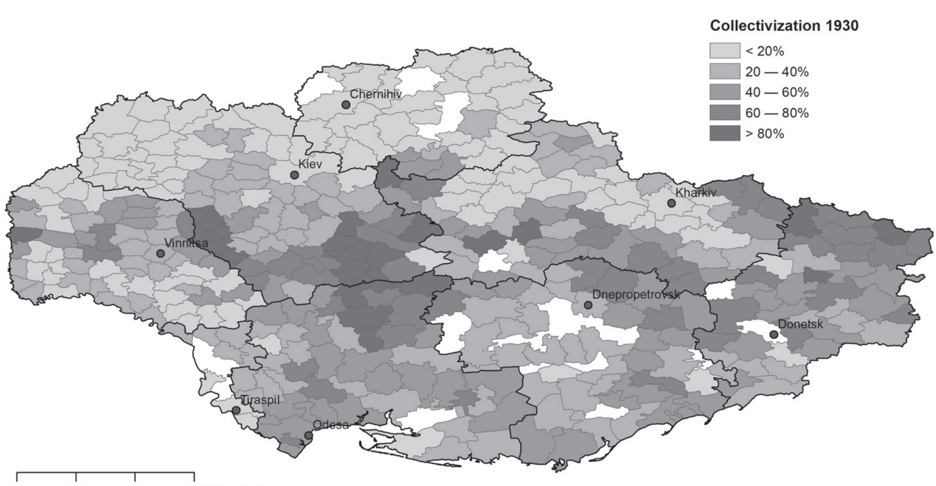



FIGURE 3
MAPS OF EARLY COLLECTIVIZATION AND FAMINE MORTALITY IN UKRAINE

*Note*: Thick lines are province borders as of 1 January 1934.
*Source*: See Appendix Table E3.

average monthly temperature and total monthly precipitation on a 0.5×0.5-degree grid starting in 1900. For robustness checks and to go further back in time, I interpolate raw station reports from Rennie et al. (2014) (monthly temperature only). The details are in Appendix B.4. I also consider daily weather station reports from Razuvaev et al. (1993).

Historical weather data are less accurate than present-day data: Razuvaev et al. (1993) and Rennie et al. (2014) report information from fewer than 200 weather stations in the whole Soviet Union (the number of stations varied year to year, generally increasing with time). Interpolated historical weather is especially problematic for rugged areas (Dell 2010). However, the territory of 1933 Ukraine is relatively flat, and these data are the best available now; recent works using them include Markevich and Zhuravskaya (2018) and Rozenas and Zhukov (2019).

The 1930 collectivization data come from published sources. In 1930, the disastrous famine was not yet anticipated, and many state organizations celebrated and advertised collectivization, publishing detailed statistics on its progress. As the primary source of collectivization data, I use a survey conducted on May 1, 1930, that covered the whole Soviet Union. From this survey, I collect district collectivization rates (share of rural households in collective farms) and the average number of households per collective farm in a district. Figure 3b maps 1930 collectivization rate. The Harvard Ukrainian Research Institute (HURI) kindly shared 1932 district collectivization rates with me, which I use for robustness checks.[26]

From various statistical publications, I collected all other prefamine characteristics and policy proxies: the number of industrial workers in 1930, amount of agricultural equipment in 1925, and livestock and average long-term grain production as reported in 1925.[27] Data on population, urbanization, and ethnic composition come from the 1927 census, the most detailed and best published Soviet census. Using a digitized map of 1933 railroads, I calculate the distance to a railroad as the distance from the district centroid to the nearest railroad line. While most of Ukraine was considered fertile, a small Polissia (literally, forest) area in the north was closer to Belarus in its agroclimatic characteristics. I mark Polissia districts, some 10 percent of the Ukrainian territory, using the classification in the 1927 census. Administrative divisions changed from 1925 to 1927, to 1930, and to 1933. I use 1925, 1927, and 1933 maps to calculate data on 1933 administrative borders, and I match 1930 districts to 1933 districts by name; details are in Appendix A.1.

[26] I prefer using 1930 collectivization because it would later allow for comparison with other Soviet republics, especially Belarus and Russia. To my knowledge, detailed 1932 collectivization figures are available only for Ukraine. Plus, in 1932, the crisis was already apparent, so 1932 collectivization raises reverse causality concerns: what if peasants joined collectives because of the imminent famine?

[27] The books I have report actual 1925 grain sown area and "average long-term yield of field crops (according to the 1925 sample census)." I multiply the actual sown area by this long-term yield to obtain average long-term grain production as reported in 1925 (in short, average grain per capita 1925). In robustness checks, I replace it with the grain suitability index from the FAO GAEZ database.

1927 and 1928 mortality comes from the Ukrainian statistical yearbooks published in 1928 and 1929. Unfortunately, no rural-urban division is available, and these data are more aggregated; only numbers for 41 larger regions were published.

Because I want to use both aggregated prefamine mortality and more detailed district data, I construct two datasets: a cross-section of 287 districts with information on 1933 mortality and all prefamine characteristics, and a short panel of 38 regions that includes information on 1927, 1928, and 1933 mortality. Appendix Table A1 reports summary statistics of all variables in both datasets. The average prefamine mortality in Ukraine was about 18 per 1,000, as compared to 59 per 1,000 in 1933. The 1930 collectivization rate was roughly 36 percent, but it varied from less than 3 percent to more than 90 percent. On average, the newly created collective farms consisted of some 90 households, but the size varied widely, from just 14 households to more than 500. In 1927, Ukraine was an agrarian republic; more than 80 percent of the population resided in the countryside. Few workers were employed in the crucial for the first five-year plan Group A industries—on average just eight per 1,000 district inhabitants. Most of the rural population had Ukrainian ethnicity, although some districts were predominantly Russian or German.

Ukraine consisted of 392 districts and 41 regions, but because I combine many different sources, my final datasets include only 287 districts and 38 regions. Unlike other prefamine characteristics, information on birth and death rates, 1927 census data, and weather and soil quality are available for the whole Ukrainian territory. Appendix Table A2 compares the available characteristics of districts and regions in and out of the sample. In-sample districts have slightly higher mortality than out-of-sample districts, but in-sample regions have lower mortality than out-of-sample regions. This difference is driven by a few small districts with extremely high mortality that are averaged out in regions. Both in-sample districts and regions have higher birth rates than out-of-sample ones. Thus, the territories with the most extreme values (highest mortality, lowest natality), are to a large extent, out of the sample. More important, in-sample districts and regions have significantly lower urbanization rates and are located farther from railroads. This is because I do not have data on industry location around many large urban centers (see Appendix map A1a). Thus, all subsequent regressions probably underestimate the importance of industry, as for many industrialized areas, the information is missing. Finally, in-sample districts have fewer ethnic Russians (not surprising, because more Russians lived closer to urban areas), but more ethnic Germans, Jews, and other ethnicities. Thus, my sample is slightly more ethnically diverse than the whole of Ukraine.

## RESULTS

First, I look at the weather and aggregate grain production in Ukraine; after that, I analyze disaggregated district- and region-level data.

### *Weather and Grain Accounting*

Most 1933 famine victims lived in the countryside. Figure 4 shows official 1916–1940 rural grain retention (harvest minus procurement) in the whole Soviet Union, Russia, and Ukraine.[28] The 1922–1923 and 1933 famines provide a useful comparison with other years. Consistent with the 1922–1923 famine, 1921 rural grain retention is extremely low, 0.6 kilograms per person per day. The epicenter of the 1922–1923 famine was the Volga region of Russia; Russian rural grain retention was 0.6 kilograms per person per day. By contrast, Ukraine had much higher retention in 1921 (1.2 kilograms per person per day) and was much less affected.

By anecdotal accounts, the 1933 famine was comparable to or worse than the 1922–1923 famine. Yet officially reported rural grain retention in the Soviet Union was much higher in 1932 than in 1921, 1.1 kilograms per person per day. Moreover, the officially reported 1932 retention is inconsistent with the geography of the famine: in 1933, Ukraine suffered as much as North Caucasus and the Volga region in Russia, but the officially reported rural grain retention in Ukraine (1.1 kilograms per person per day) if far above the 1921 starvation level of 0.6 kilograms per person per day, incompatible with the loss of almost 10 percent of the Ukrainian population.

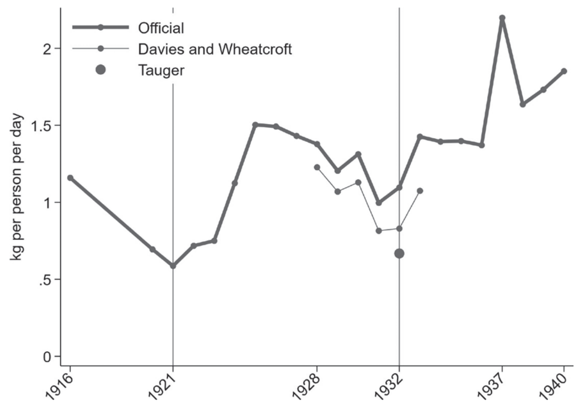
Davies and Wheatcroft (2004) and Tauger (2001) therefore argue that the government inflated grain production figures and offer their corrections.[29] So, in addition to the official data, Figure 4a shows rural grain retention based on their harvest estimates.[30] Since Davies and Wheatcroft

[28] Appendix Figure B1 shows officially reported harvest and procurement. Unfortunately, I do not have disaggregated procurement figures after 1933, so rural grain retention in Russia and Ukraine are calculated only for 1916 through 1933.

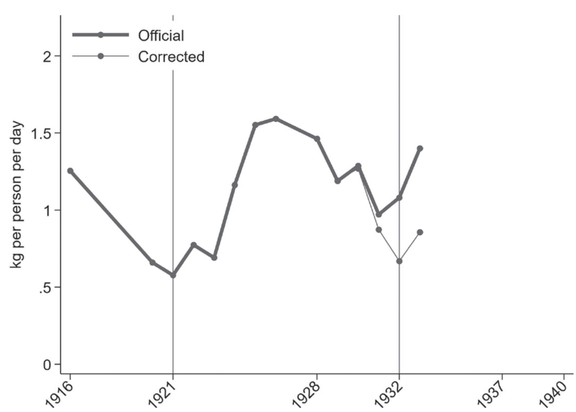
[29] Procured grain enters government storage facilities and is relatively well accounted for. Sown area is directly observable. Harvest, on the other hand, is much harder to estimate, as most of the grain remains in the countryside and is consumed by peasants or used as fodder and seed.

[30] Davies and Wheatcroft (2004, pp. 442–47) explain how difficult it is to know the true harvest; they offer their estimates "based on a range of different data that were accepted internally by the best experts of the time, and our own assessments of the reliability of these different data" (p. 446). Tauger (2001) constructs harvest estimates using officially reported sown area and yields reported by collective farms.

(a) Whole Soviet Union




(b) Russia




(c) Ukraine

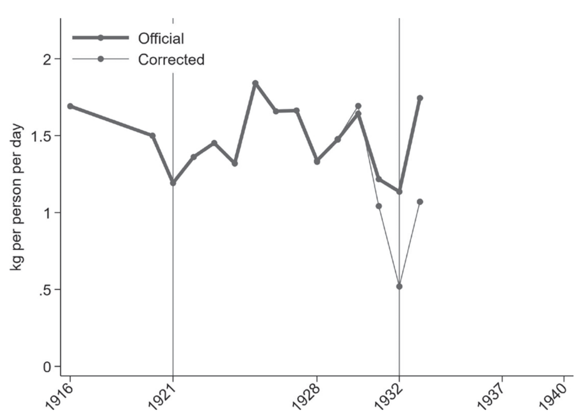



FIGURE 4
RURAL GRAIN RETENTION

*Source*: See notes to Appendix Table E2.

(2004) and Tauger (2001) do not offer corrections for separate Soviet republics, I roughly follow Tauger and use available archival data to calculate corrected harvests for Russia and Ukraine. Figures 4b and 4c show corrected rural grain retention for Russia and Ukraine; notes to Appendix Table E2 describe my calculations. The corrected figures are more consistent with the severity and geography of the 1933 famine: the corrected 1932 rural grain retention is 0.7 kilograms per person per day in Russia and 0.5 kilograms per person per day in Ukraine, consistent with parts of Russia and most of Ukraine starving in 1933. All my corrections, however, are based on scant archival evidence; it is impossible to know how close they are to the truth.

Unlike in the early 1920s, the sown area did not decrease dramatically in the years preceding the 1933 famine.[31] Therefore, other factors must have generated the presumed gap between the officially reported harvest and the true harvest.

Davies and Wheatcroft (2004) argue that the official harvest estimates ignored bad weather. According to them, in 1931, spring was late and cold, and that there was a severe drought in June, especially in West Siberia, the Urals, and the Volga region of Russia.[32] The spring of 1932 was again late and cold, and June was too hot again, although probably less bad than the drought of 1931. Torrential rains occurred in the Kiev region in July 1932, undermining the harvesting of winter grains. By contrast, Tauger argues that precipitation in 1932 should have been beneficial for grain (Tauger 2001, p. 12), were it not for the widespread grain diseases and pests. He claims that rust, smut, ergot, locusts, meadow moths, and mice destroyed a large share of the 1932 harvest. Remarkably, the authors emphasize *different* negative factors as the main explanation of the presumed poor harvest. They also disagree on the true size of the 1932 harvest. This highlights how difficult it is to quantify the importance of different environmental factors from predominantly qualitative and narrative sources.

To see which of the above temperature and rainfall shocks occurred in Ukraine, I first look at monthly weather data. Figure 5 plots de-meaned temperature and precipitation from 1920 to 1940 for April, May, June, and July. That is, for each year from 1920 to 1940 for each month, it presents the difference between the month's temperature and precipitation and

[31] To demonstrate this point, Appendix Figure B2 plots sown area in the Soviet Union, Russia, and Ukraine from 1916 to 1940.

[32] Davies and Wheatcroft (2004) locate the 1931 drought in "the Volga and Black-Earth regions and on the Ukrainian steppe" (Davies and Wheatcroft 2004, p. 68–69). In the later review chapter, Wheatcroft (2017) places the drought in the Volga region only.

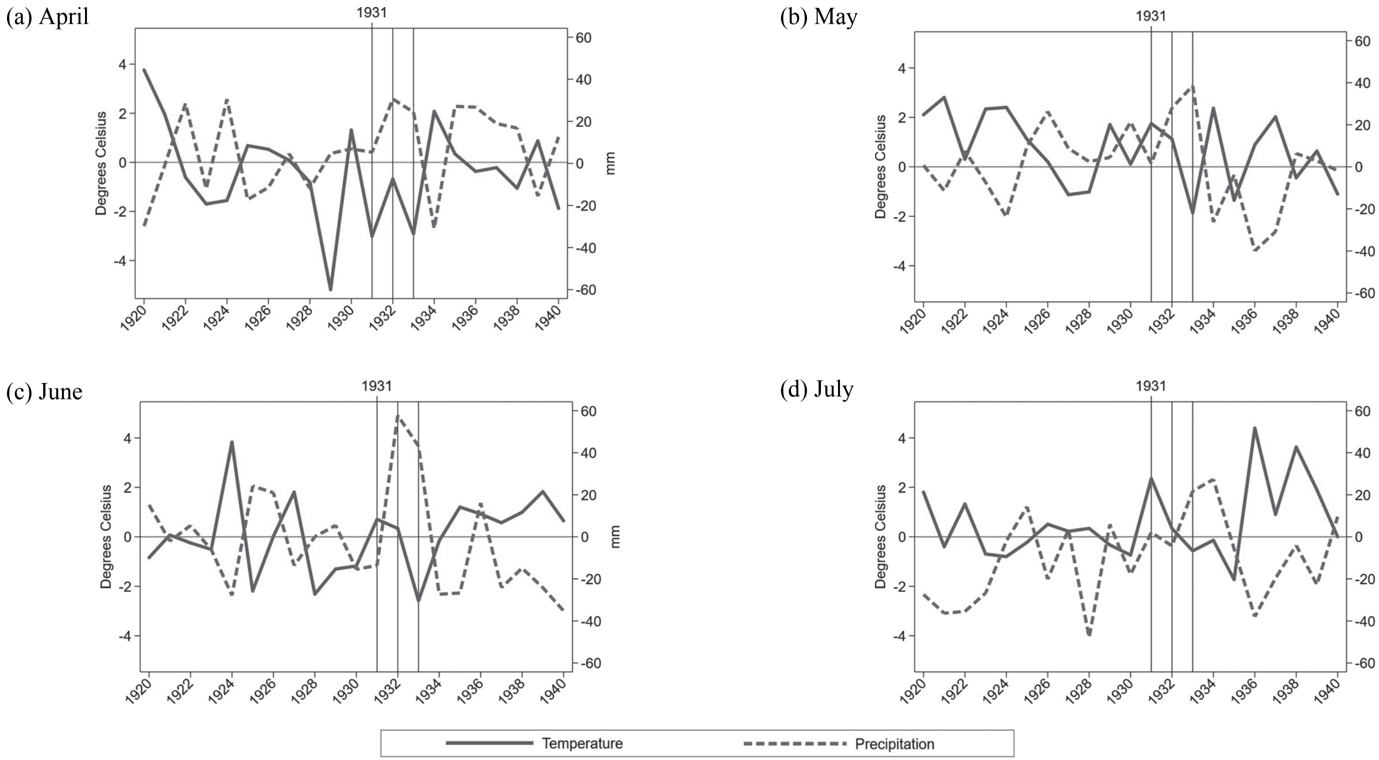



FIGURE 5
DE-MEANED TEMPERATURE AND PRECIPITATION IN UKRAINE

*Notes*: De-meaned temperature (precipitation) is the difference between the reported temperature (precipitation) and the average temperature (precipitation) from 1910 to 1950. Appendix Figure B4 presents these data for all months of the year.

*Source*: *Terrestrial Air Temperature and Precipitation: 1900–2014 Gridded Monthly Time Series,* Version 4.01, Matsuura and Willmott (2014).

https://doi.org/10.1017/S0022050720000625 Published online by Cambridge University Press

the 1910–1950 average.[33] It demonstrates that 1931 and 1932 weather was close to average with one exception: in May and June 1932, rainfall was significantly higher than average. However, rainfall in May and June 1933 was similar to the 1932 levels (May 1933 slightly higher than 1932, June 1933 slightly lower), and historians (including Davies and Wheatcroft, although, remarkably, not Tauger) agree that the 1933 harvest was good.[34]

One might argue that temperature and precipitation for all of Ukraine may not reflect the severity of the drought or rainfall if only a small share of the Ukrainian territory was affected by the presumed shock. In that case, temperature and precipitation would be close to normal and would not reflect the extent of the disaster. However, if only a small area was affected, then the impact on the total harvest should have been small as well. And, if much of the Ukrainian territory suffered, this should have been reflected in the temperature and precipitation figures.

Another concern is that the monthly temperature and precipitation figures could mask poor weather. For example, if half of June was extremely hot and dry, and the other half was very cold and rainy, then the reported monthly averages might look normal. To address this concern, Appendix B.3 studies available daily weather data. Overall, daily data are consistent with monthly averages.

It is, however, difficult to assess how good or bad the weather was from raw monthly averages: while no factor seems too extreme, maybe the combination was particularly bad for grain.[35] The best way to analyze the weather is to predict how much grain would have been produced in Ukraine had *only* the weather changed in 1931 and 1932 compared to the previous years, with no reforms affecting the rural economy. I use 1901–1915 weather and harvest data from 52 Russian provinces and estimate the relationship between province area, FAO GAEZ grain suitability index, fall (October–December), winter (January–March), spring (April–June),

[33] I selected the range of 1910 to 1950 because it is roughly symmetric around 1931 and is short enough to exclude the impact of climate change. The results are similar if 1900–1970 averages are used instead (available upon request). To preserve space, the paper shows only figures for April, May, June, and July, the crucial months for grain cultivation most discussed in the literature. Appendix Figure B4 shows the de-meaned temperature and precipitation for all 12 months. Appendix Figure B3 shows de-meaned June 1931 temperature and de-meaned June and July 1932 precipitation on the map of Ukraine.

[34] Appendix B.2 discusses monthly weather in detail.

[35] According to Kabanov (1975), an agronomy handbook, many conditions should be met to achieve a good harvest: there should be enough precipitation during the previous fall to allow land to accumulate moisture in the deep layers of soil. But not too much, otherwise winter sowing might be delayed. Winter should not start too early or too late, and there should be enough snow to protect winter crops and again to provide moisture for the soil in the spring. Spring should not start too late and should not be too cold. But too early and too hot spring is also undesirable. There should be some rainfall in spring and early summer, but not too much. The optimal temperature in the summer should be between 25 and 30°C, and prolonged periods of heat above 30°C are detrimental.

and summer (July–September) temperature and precipitation, their square terms and pairwise interactions, and harvest. I then predict how much grain should have been produced in Ukraine from 1916 to 1936. Thus, I estimate how good or bad the weather was, keeping all other factors fixed.[36]

Figure 6 plots the reported and predicted Ukrainian harvests with a 95 percent confidence interval.[37] There are three important takeaways. First, starting in 1926, the reported harvest is very close to the predicted harvest. Thus, consistent with Gregory (1994) and Markevich and Harrison (2011), by the second half of the 1920s, agricultural production appears to have recovered from the shocks of WWI, the civil war, and the 1921–1923 famine. Moreover, Soviet statisticians appear to have taken the weather into consideration when they estimated harvest. Second, the predicted harvests in 1931 and 1932 are very close to the reported 1924–1929 average. 1931 seems similar to the 1926–1927, not too bad, not exceptionally great. 1932 seems more similar to 1928, not that good, but not exceptionally bad either. If anything, 1924 and 1934 seem worse, but no famines occurred after 1924 or 1934. Third, if there was a gap between the officially reported harvest and the true harvest (and there must have been, otherwise rural retention is too high), in Ukraine, this gap *is not predicted by the weather*.[38]

Unfortunately, it is impossible to directly quantify the presumed damage from pests and grain diseases. To the extent that weather is conducive to their spread, the weather predicts harvest very close to the

[36] In predicting the harvest, I specifically avoid using any data that could have been affected by the Soviet policies or manipulated by the Soviet statisticians (population, sown area, livestock) and use *only* total area, FAO GAEZ grain suitability index, and weather. Not using Soviet production data for predicting harvest also avoids the discussion of whether field or barn yields were reported in the early 1930s. Officially, Soviet grain accounting changed in 1933: instead of barn yields, statisticians started using field yields that did not account for 15–20 percent harvesting losses. There is a debate on whether field or barn yields were used in 1931 and 1932 harvest reports; see the excellent discussion of the topic in Tauger (1991). Provinces are large enough to use low-resolution historical weather data. In a historical context, it is easier to predict grain production for larger territories: the smaller the administrative unit, the larger the idiosyncratic error, and the worse the quality of weather data. It would be a mistake to attempt predicting the harvest for districts. Recent works, for example, Meng, Qian, and Yared (2015) predict harvest for large territories but avoid doing so for smaller units. I use data on grain production from 49 European provinces (all European provinces except the most industrialized, Saint Petersburg) plus three North-Caucasus provinces (they would later also be hit by the famine) from 1901 to 1915 (or from 1883 to 1915 in some specifications). Appendix B.4 discusses data sources and estimates and validates different production function specifications. The best out-of-sample fit I achieved is $R^2$ of 0.84.

[37] Appendix Figure B10 plots a few other production functions. Appendix Table B2 reports the exact estimated harvest figures with 95 percent confidence intervals.

[38] Historical weather data are not detailed or precise. New evidence or more sophisticated harvest prediction methods might alter the above conclusions. The quality of weather data is not great, but it is equally not great for claiming that the weather in Ukraine was extremely bad. It is also possible that there was a severe drought in 1931 in Russia or Kazakhstan (areas outside the scope of this paper). If this were the case, the weather cannot explain why a large share of famine victims occurred in Ukraine.

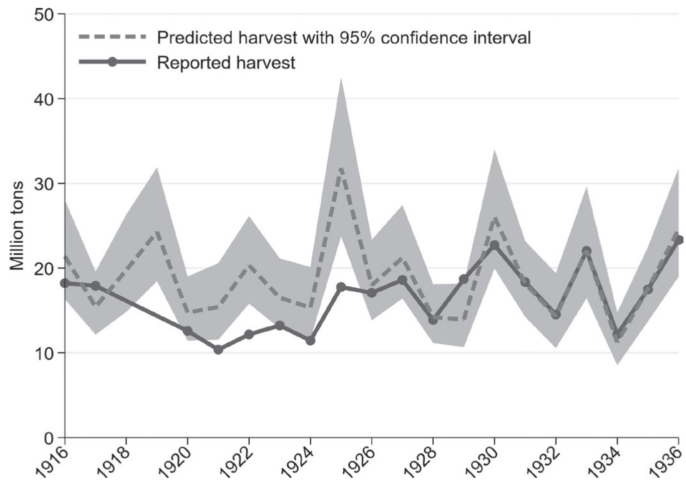



FIGURE 6
REPORTED AND PREDICTED HARVEST IN UKRAINE

*Sources*: Reported harvest, see notes to Appendix Table E2. Predicted harvest, see Appendix Section Predicted Harvest.

officially reported. If pests and diseases spread independently of weather, the available data do not allow quantification of the damage they caused. Instead, Appendix B.5 studies how often published archival documents discussed famine, weather, grain diseases and pests, and effort and organization. It shows that weather or pests were not discussed more than usual in the years leading up to the 1933 famine.

To conclude, the available weather data do not support claims of exceptionally poor weather in Ukraine. Grosfeld, Sakalli, and Zhuravskaya (2019) argue that the single best predictor of crop failure in the Russian Empire is exceptionally hot April–June weather. Similarly, Stephen Wheatcroft, in a series of books, papers, and talks, emphasizes the drought of 1931. Yet, there is no evidence of severe drought in Ukraine. There is also no evidence of exceptionally strong rains in July 1932. Precipitation was high in June, not July, but while the weather was not great in 1932 (the 1932 harvest is lower than the 1930 harvest), the predicted harvest alone is not bad enough to have generated a famine.

### *Government Policies*

Since the aggregate weather does not seem disastrous enough to have caused the famine, next, I turn to government policies. I study three policies that could have affected food production, procurement, and distribution. First, to examine the impact on production, and ultimately on

https://doi.org/10.1017/S0022050720000625 Published online by Cambridge University Press

mortality, I consider the collectivization rate, that is, the share of rural households in collective farms in 1930. Second, since no reliable disaggregated procurement figures are available, I use distance to a railroad as a proxy for grain procurement. Presumably, the closer an area was to a railroad, the cheaper it was to extract grain from it. Third, to investigate how food distribution affected mortality, I study the relationship between the number of workers employed in Group A industries and mortality. Group A industries were the industries producing "means of production": arms, coal, steel, and the like, as opposed to Group B industries producing consumer goods. Because Group A factories were deemed important for industrialization and implementation of the first five-year plan, they had a higher chance of being placed on a priority supply list.

Because 1933 mortality, policy measures, and prefamine characteristics are available for Ukrainian districts, but 1927 and 1928 mortality is available only for larger regions, two empirical approaches are possible: studying the relationship between policies and mortality on a cross-section of smaller districts, or using a difference-in-differences approach on a short panel of larger regions.

On the cross-section of 287 districts, I estimate the following specification:

$$mortality_d = \beta policy_d + X_d'\gamma + \alpha_p + \varepsilon_d, \quad (1)$$

where $d$ stands for district, $p$ for province where the district is located, $mortality_d$ for district mortality in 1933, $policy_d$ for measure of intensity of the government policy in district $d$, $X_d$ for a vector of district-specific characteristics, $\alpha_p$ for province fixed effect, and $\varepsilon_d$ is an error term.

There are two main challenges to this specification. First, reverse causality—the observed relationship between policy and mortality may be a result of the famine, instead of policies increasing mortality. For example, the threat of famine could induce peasants to join collective farms. However, all policies are measured in 1930, when the famine was not yet anticipated, so this concern can be eliminated. A more serious problem is omitted variable bias: the relationship between policies and mortality may be driven by some omitted factor correlated with the intensity of the policy. For example, the government attempted to collectivize more productive and, therefore, richer rural areas first, so if wealth is not considered, the estimated relationship between collectivization and mortality may be biased downward.[39]

[39] As reported in the documents, Soviet territory was divided into three groups according to collectivization priority: group 1 was to be collectivized as soon as possible, group 2 next, and group 3 last. Except for the small northern region of Polissia, all of Ukraine was in group 1 (Danilov et al. 1999–2006, vol. 2, pp. 570–75). Therefore, more productive and wealthier areas were targeted first.

To account for possible omitted variable bias, I control for prefamine characteristics that could have had a direct effect on mortality in 1933 and could have been correlated with the intensity of the policies: food sources (average grain production per capita in 1925, livestock per capita in 1925), and wealth and economic development (value of agricultural equipment per capita in 1925, rural literacy rate in 1927, urbanization in 1927, and rural population density in 1927). To account for varying agroclimatic conditions, I also include a Polissia region indicator in the controls.

Finally, to illuminate the contrast between policies and weather, all estimates control for de-meaned June 1931 temperature and de-meaned June 1932 precipitation. The identifying assumption is that, if not for varying exposure to government policies, districts with similar prefamine characteristics and similar weather should have had similar mortality in 1933.

For comparison, I also estimate the relationship between policies and mortality on the cross-section of regions. I do not include province fixed effects: there are just 38 regions in my sample, and regions do not fit into subsequently created provinces—many were split between two or three provinces.

Next, on the panel of regions, I estimate a difference-in-differences specification:

$$mortality_{i,t} = \beta policy_i I_t^{fam} + X_i' I_t^{fam} \gamma + \alpha_i + \tau_t + \varepsilon_{i,t}, \tag{2}$$

where $i$ stands for region, $t$ stands for year (1927, 1928, and 1933), $mortality_{i,t}$ is mortality in region $i$, in year $t$, $policy_i I_t^{fam}$ is a policy measure interacted with a famine indicator that equals one in 1933 and zero otherwise, $X_i' I_t^{fam}$ are region characteristics interacted again with a famine indicator, $\alpha_i$ and $\tau_t$ are region and year fixed effects, and $\varepsilon_{i,t}$ is an error term. Region characteristics $X_i$ are the same as district characteristics, except weather: I take advantage of the panel structure and control for twice lagged de-meaned June temperature and once lagged de-meaned June precipitation. The identifying assumption is that, if not for the difference in policy intensities, the change in mortality from nonfamine years to the famine year would have been similar among regions with similar characteristics and similar weather.

Nearby districts and regions share similar characteristics; this spatial correlation might inflate the statistical significance of the estimates (Conley 1999). Kelly (2019) argues that we should adjust for a larger spatial correlation than we used to. Therefore, in all estimates, I correct standard errors, allowing for spatial correlation within a radius of 700 kilometers, roughly the north-south distance of 1933 Ukraine, or more than two-thirds of the east-west distance.

Table 1 Panel A reports the cross-section estimates of the relationship between government policies and mortality on a sample of districts using Model (1). Column (1) shows the relationship between the collectivization rate in 1930 and mortality in 1933. The collectivization coefficient is positive and highly statistically significant (p-value below 0.1 percent). Moreover, it is nontrivial in magnitude: one standard deviation increase in collectivization rate (22 percent increase) raises 1933 mortality by 0.14 of a standard deviation, or by 5.4 people per 1,000. This is a sizable effect, given that mortality in nonfamine years was around 18 per 1,000. Appendix Figure C1a plots conditional scatter plot and fitted values corresponding to the estimates in Column (1) and demonstrates that the relationship between collectivization and mortality is not driven by one observation or group of observations.

Table 1 Panel A Column (2) reports the relationship between Group A workers per capita in 1930 and mortality in 1933. More Group A workers per capita reduced 1933 mortality; the coefficient is highly statistically significant, and the magnitude is also not negligible: one standard deviation increase in the number of Group A workers per capita (32 more Group A workers per 1,000 people) reduces mortality by 0.10 of a standard deviation, or by 3.8 people per 1,000. Appendix Figure C1b plots the corresponding conditional scatter plot and fitted values and demonstrates that, unlike collectivization, the relationship between Group A workers and mortality is driven by the relatively few districts that had Group A workers. This is not surprising, given that most districts in the sample had no Group A industries.

Table 1 Panel A Column (3) estimates the relationship between log distance to a railroad and 1933 mortality. Surprisingly, the coefficient is positive—if anything, being located farther from a railroad increased famine mortality. Railroads played a dual role: on the one hand, they facilitated grain procurement, on the other—allowed starving peasants to escape, so the aggregated effect is ambiguous.

Finally, Table 1 Panel A Column (4) includes all three policy intensity measures on the right-hand side of the regression. The estimated coefficients are similar to the ones reported in Columns (1) to (3), in both statistical significance and magnitude: collectivization increases 1933 mortality, Group A workers decrease mortality, and distance to a railroad increases mortality.

Next, for comparison, Table 1 Panel B reports the estimates of the relationship between policies and mortality on a cross-section of regions.

TABLE 1
POLICIES AND MORTALITY

| | Dependent Variable: Mortality 1933 | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Panel A: Cross-section, Districts | | | | |
| Collectivization 1930 | 0.024*** | | | 0.025*** |
| | (0.008) | | | (0.008) |
| Group A workers pc 1930 | | –0.121*** | | –0.101*** |
| | | (0.039) | | (0.031) |
| *Ln*(distance to a railroad) | | | 0.003*** | 0.003*** |
| | | | (0.001) | (0.001) |
| De-meaned June 1931 temperature, °C | –0.031*** | –0.032*** | –0.035*** | –0.032*** |
| | (0.011) | (0.010) | (0.010) | (0.012) |
| De-meaned June 1932 precipitation, 100s mm | 0.007 | 0.007 | 0.005 | 0.007 |
| | (0.005) | (0.005) | (0.005) | (0.005) |
| Baseline controls, Province FE | ✓ | ✓ | ✓ | ✓ |
| Observations | 287 | 287 | 287 | 287 |
| $R^2$ | 0.542 | 0.534 | 0.534 | 0.552 |
| Panel B: Cross-section, Regions | | | | |
| Collectivization 1930 | 0.051*** | | | 0.048*** |
| | (0.011) | | | (0.011) |
| Group A workers pc 1930 | | –0.183 | | –0.110 |
| | | (0.127) | | (0.120) |
| *Ln*(distance to a railroad) | | | 0.011** | 0.006 |
| | | | (0.005) | (0.005) |
| De-meaned June 1931 temperature, °C | –0.041*** | –0.048*** | –0.047*** | –0.043*** |
| | (0.011) | (0.012) | (0.010) | (0.011) |
| De-meaned June 1932 precipitation, 100s mm | –0.002 | –0.010 | –0.006 | –0.003 |
| | (0.007) | (0.008) | (0.008) | (0.010) |
| Baseline controls | ✓ | ✓ | ✓ | ✓ |
| Observations | 38 | 37 | 38 | 37 |
| $R^2$ | 0.797 | 0.752 | 0.766 | 0.811 |
| Panel C: Diff-in-diff, Regions | Dependent variable: Mortality | | | |
| Collectivization 1930 × Famine | 0.060*** | | | 0.058*** |
| | (0.017) | | | (0.018) |
| Group A workers pc 1930 × Famine | | –0.173 | | –0.122 |
| | | (0.130) | | (0.097) |
| *Ln*(distance to a railroad) × Famine | | | 0.009 | 0.004 |
| | | | (0.006) | (0.007) |
| Twice-lagged de-meaned June temperature, °C | –0.016 | –0.019 | –0.020* | –0.018* |
| | (0.010) | (0.012) | (0.010) | (0.010) |
| Lagged de-meaned June precipitation, 100s mm | 0.004** | 0.003 | 0.003 | 0.003* |
| | (0.002) | (0.002) | (0.002) | (0.002) |
| Baseline controls × Famine, Year and Region FE | ✓ | ✓ | ✓ | ✓ |
| Observations | 114 | 111 | 114 | 111 |
| $R^2$ | 0.906 | 0.889 | 0.889 | 0.909 |

* = Significance at the 10 percent level.
** = Significance at the 5 percent level.
*** = Significance at the less than 1 percent level.
*Notes*: Standard errors are corrected for spatial correlation in a radius of 700 km. Baseline controls are average grain production per capita 1925, livestock per capita 1925, value of agricultural equipment per capita 1925, urbanization 1927, Polissia region indicator, rural literacy rate 1927, and rural population density 1927.
*Sources*: Section Data provides details on data construction, Appendix Table A1 shows summary statistics, and Appendix Table E3 lists the exact source of every variable.

There are three important differences. First, the collectivization coefficient increases: one standard deviation increase in collectivization rate (18 percent increase) raises 1933 mortality by 0.33 of a standard deviation, or by 9 people per 1,000. There are two explanations for this increase: (1) without province fixed effects, there is more useful variation in collectivization rates and in baseline region characteristics, and (2) measurement error is smaller in larger regions. The second important difference is that Group A workers per capita coefficient loses statistical significance. Possibly, this is because few districts have many Group A workers, and when data are aggregated to regions, there is little variation in the industry composition. The third difference is that on the cross-section of regions, no strong relationship exists between distance to a railroad and mortality in 1933.

Finally, Table 1 Panel C presents the estimates using a difference-in-differences Specification (2). The collectivization coefficient is even larger than the one presented in Panel B: one standard deviation increase in collectivization rate (18 percent increase) raises 1933 mortality by 0.37 of a standard deviation, or by 10 people per 1,000. Appendix Figure C2 shows the relationship between collectivization and mortality for 1927 and 1928, and in 1933 conditional on baseline controls. It demonstrates that 1927 and 1928 mortality and future collectivization are not correlated and that a strong positive correlation exists between collectivization and 1933 mortality. The increase of the collectivization coefficient from the cross-section to difference-in-differences specification means that region fixed effects indeed help to better account for unobserved differences in wealth and economic development. Next, the Group A workers coefficient remains negative, and the distance-to-a-railroad coefficient remains positive, but neither is statistically significant. To conclude, the estimates obtained with the most demanding difference-in-differences specification suggest that collectivization had a large impact on famine mortality.

All estimates in Table 1 control for the reportedly bad weather: de-meaned June 1931 temperature and de-meaned June 1932 precipitation. In all specifications, higher June 1931 temperature is associated with lower famine mortality, demonstrating again that the presumed drought of June 1931 did not directly lead to higher mortality in Ukraine. Higher June 1932 precipitation does increase mortality—the coefficient is positive and marginally statistically significant in the difference-in-differences specification (Panel C). However, it is small in magnitude: one standard deviation increase in precipitation (increase by 23 mm) raises 1933 mortality by 0.02 of a standard deviation, or by 0.69 people per 1,000.[40,41]

I follow Meng, Qian, and Yared (2015) to estimate how many excess deaths are explained by government policies and the weather (Appendix Table C13 shows the estimates). First, *deaths if no famine* is the number of deaths in my sample if mortality was as in 1927–1928. Second, *reported deaths* is the number of reported 1933 deaths in my sample; and therefore, *excess deaths* is the number of deaths above the no-famine benchmark, the difference between *reported deaths* and *deaths if no famine* (not shown). Third, *predicted deaths* is the sum of predicted (from the models in Table 1 Column (4)) mortality rates multiplied by the 1933 population. Predicted deaths are close to reported deaths—the model fits the data well. Fourth, I construct alternative policy scenarios: (a) I predict mortality rates for a zero collectivization rate (thus calculating the number of deaths that would have occurred if the weather and all government policies were the same but agriculture was not collectivized), (b) I predict mortality rates if each district had 0.025 Group A workers per capita (thus calculating the number of deaths that would have occurred if there were more Group A workers but weather and all other policies were the same), and (c) I combine (a) and (b), predicting mortality for a

[40] To make the coefficients readable, I measure rainfall in hundreds of mm in Table 1.

[41] Appendix C presents robustness checks. Section C.1 re-estimates the effects of economic policies controlling for the FAO GAEZ grain suitability index instead of 1925 average grain production per capita; Section C.2 re-estimates the impact of collectivization on a larger sample of districts for which I do not know industrial composition but know collectivization rate. Changing specifications or adding more observations does not significantly change the estimated effects of government policies. Section C.3 uses 1932 collectivization instead of 1930 collectivization. By 1932, average collectivization increased to 70 percent, and the estimated collectivization coefficients are also much larger, so, if anything, Table 1 reports the most conservative estimates of the impact of collectivization on mortality. Section C.4 uses population losses prepared by Oleh Wolowyna instead of registered 1933 mortality; Section C.5 estimates the impact of policies on natality; Section C.6 further investigates the composition of the industry: it shows that the presence of Group A factories decreases mortality, while the effect is less stable with Group B workers and factories. Since historians paid so much attention to July rainfall, Section C.7 presents estimates controlling for 1932 June–July precipitation instead of June only. Wheatcroft (2017) mentions that in 1933, Kiev province was mostly cut off from the central supply of grain as a punishment for low procurement, so Section C.8 repeats the estimates controlling for log distance to Kiev. Indeed, being farther from Kiev appears to be beneficial. However, this does not remove the effect of collectivization; if anything, 1932 rainfall becomes unimportant—the coefficient flips sign and loses statistical significance. Sections C.9, C.10, and C.11 control for a distance to a city with at least 20,000, 50,000, or 100,000 inhabitants instead of urbanization. If anything, being away from a large city is associated with lower mortality but also makes the Group A industry effect statistically stronger. This highlights the dual role of the cities: while Group A industries had a better chance to obtain food supplies, decreasing mortality, large cities were also a danger to the rural areas if local officials procured food from the nearby villages. Finally, although I already adjust standard errors for spatial correlation of up to 700 km, Section C.12 demonstrates that collectivization explains famine mortality better than spatially correlated noise.

zero collectivization rate and 0.025 Group A workers per capita.[42] The decrease in excess deaths in these alternative scenarios relative to the actual excess deaths is the *share of excess deaths explained*. As Table C13 shows, collectivization explains up to 52 percent of excess deaths, having few Group A workers explains up to 5.9 percent of excess deaths (but this depends on the random benchmark of 0.025 Group A workers per capita that I picked), and the two policies combined explain up to 57 percent of excess deaths.

I also consider how many deaths the weather can explain. Because the June 1931 temperature decreases mortality, to calculate the maximum possible impact of the weather, I concentrate only on June 1932 precipitation. I calculate how many deaths there would have been had the government policies remained unchanged, but June 1932 rainfall was equal to the long-term average (that is, de-meaned June 1932 precipitation was zero). Table C13 shows that rain explains up to 8.1 percent of excess deaths. Thus, the famine appears to be chiefly the result of government policies and not the weather.

### *Mechanisms: Why Collectivization Increased Mortality*

There are two main (not mutually exclusive) potential mechanisms: the government might have extracted relatively more grain from collectives, and collective farms could have been less productive.[43]

As the crisis unfolded, the quality of accounting and reporting deteriorated. So, unfortunately, little reliable disaggregated information on grain procurement is available. The one often cited archival document states that in Ukraine in 1930, 27.9 percent of the harvest was extracted from collectives and 30.3 percent from individual peasants; in 1931, 42.8 percent was extracted from collectives and 32.4 percent from individual

[42] The zero collectivization rate is an obvious benchmark, but it is harder to think of a reasonable alternative industry allocation, since it was mainly determined by historical reasons (arms production) or resource endowments (coal).

[43] Another often mentioned mechanism is dekulakization, the deportation and killing of the richest, most productive peasants. Unfortunately, I do not have disaggregated data on dekulakization. To see whether areas that had more kulaks were more affected, I experimented with including in explanatory variables the 1925 share of rural households that hired labor (the canonical definition of a kulak household). I found nil results (table available upon request). Either this proxy does not capture dekulakization well, or dekulakization did not have a large direct effect on famine mortality. While the prosecution and suffering were very real, relatively few peasants were dekulakized: by 30 December 1930, a year after the dekulakization campaign started, 146,229 people were dekulakized, 0.6 percent of Ukraine's rural population of approximately 25 million (number of dekulakized is from Danilov et al. 1999–2006, vol. 2, doc. 267, p. 745; 1930 rural population is from RSAE 4372/30/107). The *threat* of dekulakization is what mattered, and it made people join collective farms (Kotkin 2017, p. 74).

peasants; and in 1932, 45.1 percent was extracted from collectives and 40.6 percent from individual peasants.[44] Thus, in the two years preceding the famine, a higher share of harvest was extracted from collectives.

At the same time, individual peasants were moved to the worst land and their sown area dropped disproportionally (in 1932, 69 percent of rural households were in collectives, but 80 percent of sown area was collectivized, Appendix Table E1). Therefore, while high procurement must have contributed to the famine, it is hard to tell if relatively more grain per capita was extracted from collective farm members or from the remaining individual peasants.

Next, I consider the impact of collectivization on production. Unfortunately, there is no disaggregated data on collective farms' output, and even the available aggregate figures are debated among historians, so I must rely on indirect evidence. Collective farms varied in size, from just 14 households per farm to more than 500, so I investigate the relationship between collective farm size and mortality. Table 2 Column (1) estimates Specification (1) adding the average size of collective farms to the controls. The collectivization coefficient becomes negative and statistically significant, although small in magnitude. This may be because the government tried to collectivize wealthier, more productive areas first, and other cross-section controls do not fully capture the wealth. More important, the size of collective farms is what drives 1933 mortality up. One standard deviation increase in the collective farm size (66 more households per kolkhoz) increases mortality by 0.28 of a standard deviation, or by 11 people per 1,000.[45] One explanation is that the larger the collective, the more difficult it was to manage and monitor the effort and quality of the members' work.

An alternative explanation is that the effect of collective farm size is driven by the members being crammed on a tiny plot of land. To investigate this, I regress the share of socialized land on the collectivization rate in 1930. Table 2 Column (2) reports the estimates.[46] If the land was divided proportionally among individual peasants and collective farm members, the constant should be zero, and the slope coefficient should be equal to one. However, the constant is positive, and the slope coefficient is statistically significantly larger than one. That is, collective farm

[44] "Statisticheskiye tablitsy pokazateley vypolneniya I pyatiletnego plana razvitiya sel'skogo khozyaystva" (*Statistical Tables of Performance Indicators for the First Five-Year Agricultural Development Plan*), RSAE 4372/30/871, p. 30.

[45] The two variables, collectivization rate and number of households per collective farm, are positively correlated but are not identical: the correlation between them is 0.62.

[46] Share of socialized land is the amount of land used by collective farm members divided by the amount of land used by collective farm members plus the amount of land used by individual peasants.

TABLE 2
SIZE OF COLLECTIVE FARMS AND MORTALITY: DISTRICT-LEVEL ESTIMATES

| | Dependent Variable: | | | | | |
|---|---|---|---|---|---|---|
| | | | Sown Area per Capita 1930 | | | |
| | Mortality 1933 | Socialized Land 1930, % | Collectives | | Individual Peasants | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Collectivization 1930 | –0.014** (0.007) | 1.144*** (0.029) | –0.518*** (0.097) | | –0.150*** (0.043) | |
| HH per collective farm 1930 | 0.017*** (0.002) | | | –0.149*** (0.027) | | –0.023 (0.017) |
| Sown area per capita 1925 | | | 1.128*** (0.133) | 1.223*** (0.119) | 0.501*** (0.140) | 0.526*** (0.133) |
| Constant | ✓ | 0.019*** (0.004) | ✓ | ✓ | ✓ | ✓ |
| Baseline controls, Province FE | ✓ | | ✓ | ✓ | ✓ | ✓ |
| Observations | 287 | 280 | 284 | 284 | 283 | 283 |
| $R^2$ | 0.573 | 0.849 | 0.796 | 0.795 | 0.766 | 0.761 |
| | Magnitude: Standardized Beta Coefficients | | | | | |
| Collectivization 1930 | –0.082 | | –0.142 | | –0.097 | |
| HH per collective farm 1930 | 0.280 | | | –0.120 | | –0.043 |

* = Significance at the 10 percent level.
** = Significance at the 5 percent level.
*** = Significance at the less than 1 percent level.
*Notes*: Standard errors are corrected for spatial correlation in a radius of 700 km. Baseline controls are average grain production per capita 1925, livestock per capita 1925, value of agricultural equipment per capita 1925, urbanization 1927, Polissia region indicator, rural literacy rate 1927, rural population density 1927, de-meaned June 1931 temperature, and de-meaned June 1932 precipitation.
*Sources*: Section Data provides details on data construction, Table A1 shows summary statistics, and Appendix Table E3 lists the exact source of every variable.

members on average had 1.9 percent more land (the constant coefficient equals 0.019), and the higher the collectivization rate was, the more additional land collective farm members had (the slope coefficient is greater than one). Thus, the effect of collectivization on mortality cannot be explained by collective farm members having less land.

Next, although I do not have disaggregated data on collective farm yields, I observe the 1930 sown area. Table 2 Columns (3)–(6) study the impact of collectivization and collective farm size on the collective

https://doi.org/10.1017/S0022050720000625 Published online by Cambridge University Press

and individual sown area. All estimates control for sown area per capita in 1925 and all baseline controls. Columns (3) and (4) show that, on average, collective farms maintained or even increased 1925 sown area. By contrast, Columns (5) and (6) demonstrate that the remaining individual peasants cultivated approximately half the size of the 1925 sown area. On top of that, Columns (3) and (5) show that higher collectivization is associated with a decrease in the sown area of both collective farms and individual peasants. Columns (4) and (6) demonstrate that a higher number of households per collective is negatively associated with the collectives' sown area while not affecting individual peasants' sowing. Thus, there are two opposing effects: on average, collective farms increase per capita sown area relative to the 1925 level, but the higher the district collectivization rate, or the more households there are in the collective, the less advantage collectives had in sown area. The total 1930 sown area still increased (Appendix Figure B2), but collective farm size appears to be a disadvantage already in 1930.[47]

Finally, Table 3 investigates the impact of collectivization on the drop in livestock. Columns (1)–(4) report the relationship between the 1930 collectivization rate and, respectively, the drop in cows, horses, sheep, and all livestock per capita, controlling for all baseline controls and, respectively, cows, horses, and sheep per capita in 1925 (livestock is already in the baseline controls). Consistent with historical accounts, collectivization is associated with a drop in livestock: all coefficients are positive, although only the impact on a drop in horses, sheep, and all livestock is statistically significant. Thus, more collectivized areas had less draught power and fewer animals to rely on as an alternative to grain emergency food sources.

To conclude, available data show that collectivization is associated with a drop in livestock and that, consistent with larger collectives being less productive, larger collective farms drive famine mortality up.

### *Ethnic Composition and Mortality*

No study of the Ukrainian famine can avoid the question of whether ethnic Ukrainians were discriminated against. Without other Soviet republics, Ukraine is not ideal for investigating this question because the

[47] It is possible that larger collectives specialized in grain, as opposed to technical crops like sugar beets or livestock, and that grain-producing collectives were under more pressure from the government. In that case, the impact of collective farm size on mortality would be driven by larger collectives' different specialization. To account for this, Appendix Table C14 reproduces Table 2, controlling for the share of arable land used for grain cultivation in 1930, that is, 1930 specialization in grain. The results are unchanged. It is possible also that larger collectives became more specialized in grain later, in 1932, so the estimates from Table 2 should be considered as suggestive.

TABLE 3
DROP IN LIVESTOCK: DISTRICT-LEVEL ESTIMATES

| | Dependent Variable: Drop in Livestock per Capita 1930 | | | |
|---|---|---|---|---|
| | Cows<br>(1) | Horses<br>(2) | Sheep<br>(3) | All Livestock<br>(4) |
| Collectivization 1930 | 0.008<br>(0.007) | 0.031***<br>(0.007) | 0.081***<br>(0.017) | 0.039***<br>(0.015) |
| Cows per capita 1925 | ✓ | | | |
| Horses per capita 1925 | | ✓ | | |
| Sheep per capita 1925 | | | ✓ | |
| Baseline controls, Province FE | ✓ | ✓ | ✓ | ✓ |
| Observations | 286 | 286 | 284 | 286 |
| $R^2$ | 0.589 | 0.557 | 0.694 | 0.644 |
| | Magnitude: Standardized Beta Coefficients | | | |
| Collectivization 1930 | 0.037 | 0.129 | 0.104 | 0.068 |

* = Significance at the 10 percent level.
** = Significance at the 5 percent level.
*** = Significance at the less than 1 percent level.
*Notes*: Standard errors are corrected for spatial correlation in a radius of 700 km. Baseline controls are average grain production per capita 1925, livestock per capita 1925, value of agricultural equipment per capita 1925, urbanization 1927, Polissia region indicator, rural literacy rate 1927, rural population density 1927, de-meaned June 1931 temperature, and de-meaned June 1932 precipitation.
*Sources*: Section Data provides details on data construction, Table A1 shows summary statistics, and Appendix Table E3 lists the exact source of every variable.

counterfactual is limited: in my sample, more than 80 percent of the rural population are ethnic Ukrainians. Nevertheless, there is some variation in ethnic composition; Appendix Figure D1 shows four major ethnic groups on the map (Ukrainians, Russians, Germans, and Jews), and Appendix Figure D2 presents histograms of the share of the rural population belonging to these ethnicities. This section studies how famine mortality changed with rural ethnic composition.

Table 4 presents the estimates of the relationship between ethnicity and mortality on the cross-section of districts (Panel A), the cross-section of regions (Panel B), and the short panel of regions (Panel C). As before, all estimates account for baseline controls (including weather), province fixed effects (Panel A), and year and region fixed effects (Panel C). Column (1) estimates the relationship between the rural share of ethnic Ukrainians and mortality in 1933 conditional only on baseline controls; the Ukrainian coefficient is positive but not statistically significant on the cross-section of districts, and positive and statistically significant when

TABLE 4
ETHNIC COMPOSITION AND MORTALITY

| | Dependent Variable: Mortality 1933 | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Panel A: Cross-section, Districts | | | | |
| Ukrainians 1927 | 0.016<br>(0.014) | 0.010<br>(0.012) | 0.032***<br>(0.011) | 0.015*<br>(0.009) |
| Germans 1927 | | | 0.041***<br>(0.011) | 0.025**<br>(0.012) |
| Jews 1927 | | | –0.055<br>(0.053) | –0.041<br>(0.048) |
| Other 1927 | | | 0.008<br>(0.022) | –0.009<br>(0.024) |
| Baseline controls, Province FE | ✓ | ✓ | ✓ | ✓ |
| Policy controls | | ✓ | | ✓ |
| Observations | 287 | 287 | 287 | 287 |
| $R^2$ | 0.531 | 0.552 | 0.536 | 0.555 |
| Panel B: Cross-section, Regions | | | | |
| Ukrainians 1927 | –0.009<br>(0.016) | –0.023<br>(0.019) | –0.022<br>(0.022) | –0.037<br>(0.032) |
| Germans 1927 | | | 0.221***<br>(0.035) | 0.254***<br>(0.071) |
| Jews 1927 | | | 0.262<br>(0.392) | 0.551***<br>(0.143) |
| Other 1927 | | | –0.044<br>(0.029) | –0.047<br>(0.039) |
| Baseline controls | ✓ | ✓ | ✓ | ✓ |
| Policy controls | | ✓ | | ✓ |
| Observations | 38 | 37 | 38 | 37 |
| $R^2$ | 0.744 | 0.815 | 0.771 | 0.851 |
| Panel C: Diff-in-diff, Regions | Dependent variable: Mortality | | | |
| Ukrainians 1927 × Famine | 0.054**<br>(0.026) | 0.046*<br>(0.026) | 0.070*<br>(0.042) | 0.070<br>(0.067) |
| Germans 1927 × Famine | | | 0.254***<br>(0.074) | 0.263*<br>(0.140) |
| Jews 1927 × Famine | | | –0.904***<br>(0.137) | –0.792***<br>(0.147) |
| Other 1927 × Famine | | | 0.035<br>(0.043) | 0.037<br>(0.071) |
| Baseline controls × Famine, Year and Region FE | ✓ | ✓ | ✓ | ✓ |
| Policy controls × Famine | | ✓ | | ✓ |
| Observations | 114 | 111 | 114 | 111 |
| $R^2$ | 0.894 | 0.915 | 0.918 | 0.934 |

* = Significance at the 10 percent level.
** = Significance at the 5 percent level.
*** = Significance at the less than 1 percent level.
*Notes*: Standard errors are corrected for spatial correlation in a radius of 700 km. Baseline controls are average grain production per capita 1925, livestock per capita 1925, value of agricultural equipment per capita 1925, urbanization 1927, Polissia region indicator, rural literacy rate 1927, and rural population density 1927. Cross-section specifications (Panels A and B) control for de-meaned June 1931 temperature and de-meaned June 1932 precipitation. Diff-in-diff specification (Panel C) controls for twice-lagged June temperature and lagged June precipitation. Policy controls are the collectivization rate 1930, number of Group A workers per capita 1930, and log stance to a railroad. In Columns (3) and (4), the omitted category is Russians.
*Sources*: Section Data provides details on data construction, Table A1 shows summary statistics, and Appendix Table E3 lists the exact source of every variable.

estimated using the panel of regions.[48] Column (2), in addition to baseline controls, also accounts for the exposure to government policies. The Ukrainian coefficient is still positive and marginally statistically significant when estimated on the panel of regions. Its magnitude reduces somewhat, but because the sample is small, the coefficients are not precisely estimated (the standard errors are large). I cannot reject the hypothesis that the coefficients in Column and Column (2) are equal.

Table 4 Columns (3) and (4) add rural shares of ethnic Germans, Jews, and a synthetic group of all other non-Russian ethnicities, estimating how mortality in these groups compared to the mortality of ethnic Russians (omitted category). Ethnic Ukrainians and ethnic Germans appear to die at a higher rate than ethnic Russians: the coefficients in Column (3) Panels A and C are positive and marginally statistically significant. Appendix Figure D3 presents conditional scatter plots and fitted values of the Ukrainian and German coefficients corresponding to the estimates in Panel A Column (3) and shows that the sizes of the coefficients are not driven by the outliers, but once the outliers are removed, while the slope does not change, statistical significance disappears. Next, controlling for exposure to government policies in Panel A Column (4) makes the Ukrainian and German coefficients smaller though still positive and marginally statistically significant; in Panel C Column (4), the Ukrainian coefficient loses statistical significance, but I cannot reject the hypothesis that it is equal to the coefficient in Column (3)—the standard errors are too large. Overall, the estimates demonstrate that a positive though statistically weak relationship exists between the higher share of rural ethnic Ukrainians and ethnic Germans and 1933 mortality and that higher mortality in Ukrainian and German areas is not fully explained by exposure to the government policies.[49]

[48] The fact that the Ukrainian coefficient is negative when estimated on a cross-section of regions (Panel B) is probably because Ukrainian areas were relatively richer and had lower mortality before the famine. Using 1927 and 1928 mortality, and controlling for region and year fixed effects, makes the Ukrainian coefficient positive and statistically significant. Thus, from 1927–1928 to 1933, mortality increased more in the areas with more ethnic Ukrainians.

[49] Appendix D presents robustness checks. Section D.1 replicates Table 4 controlling for 1932 collectivization instead of 1930 collectivization; Section D.2 shows a positive relationship between ethnic Ukrainians and Germans and total population losses; Section D.3 demonstrates a negative relationship between ethnic Ukrainians and Germans and 1933 birth rates. In addition, before the revolution, and especially before the 1906 Stolypin reforms, peasants in the Russian Empire mostly owned land communally, and there were two main types of commune: dominant among Russians repartition commune, where the land was redistributed every few years depending on the change of peasant households' sizes, and dominant among Ukrainians hereditary commune, where no regular land redistributions occurred (see, e.g., Nafziger 2016). It is possible that the experience of repartition commune could have made ethnic Russians better prepared for collective farms. To account for this, Section D.4 uses the 1905 land census from Dower and Markevich (2018). It demonstrates that ethnic Ukrainians and ethnic Germans die at a higher rate, even after controlling for the 1905 share of communal land: the estimates become even less precise and lose statistical significance, but are still not zero.

TABLE 5
EXPOSURE TO THE GOVERNMENT POLICIES: DISTRICT-LEVEL ESTIMATES

| | Dependent Variable: | | | |
|---|---|---|---|---|
| | Collectivization 1930 | | Group A Workers pc 1930 | |
| | (1) | (2) | (3) | (4) |
| Ukrainians 1927 | 0.209*** | 0.274*** | –0.007 | –0.083*** |
| | (0.061) | (0.065) | (0.011) | (0.024) |
| Germans 1927 | | 0.112 | | –0.108*** |
| | | (0.110) | | (0.038) |
| Jews 1927 | | –0.440 | | 0.000 |
| | | (0.443) | | (0.030) |
| Other 1927 | | 0.087 | | –0.122*** |
| | | (0.128) | | (0.046) |
| Baseline controls | ✓ | ✓ | ✓ | ✓ |
| Province FE | ✓ | ✓ | ✓ | ✓ |
| Observations | 287 | 287 | 287 | 287 |
| $R^2$ | 0.358 | 0.360 | 0.449 | 0.502 |

* = Significance at the 10 percent level.
** = Significance at the 5 percent level.
*** = Significance at the less than 1 percent level.
*Notes*: Standard errors are corrected for spatial correlation in a radius of 700 km. Baseline controls are average grain production per capita 1925, livestock per capita 1925, value of agricultural equipment per capita 1925, urbanization 1927, Polissia region indicator, rural literacy rate 1927, and rural population density 1927. In Columns (2) and (4), the omitted category is Russians.
*Sources*: Section Data provides details on data construction, Table A1 shows summary statistics, and Appendix Table E3 lists the exact source of every variable.

Next, because the Ukrainian and German coefficients decrease in magnitude (in Table 4 Panel A) and lose statistical significance (in Table 4 Panel C) after controlling for government policies, Table 5 investigates the relationship between ethnic composition and exposure to policies. I concentrate on two policies that have been shown to affect mortality: collectivization and the lack of favored industries. Column (1) demonstrates that a positive and statistically significant relationship exists between the rural share of ethnic Ukrainians and the 1930 collectivization rate (conditional on all baseline controls and province fixed effects): one standard deviation increase in ethnic Ukrainians (18 percent increase) raises 1930 collectivization by approximately 0.17 of a standard deviation, or by 4 percent. Appendix Figure D5 presents corresponding conditional scatter plot and fitted values and show that the relationship between ethnic Ukrainians and collectivization is not driven by one observation or a group of observations. Next, Column (2) adds other ethnic groups (Germans, Jews, and all other non-Russians) and demonstrates that ethnic Ukrainians were more collectivized than ethnic Russians. The German coefficient, while positive, is not statistically significant, so there is no strong evidence that ethnic Germans were more collectivized.

Ethnic Ukrainians could have voluntarily collectivized more than other ethnic groups. To address this, I study the relationship between ethnicity and collectivization in 1928, when it was not yet forced.[50] Only region-level collectivization data are available for 1928, so with region data, I estimate the relationship between the share of rural ethnic Ukrainians and collectivization rates in 1928 and 1930 conditional on all baseline controls except the weather. Appendix Table D5 shows that in 1928 fewer ethnic Ukrainians were collectivized, while in 1930, the relationship flipped. Thus, higher collectivization rates of ethnic Ukrainians cannot be explained by their voluntary preference for collectivization.

Table 5 Columns (3) and (4) show that ethnic Ukrainian and ethnic German districts had fewer Group A industries relative to ethnic Russian districts. Appendix Figure D6 shows that this relationship is not driven by just one district or a small subset of districts. However, industry location was mainly determined by the resource endowment (e.g., coal in the Donbass area) and by historical reasons (e.g., arms-producing factories in Kiev). So, while Ukrainians and Germans were unlucky to have had fewer well-supplied industries, this fact cannot be interpreted as proof of government intent.[51]

Finally, Table 6 investigates how enforcement of government policies varied with ethnic composition. I estimate how 1933 mortality is affected by the ethnic composition, exposure to government policies (collectivization and Group A workers), and the interactions between the shares of ethnic Ukrainians and ethnic Germans and the government policies. If collectivization was more harshly enforced on Ukrainians or Germans, the interaction coefficient between Ukrainians (or Germans) and collectivization should be positive. If favored industries were treated worse in ethnic Ukrainian or German areas, the interaction coefficient between the share of Ukrainians (or Germans) and the number of Group A workers per capita should be positive. Column (1) shows that the interaction

[50] Government propaganda advertised collectivization, but fewer than 4 percent of rural households in Ukraine voluntarily organized collectives by 1928 (Figure 1 and Appendix Table E1).

[51] It is possible that Ukrainians just happened to live in the lands better suited for grain production and therefore more collectivized in 1930. While estimates in Table 5 control for 1925 grain production per capita, Appendix Table D6 replaces this control with the grain suitability index. The results (Columns 1 and 2) are similar to the ones reported in Table 5: ethnic Ukrainians were more collectivized in 1930. Finally, the industrial composition might be driven by more Russian coal-mining Donbass region. Table D6 Columns 3 and 4 reproduce the estimates from Table 5, omitting the Donetsk province. Indeed, the relationship between the location of Group A industries and ethnic composition appears to be driven by the Donbass region (with the caveat that I do not know the industrial composition of the most urbanized areas; see Section Data and Appendix Table A2).

TABLE 6
ENFORCEMENT OF THE GOVERNMENT POLICIES: DISTRICT-LEVEL ESTIMATES

| | Dependent Variable: Mortality 1933 | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Ukrainians 1927 | 0.011 | 0.037*** | 0.017** | 0.018** |
| | (0.012) | (0.012) | (0.009) | (0.009) |
| Germans 1927 | 0.026** | 0.046*** | 0.078*** | 0.028** |
| | (0.011) | (0.013) | (0.020) | (0.011) |
| Jews 1927 | –0.047 | –0.036 | –0.051 | –0.046 |
| | (0.049) | (0.048) | (0.048) | (0.049) |
| Other 1927 | –0.008 | 0.013 | –0.010 | –0.005 |
| | (0.024) | (0.025) | (0.025) | (0.023) |
| Collectivization 1930 | 0.009 | 0.022*** | 0.026*** | 0.022*** |
| | (0.019) | (0.008) | (0.007) | (0.008) |
| Group A workers pc 1930 | –0.105*** | 0.293*** | –0.112*** | –0.092*** |
| | (0.036) | (0.090) | (0.036) | (0.035) |
| Ukrainians 1927 × Collectivization 1930 | 0.015 | | | |
| | (0.018) | | | |
| Ukrainians 1927 × Group A workers pc 1930 | | –0.543*** | | |
| | | (0.129) | | |
| Germans 1927 × Collectivization 1930 | | | –0.121*** | |
| | | | (0.022) | |
| Germans 1927 × Group A workers pc 1930 | | | | –0.498 |
| | | | | (0.805) |
| Baseline controls, Province FE | ✓ | ✓ | ✓ | ✓ |
| Observations | 287 | 287 | 287 | 287 |
| $R^2$ | 0.550 | 0.554 | 0.554 | 0.550 |

* = Significance at the 10 percent level.
** = Significance at the 5 percent level.
*** = Significance at the less than 1 percent level.
*Notes:* Standard errors are corrected for spatial correlation in a radius of 700 km. Baseline controls are average grain production per capita 1925, livestock per capita 1925, value of agricultural equipment per capita 1925, urbanization 1927, Polissia region indicator, rural literacy rate 1927, rural population density 1927, de-meaned June 1931 temperature, and de-meaned June 1932 precipitation.
*Sources*: Section Data provides details on data construction, Table A1 shows summary statistics, and Appendix Table E3 lists the exact source of every variable.

coefficient between the share of ethnic Ukrainians and collectivization is positive but not statistically different from zero. Column (3) shows that the interaction coefficient between the share of ethnic Germans and collectivization is negative. Column (2) demonstrates that the interaction coefficient between Ukrainians and Group A workers is negative and statistically significant, while Column (4) demonstrates that the interaction coefficient between ethnic Germans and Group A workers is negative, although not statistically different from zero. No strong evidence exists that government policies were enforced more harshly on ethnic Ukrainians or Germans.

To conclude, there are indications that ethnic Ukrainians and ethnic Germans were discriminated against: they die more, even after controlling for exposure to government policies (although this result is underpowered), and ethnic Ukrainians were more collectivized. This is *not* proof of genocide. To prove genocide, one would have to show that Stalin knew collectivization would fail several years before the famine, and that, he therefore disproportionally exposed ethnic Ukrainians to it.

## CONCLUSION

Weather and environmental factors have always been blamed for famines in command economies: drought in the Soviet Union, insects (Dikötter 2010) or drought (Chen and Yang 2019) in China, and floods and droughts in North Korea. By contrast, in the twentieth century, no famines occurred during peacetime in market economies. Either nature hates totalitarian regimes, or it is time to put the blame where it belongs: government policies that make food supply susceptible to a disaster when environmental conditions are less than perfect.

In this paper, I study the three most popular explanations of the 1933 famine in Ukraine: weather, government policies, and genocide. I argue that weather explains up to 8.1 percent of excess deaths, while collectivization explains up to 52 percent of excess deaths, so weather cannot be the main cause of the famine. I also find some evidence that ethnic Ukrainians and ethnic Germans were discriminated against: they were more likely to die, even after accounting for government policies, and ethnic Ukrainians were more collectivized.

While this paper makes progress toward a better understanding of the 1933 famine, at least three important questions are not addressed in this work. First, grain procurement. This paper only has data on aggregate procurement in Ukraine; we need to better understand the procurement system and its impact on the population. Second, ethnicity and famine mortality. While ethnicity likely played a role, Ukraine alone is not suitable for addressing the ethnic question because it lacks sufficient variation in ethnic composition. The question of whether different ethnic groups were discriminated against because of central government policy or local tensions remains open. Third, the 1933 famine became *the Famine* in the post-Soviet territory—it is one of the most traumatic events of the twentieth century. More work is necessary to understand its consequences.

REFERENCES

Adamets, Serge. *Guerre civile et famine en Russie*. Paris: Institut d'études slaves, (2002).

Alfani, Guido, and Cormac Ó Gráda, eds. *Famine in European History*. Cambridge, UK: Cambridge University Press, 2017.

Allen, Robert C. *Farm to Factory: A Reinterpretation of the Soviet Industrial Revolution*. Princeton, NJ: Princeton University Press, 2003.

Andreyev, Yevgeniy, Leonid Darskiy, and Tatiana Khar'kova. "Opyt otsenki chislennosti naseleniya SSSR 1926–1941 gg.: kratkiye rezul'taty issledovaniya [An exercise in estimating the population of the USSR 1926–1941: Brief results of the study]." *Vestnik statistiki*, 7, 1990.

Applebaum, Anne. *Red Famine: Stalin's War on Ukraine*. Toronto, Canada: McClelland and Stewart, 2017.

Belov, Fedor. *The history of a Soviet collective Farm*. Great Britain: Routledge and Kegan Paul Ltd, 1956. Reprinted in 1998 by Routledge.

Cameron, Sarah. *The Hungry Steppe. Famine, Violence, and the Making of Soviet Kazakhstan*. Ithaca, NY: Cornell University Press, 2018.

Chen, Shuo, and Xiaohuan Lan. "There Will Be Killing: Collectivization and Death of Draft Animals." *American Economic Journal: Applied Economics* 9, no. 4 (2017): 58–77.

Chen, Yuyu, and David Yang. "Historical Traumas and the Roots of Political Distrust: Political Inference from the Great Chinese Famine." Mimeo, 2019. Available at https://ssrn.com/abstract=2652587.

Cheremukhin, Anton, Mikhail Golosov, Sergei Guriev, and Aleh Tsyvinski. "The Industrialization and Economic Development of Russia through the Lens of a Neoclassical Growth Model." *Review of Economic Studies* 84, no. 2 (2017): 613–49.

Conley, Timothy G. "GMM estimation with Cross Sectional Dependence." *Journal of Econometrics* 92, no. 1 (1999): 1–45.

Conquest, Robert. *The Harvest of Sorrow: Soviet Collectivization and the Terror–Famine*. Oxford, UK: Oxford University Press, 1986.

Danilov, Viktor. *Istoriya krestyanstva Rossii v XX veke [The history of the peasantry of Russia in the twentieth century]*, 1. Moscow: Rosspen, 2011.

Danilov, Viktor, R. Manning, Lynne Viola, Robert Davies, Ha Yong-Chool, R. Jonson, V. Kozlov, A. Sakharov, V. Vinogradov, and Stephen Wheatcroft, eds. *Tragediya Sovetskoy derevni. Kollektivizatsiya i raskulachivaniye. Dokumenty i materialy v 5 tomakh 1927–1939 [The Tragedy of the Russian Village. Collectivization and Dekulakization. Documents and Materials In 5 volumes 1927–1939.]*. Moscow: Rosspen, 1999–2006.

Davies, Robert W. *The Industrialization of Soviet Russia 2: The Soviet Collective Farm 1929–1930*. Basingstoke, UK: Palgrave Macmillan, 1980.

Davies, Robert W., and Stephen G. Wheatcroft. *The Industrialization of Soviet Russia 5: The Years of Hunger: Soviet Agriculture, 1931–1933*. Basingstoke, UK: Palgrave Macmillan, 2004.

Dell, Melissa. "The Persistent Effects of Peru's Mining Mita." *Econometrica* 78, no. 6 (2010): 1863–903.

Dikötter, Frank. *Mao's Great Famine: The History of China's Most Devastating Catastrophe, 1958–62*. New York: Bloomsbury USA, 2010.

Dower, Paul Castañeda, and Andrei Markevich. "Labor Misallocation and Mass Mobilization: Russian Agriculture during the Great War." *Review of Economics and Statistics* 100, no. 2 (2018): 245–59.

Ellman, Michael. "Stalin and the Soviet Famine of 1932–33 Revisited." *Europe-Asia Studies* 59, no. 4 (2007): 663–93.

Graziosi, Andrea. "The Uses of Hunger: Stalin's Solution of the Peasant and National Questions in Soviet Ukraine, 1932 to 1933." In *Famines in European Economic History: The Last Great European Famines Reconsidered*, edited by Declan Curran, Lubomyr Luciuk, and Andrew G. Newby, ch. 9. Abingdon, UK: Routledge, 2015.

Gregory, Paul R. *Before Command: An Economic History of Russia from Emancipation to the First Five–Year*. Princeton, NJ: Princeton University Press, 1994.

Gregory, Paul R., and Manouchehr Mokhtari. "State Grain Purchases, Relative Prices, and the Soviet Grain Procurement Crisis." *Explorations in Economic History* 30, no. 2 (1993): 182–94.

Grosfeld, Irena, Seyhun Orcan Sakalli, and Ekaterina Zhuravskaya. "Middleman Minorities and Ethnic Violence: Anti-Jewish Pogroms in the Russian Empire." *Review of Economic Studies* 87, no. 1 (2019): 289–342.

Hunter, Holland. "Soviet Agriculture with and without Collectivization, 1928–1940." *Slavic Review* 47, no. 2 (1988): 203–16.

Iordachi, Constantin, and Arnd Bauerkämper, eds. *The Collectivization of Agriculture in Communist Eastern Europe: Comparison and Entanglements*. Budapest, Hungary: Central European University Press, 2014.

Kabanov, P. G. *Pogoda i pole [Weather and Field]*. Saratov, Russia, 1975.

Kelly, Morgan. "The Standard Errors of Persistence." Mimeo, 2019. Available at https://ssrn.com/abstract=3398303.

Kontorovich, Vladimir. "The Military Origins of Soviet Industrialization." *Comparative Economic Studies* 57 (2015): 669–92.

Kotkin, Stephen. *Stalin. Paradoxes of Power, 1878–1928*. New York: Penguin Press, (2014).

———. *Stalin. Waiting for Hitler, 1929–1941*. New York: Penguin Press, 2017.

Lewin, Moshe. *Russian Peasants and Soviet Power*. Evanston, IL: Northwestern University Press, 1968.

Li, Wei, and Dennis Tao Yang. "The Great Leap Forward: Anatomy of a Central Planning Disaster." *Journal of Political Economy* 113, no. 4 (2005): 840–77.

Libanova, Ella. *Demohrafichna katastrofa v Ukrayini vnaslidok Holodomoru 1932–1933 rokiv: skladovi, masshtaby, naslidky [Demographic catastrophe in Ukraine as a result of the Holodomor of 1932–1933: factors, scale, consequences]*. Kiev, Ukraine: Institute for Demography and Social Studies of the National Academy of Science of Ukraine, 2008.

Lin, Justin Yifu. "Collectivization and China's Agricultural Crisis in 1959–1961." *Journal of Political Economy* 98 (1990): 1228–52.

Litoshenko, Lev. *Sotsializatsiya zemli v Rossii [Socialization of land in Russia]*. Novosibirsk, Russia: Sibirskiy khronograf, 2001.

Liu, Chang, and Li-An Zhou. "Does Setting Performance Targets Work in Bureaucracies? Evidence from China's Great Leap Forward." Mimeo, 2019. Available at https://ssrn.com/abstract=3075015.

Maddison, Angus. *Monitoring the World Economy, 1820–1992*. Paris, France: OECD, Development Centre Studies, 1995.

Markevich, Andrei, and Mark Harrison. "Great War, Civil War, and Recovery: Russia's National Income, 1913 to 1928." *Journal of Economic History* 71, no. 3 (2011): 672–703.

Markevich, Andrei, and Ekaterina Zhuravskaya "The Economic Effects of the Abolition of Serfdom: Evidence from the Russian Empire." *American Economic Review* 108, nos. 4–5 (2018): 1074–117.

Matsuura, Kenji, and Cort Willmott. "Terrestrial Air Temperature and Precipitation: 1900–2014 Gridded Monthly Time Series (Version 4.01)." Washington, DC: National Oceanic and Atmospheric Administration, 2014.

Meng, Xin, Nancy Qian, and Pierre Yared. "The Institutional Causes of China's Great Famine, 1959–1961." *Review of Economic Studies* 82, no. 4 (2015): 1568–611.

Meslé, France, Jacques Vallin, and Evgeny Andreev. "Demographic Consequences of the Great Famine: Then and Now." In *After the Holodomor: The Enduring Impact of the Great Famine on Ukraine*, edited by Andrea Graziosi, Lubomyr A. Hajda, and Halyna Hryn, 217–42. Cambridge, MA: Harvard University Press, 2013.

Nafziger, Steven. "Communal Property Rights and Land Redistributions in Late Tsarist Russia." *Economic History Review* 69, no. 3 (2016): 773–800.

Naumenko, Natalya. "Replication: The Political Economy of Famine: The Ukrainian Famine of 1933." Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2020-12-8. https://doi.org/10.3886/ E128401V1.

Ó Gráda, Cormac. *Famine: A Short History*. Princeton, NJ: Princeton University Press, 2009.

Razuvaev, V. N., E. G. Apasova, R. A. Martuganov, R. S. Vose, and P. M. Steurer. *Daily Temperature and Precipitation Data for 223 USSR Stations*. Oak Ridge, TN: Oak Ridge National Lab, 1993.

Rennie, Jared J. et al. "The International Surface Temperature Initiative Global Land Surface Databank: Monthly Temperature Data Release Description and Methods." *Geoscience Data Journal* 1, no. 2 (2014): 75–102.

Rozenas, Arturas, and Yuri M. Zhukov. "Mass Repression and Political Loyalty: Evidence from Stalin's 'Terror by Hunger'." *American Political Science Review* 113, no. 2 (2019): 569–83.

Rudnytskyi, Omelian, Nataliia Levchuk, Oleh Wolowyna, Pavlo Shevchuk, and Alla Kovbasiuk. "Demography of a Man-Made Human Catastrophe: The Case of Massive Famine in Ukraine 1932–1933." *Canadian Studies in Population* 42, no. 1–2 (2015): 53–80.

Shanin, Teodor. *The Awkward Class. Political Sociology of Peasantry in a Developing Society: Russia 1910–1925*. Oxford: Clarendon Press, 1972.

Snyder, Timothy. *Bloodlands: Europe between Hitler and Stalin*. New York City, NY: Basic Books, 2010.

Solovieva, Antonina. "Sent by the Komsomol." In *In the Shadow of Revolution:. Life stories of Russian Women from 1917 to the Second World War*, edited by Sheila Fitzpatrick and Yuri Slezkine, 235–40. Princeton, NJ: Princeton University Press, 2000.

State Duma of the Russian Federation. "Pamyati zhertv goloda 30-kh godov na territorii SSSR [In memory of the victims of the famine of the 30s in the territory of the USSR]," 2008. Available at http://duma.gov.ru/news/1293/.

Tauger, Mark B. "The 1932 Harvest and the Famine of 1933." *Slavic Review* 50, no. 1 (1991): 70–89.

———. "Natural Disaster and Human Actions in the Soviet Famine of 1931–1933." *The Carl Beck Papers in Russian and East European Studies* (1506). Pittsburgh, PA: University of Pittsburgh, 2001.

Viola, Lynne. *Peasant Rebels under Stalin*. Oxford, UK: Oxford University Press, 1996.

Wheatcroft, S. G. "Indicators of Demographic Crisis in the Soviet Famine." In *Golod v SSSR, 1929–33 [Famine in the USSR, 1929–33]*, vol 3, book 2. Moscow, 2013. Available at http://www.melgrosh.unimelb.edu.au/famine.php.

Wheatcroft, S. G., and A. Garnaut. "Losses of Population in Separate Regions of USSR (1929–1934): Statistics, Maps and Comparative Analysis (with Special Reference to Ukraine)." In *Famine 1933 Ukraine: Collection of Scientific Papers*, 376–91. Kiev: "Priority," 2013.

Wheatcroft, Stephen. "Eastern Europe (Russia and the USSR)." In *Famine in European History*, edited by Guido Alfani and Cormac Ó Gráda, 212–39. Cambridge, UK: Cambridge University Press, 2017.