

The Causes of Ukrainian Famine Mortality, 1932-33*

Andrei Markevich,[†] Natalya Naumenko[‡] and Nancy Qian[§]

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We construct a novel panel dataset for interwar Soviet Union to study the causes of Ukrainian famine mortality (*Holodomor*) during 1932-33 and document several facts: i) Ukraine produced enough food in 1932 to avoid famine in Ukraine; ii) 1933 mortality in the Soviet Union was increasing in the pre-famine ethnic Ukrainian population share and iii) was unrelated to food productivity across regions; iv) this pattern exists even outside of Ukraine; v) migration restrictions exacerbated mortality; vi) actual and planned grain procurement were increasing and actual and planned grain retention (production minus procurement) were decreasing in the ethnic Ukrainian population share across regions. The results imply that anti-Ukrainian bias in Soviet policy contributed to high Ukrainian famine mortality, and that this bias systematically targeted ethnic Ukrainians across the Soviet Union.

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[†]University of Helsinki and New Economic School (Moscow, Russia), andrei.markevich@helsinki.fi, amarkevich@nes.ru, CEPR

[‡]George Mason University, nnaumenk@gmu.edu

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

Lazar Kaganovich “was fond of saying that every Ukrainian is potentially a nationalist” – from the memoirs of Nikita Khrushchev (Khrushchev, 1970, p. 172).

1 Introduction

During the Great Soviet Famine (1932-33), approximately seven million people perished and approximately forty percent of these deaths occurred in Ukraine, where mortality rates were four to six times higher than in Russia. 7.5% to 11.3% of the ethnic Ukrainian peasantry died during the *Holodomor* (“to die by starvation” in Ukrainian).¹ Levchuk et al. (2020) summarizes the controversy and intense debate about the causes of disproportionately high Ukrainian mortality rates. On the one hand, many historians believe that the famine was a “terror” intentionally waged by the Soviet government against Ukraine (e.g., Conquest, 1986; Applebaum, 2017). Approximately 40% of Soviet GDP was agriculture in 1928. To maximize revenues, the government forcibly procured agricultural production, the most important of which was grain, from rural areas. This was highly unpopular amongst the peasantry. The Ukrainians, who constituted the largest ethnic group in agriculturally productive regions, had a strong group identity and offered particularly stiff resistance. The Bolsheviks needed to repress Ukrainians to control agriculture (e.g., Graziosi, 2015).

On the other hand are those who argue that the high famine mortality in Ukraine was an unintended consequence of policies with no inherent anti-Ukrainian bias. No direct documentary evidence that Stalin “ordered” a famine for Ukraine has been uncovered.² Repression and starvation in agriculturally productive regions also occurred outside of Ukraine. Communist ideology, in an intentional departure from the Tsarist regime, held all ethnicities to be equal. In their seminal economic history study of the Soviet Famine, Davies and Wheatcroft (2009) document a fall in aggregate Soviet production in 1932. They argue that mortality was higher in Ukraine because it was agriculturally productive and suffered bad weather and the Soviets had no anti-Ukrainian bias *per se*.

The contentious debate reached an *impasse* because the lack of representative disaggregated data prevented a systematic evaluation of competing hypotheses. Most importantly, past studies have lacked systematic disaggregated data on mortality, production and procurement.

The primary contribution of our study is to make progress on understanding the causes of Ukrainian famine mortality in 1932-33 by constructing the largest and most comprehensive disaggregated dataset for inter-World War Soviet Union (1922-1940). Most of the data are manually digitized from archival sources made available after the fall of the USSR. The main sample includes the three largest and most populous Soviet republics: Russia, Ukraine and Belarus. We construct a province-level panel data that includes information about mortality, natality, ethnic composition, urbanization, weather, administrative capacity, realized grain production and procurement, planned targets for production and procurement, political alignment with

¹ See Section 2 for mortality estimates. Note that approximately 1 to 1.5 million famine deaths occurred in Kazakhstan, mostly among ethnic Kazakhs. We do not study Kazakh mortality because there are no reliable mortality data from Kazakhstan during the famine era.

² For example, Kotkin (2017) notes the lack of direct evidence on Stalin’s intention to produce a famine for Ukrainians. Tauger (1991) argues that there was no policy against Ukrainians or other ethnic groups and emphasizes the importance of environmental factors for causing the harvest shortfall (Tauger, 2001). Kondrashin (2008) stresses that famine was equally severe in certain parts of Russia. Similarly, Zelenin (2006) and Ivniitskii (2009) portray the famine as a Soviet Union-wide phenomenon.

Bolsheviks, and other historical economic, political and cultural variables. We use two approaches to reconstruct grain production data, which were manipulated by the Soviet government in the late 1920s and early 1930s: *i*) from previously classified grain procurement ratios, and *ii*) by predicting production with data that are hard to manipulate (e.g., weather and geography). We also construct a more granular district-level panel that contain data on mortality, demographic characteristics, weather and geography. The main advantage of these data is that they allow us to evaluate competing explanations for Ukrainian famine mortality and provide direct positive evidence on policy mechanisms.

Our study proceeds as follows. First, we document that 1932 Ukrainian production, though lower than previous years, was still enough to support all of Ukraine. Government procurement lowered food availability in rural Ukraine to a level that was similar to the famine-stricken regions of the 1921 famine. Procurement from Ukraine was not necessary for avoiding famine in other regions because production in the other republics was enough to support the rest of the Soviet population.

Second, we investigate the contributions of anti-Ukrainian bias in Soviet policy versus a fall in agricultural production caused by weather. These two causes of famine are not mutually exclusive. There is no data on ethnic-specific mortality rates. To overcome this challenge, we infer ethnic Ukrainian mortality from the relationship between famine mortality and the pre-famine ethnic Ukrainian population share across regions. Using the province-level panel, we document that for two places that produced the same amount of grain in 1932, the place with more ethnic Ukrainians suffered higher mortality in 1933. This supports the anti-Ukrainian bias view. At the same time, we find that for two regions with the same ethnic Ukrainian population share, per capita grain production is unrelated to famine mortality. Thus, grain production and by logical extension, the inputs of grain production (e.g., weather and geography), cannot explain famine mortality. This contradicts the unintended consequence view.

Our estimates account for urban population share and its interaction with the famine dummy variable, which account for urban-rural differences such as food access; province fixed effects, which account for all time-invariant differences across regions (e.g., average mortality rate); and year fixed effects, which account for changes over time that affect all provinces similarly (e.g., macroeconomic changes). We show that the results are robust to a large number of additional controls, different ways of measuring famine severity and Ukrainian population, and placebo experiments. Moreover, we document that Ukrainian population share is positively associated with famine mortality across districts within provinces as well as across provinces. This supports the interpretation that Ukrainian bias in famine mortality is policy driven since central government policies are implemented top-down and usually follow similar guidelines at each level of government.

A back-of-the-envelope calculation shows that if ethnic Ukrainians died at the same rate as other ethnicities (mostly Russians in our sample), total famine mortality would have been 92% lower in Ukraine and 77% lower in the three republics in our sample. The contribution of Ukrainian bias to famine mortality is higher in Ukraine because Ukraine has a higher share of ethnic Ukrainians.

Third, Ukrainian bias was specific to ethnic Ukrainians and present outside of Ukraine. We find a similar positive relationship between pre-famine Ukrainian population share and famine mortality in Belarus and Russia, where 25% of the ethnic Ukrainians in our sample resided prior to the famine. Other ethnic minorities, on average, had famine mortality rates similar to ethnic Russians, and much lower than Ukrainian

famine mortality rates.

Fourth, we use the district-level data to document a discrete decline in famine mortality rates when crossing the border from Ukraine to Russia. This is consistent with the belief that migration restrictions exacerbated famine mortality by preventing Ukrainians from escaping to other regions. If ethnic Ukrainians were allowed to freely migrate, mortality should not have discretely declined at the border. We then show that the border effect disappears once we control for the ethnic Ukrainian population share in each district. Thus, Ukrainian bias in famine mortality was delineated along ethnic lines.

Fifth, we provide positive evidence that anti-Ukrainian bias in famine mortality is driven by policy. We show that there was bias in the most important policy determining food availability: centrally planned grain procurement. We document that for two provinces that produced similar amounts of grain in 1932, the government procured more from the one with a higher share of ethnic Ukrainians. Thus, retention (production minus procurement) was decreasing in pre-famine ethnic Ukrainian population share. This result addresses the lack of documentary evidence for central directives ordering the famine. A simple quantification exercise suggests that anti-Ukrainian bias in centrally planned procurement explains approximately half of the total effect of anti-Ukrainian bias on famine mortality.

In addition, several supplementary results enrich our understanding of the famine. First, we document that there was anti-Ukrainian bias in the grain procurement targets published in 1928, which supports the presence of anti-Ukrainian bias in Soviet policy. Second, we document that after the famine, production recovered much sooner than population. The data on centrally allocated tractors suggest that the mechanization of agriculture was intensified to compensate for the negative impact of labor losses on production. Finally, we speculate about the regime's motivation and present some evidence consistent with the political economic explanation that the Bolsheviks repressed Ukrainians to control agriculture.

Related Literature Our study is the first to systematically evaluate the causes of Ukrainian famine mortality, to show that Soviet policy was biased against *ethnic* Ukrainians, and that this bias extended to republics other than Ukraine. These results add to the large literature on the causes of famine in the post-Industrial era discussed by Ó Gráda (2009). Sen (1981) famously argues that the central cause of 20th century famines is the unequal distribution of food from political elites to those who lack entitlement, and not low aggregate production. Our results strongly support this thesis by providing evidence on the detailed process that killed more than any other famine in the 20th century (except the Great Chinese famine of 1959-1961). Studying the Soviet context adds important insights. In market economies, famine mortality is negatively associated with food production (Sen, 1981). Our finding of no correlation between food production and famine mortality illustrates that different mechanisms are at play in the Soviet context. The lack of a negative association between food productivity and famine intensity is also notably missing in the Great Chinese Famine (Meng et al., 2015). Two key differences between the two famines of centrally planned economies is that in China, the rural political bases for the political leadership suffered high famine mortality rates and there was little ethnic delineation in mortality.

We complement existing studies of the Soviet Famine. The most well-known study in economics is Davies and Wheatcroft (2009), which pieces together the aggregate data with documentary evidence and

select variables from select regions. By conducting a systematic analysis, we arrive at very different conclusions from this seminal study about the causes of high Ukrainian mortality. Our empirical findings are in line with the interpretation of famine in Ukraine suggested by [Graziosi \(2015\)](#). More recently, [Naumenko \(2021\)](#) uses one cross section of districts in Ukraine and finds a positive association between famine mortality and ethnic Ukrainians share. Her study cannot distinguish normal mortality from excess mortality due to famine, lacks variation to meaningfully control for alternative hypotheses and data on production and procurement to examine policy mechanisms. Very recently, [Yaremko \(2022\)](#) finds that the implementation of collective punishment for areas that fail to fulfill grain procurement quotas during the famine is negatively associated with long-run economic development in Ukraine.

Our results also add to the mostly theoretical literature on authoritarian governance that is reviewed by [Egorov and Sonin \(2020\)](#) and the rapidly growing evidence on the economic determinants of mass killings and genocide. The findings are consistent with theoretical models of targeted repressions based on the characteristics of the group rather than the individual (e.g., [Horowitz, 1985](#); [Rozenas, 2020](#)). They support the theory proposed by [Esteban et al. \(2015\)](#) that mass killings are more likely in the presence of large natural resource rents, political polarization, institutional constraints regarding rent sharing and low productivity of labor. They complement recent empirical evidence on the drivers of mass killing in contexts such as Rwanda ([Heldring, 2020](#); [Rogall, 2021](#); [Yanagizawa-Drott, 2014](#)) and Gujarat ([Jha, 2014](#)). Our results are consistent with the argument that persecutions are often triggered by negative economic shocks in places with some pre-existing prejudice, and can transform into genocide if the repressed group has no exit option ([Becker et al., 2022](#)). Finally, we add to studies of the impact of early Soviet economic policy and political economy of Soviet autocracy [Zhuravskaya et al. \(e.g., 2024\)](#). [Cheremukhin et al. \(2017\)](#) provides macro-calibration evidence on the effect of early Soviet Industrial policy, but excludes the cost of famine because of data limitations. Our study is also related to [Gregory et al. \(2011\)](#), [Talibova and Zhukov \(2018\)](#) and [Castañeda Dower et al. \(2021\)](#) which investigate mass repressions under Stalin. We hope that the data we constructed will facilitate future studies about this important context.

This paper is organized as follows. Section [2](#) summarizes the historical background. Section [3](#) presents the food accounting exercise. Section [4](#) presents mortality estimates. Section [5](#) presents evidence of the role of government policy. Section [6](#) presents the long-run trends for rural population and agricultural production after the famine. Section [7](#) concludes.

2 Background

2.1 Ethnicity in the Soviet Union

In a departure from explicit ethnic discrimination during the Tsarist regime, Bolshevik ideology held all ethnicities to be equal. Yet, from the beginning of Soviet rule in 1917, the Bolsheviks needed to balance their reliance on the cooperation of nationalist groups with the concern that nationalist sentiments would undermine the regime. This was especially true for Ukrainians, who were the second largest ethnic group after Russians in the Soviet Union and the largest ethnic group on agriculturally productive lands.

The Ukrainians posed a dilemma for the Bolsheviks. On the one hand, the Bolsheviks needed their

cooperation to rule. In the only free election in the Soviet era in 1917, the Party of Socialist Revolutionaries obtained the largest vote share of 39.2% of the former Russian Empire. The Bolsheviks took second place with 23.8% of votes, while the Ukrainian Socialist-Revolutionary Party took third place with 12.4% of the votes (estimated from Protasov et al., 2014). The Bolsheviks also needed Ukrainian cooperation to achieve its economic goal of rapid industrialization, which required subsidies from agriculture, the most important source of Soviet economic production at the time. The most important agricultural commodity at the time was grain. On the other hand, the Bolsheviks were aware of the danger of nationalist sentiments to the regime and the fact that the Soviet rural economic policy of maximizing grain extraction from rural areas would be highly unpopular.

The strength of nationalist sentiments was apparent in the Civil War of 1918-1922. To appease nationalists, in 1923, the Bolsheviks launched a policy of *indigenization* (*korenizatsiya*). Indigenization encouraged schools and books in local languages, promoted native culture (e.g., national literature, theaters, museums), required local government affairs to be implemented in the native language, and promoted locals into leadership positions. The Ukrainian communist party was charged with the administration of Ukraine, but also viewed itself as representing ethnic Ukrainians across the Soviet Union.

The salience of ethnicity increased over time in rural areas. In the Russian empire, rural ethnic groups lived in separate communities. Ethnic delineations were inadvertently deepened during the Soviet regime, which established a hierarchy of national autonomous administrative units (republics, provinces, districts and villages) delineated along ethnic lines. The residential patterns and administrative structure encouraged organization and coordination along ethnic lines, and also made it logistically easier for government to implement ethnic-specific policies.

The Bolsheviks leaders were wary of the increasing salience of ethnicity in rural areas and their concerns increased when peasants began to resist agricultural collectivization in the late 1920s and early 1930s. Resistance was particularly strong amongst Ukrainians. Indigenization de facto ended in Ukraine and other European parts of the USSR in the autumn of 1932 (Graziosi, 2015; Martin, 2001).

2.2 Soviet Economic Policy and the Famine

Rapid industrialization funded by agricultural production was the cornerstone of Soviet economic policy in the late 1920s and 1930s. The government aimed to maximize the expropriation of grain surpluses from the countryside. The first grain requisitions took place amidst the Civil War (1918-1922). *War communism* limited trading of foodstuffs and introduced *prodrazverstka* aimed to extract all 'surplus' grain from peasants. The peasants resisted by decreasing sown area, which in 1921 was about 35% lower than in 1916 (L.V., 2001, p. 363). The disruptions from War Communism and the armed conflict contributed to the 1921 famine, in which approximately five million died. Most deaths were in the Volga region in Russia (Andreev et al., 1993). The scale of the resistance and the decline in agricultural production threatened to undermine the Bolshevik regime. In 1921, Lenin declared the New Economic Policy, which re-introduced a market economy for agriculture and small-scale manufacturing. The failure of *War communism* made clear to the Bolsheviks that they needed more control over agriculture.

In 1928, the Soviet Union was led by Stalin, who substantially consolidated political power. The Bolshe-

viks, no longer distracted by armed conflict, renewed their effort to control agriculture. *Collectivization* was a bundle of policies that included the removal of individual family farms and organizing peasants into large collective farms. The government started limiting and heavily regulating the trading of food and directly procuring it from peasants to feed the urban population and the small share of rural population engaged in non-agricultural production (e.g., forestry). Procured foods, mostly grain, were also exported and stored in centrally controlled reserves. Production and procurement targets were set by central planners and published in 1928 in the First Five Year Plan. Production targets were mainly based on production potential, which depended on past production, geography and rural labor. Procurement targets were set to leave the rural population enough food to be productive laborers. Forced collectivization began in late 1929. By the summer of 1932, the share of rural households living in collective farms exceeded 60% in the USSR and was almost 70% in Ukraine (Davies and Wheatcroft, 2009).

The harvest of 1931 was lower than earlier years. News of starvation traveled to Moscow, but the government did not lower procurement. In areas where the peasants retained too little food, seed stock was consumed to make up for the deficit. This, in turn, contributed to lower production in 1932. It is widely believed that the production decline was particularly prominent in Ukraine, but the exaggerated official production data during the early 1930s made it hard to verify the magnitude of the fall in each region.

Facing lower than expected harvests in 1932, Stalin simultaneously curtailed the initial targets and emphasized the need to maximize procurement. To fulfill the remaining quota, Stalin sent his closest deputies, Vyacheslav Molotov and Lazar Kaganovich (neither of whom were ethnically Ukrainian) to Ukraine and North Caucasus, the two key grain-producing regions where most ethnic Ukrainians lived.³ On December 14, 1932, the Politburo issued a classified decree to accuse Ukrainian nationalists within the Communist Party and local bureaucracy of sabotaging grain procurement. The decree required regional authorities in Ukraine (as well as in the North Caucasus and the Western region) to “crush” any resistance of “counter-revolutionaries” and nationalists and fulfill procurement quotas (Danilov et al., eds, 1999–2006, Volume 3, Document 226).

Deaths from starvation peaked in the early months of 1933. In January 1933, Moscow ordered the closure of the borders of Ukraine and the North Caucasus to prevent a mass migration of peasants out of these areas (Danilov et al., eds, 1999–2006, vol.3, p.634-5). The government gave little aid. In 1932, Ukraine received 176,200 tons of aid (Davies and Wheatcroft, 2009, Table 23). Given that 32 million people lived in Ukraine, this amounted to around 15 grams per person per day. Some cities also provided other forms of famine relief, such as aid kitchens, medical assistance or housing on an ad hoc basis. According to anecdotal accounts, rural famine victims often went to nearby urban areas to beg for food; some set up relief kitchens, while others expelled migrants back to rural areas. There are no systematic data about such relief efforts.

³In a letter to his deputy, Lazar Kaganovich, from August 11, 1932, Stalin mentioned that the party district committees in about fifty districts in Ukraine had spoken out against state procurement quotas and that the Soviet government “could lose Ukraine” (Davies et al., eds, 2003). The central leadership claimed that shortages and famine were outcomes of intentional peasant resistance aimed to undermine agricultural collectivization, and that the peasants should be penalized for their subversion (Danilov et al., eds, 1999–2006; Davies and Wheatcroft, 2009). On May, 6 1933, during the peak famine mortality, Stalin wrote to Sholokhov, a famous writer originally from the Don region, that peasants “sabotaged” his policy and accused them of engaging in a “silent war” against the Soviet state (Murin, ed, 1997). Villages were penalized for failing to fulfill procurement targets with the seizure of other foodstuffs (not just grain), bans of imports of foodstuffs and manufacturing goods to these villages, arrests of local government bureaucrats, and the deportations of peasants (Zelenin et al., 1994, p. 258, 260).

Total famine mortality estimates for the Soviet Union range from 5 to 10.8 million. Mortality was concentrated in rural areas.⁴ National mortality rates returned to trend in 1934.

There are no systematic data on ethnic-specific mortality rates in the Soviet Union for the period of our study. One way to approximate ethnic Ukrainian famine mortality is to use the most cited total famine death toll of seven million for the USSR (Conquest, 1986), and 2.6 million (Meslé et al., 2013) to 3.9 million (Rudnytskyi et al., 2015) for Ukraine. If famine deaths were equally distributed between ethnic Ukrainians (80% of Ukraine) and others ethnicities in Ukraine, and no ethnic Ukrainians died outside Ukraine, then ethnic Ukrainian deaths constitute 30% ($.8 \times 2.6/7 = .3$) to 45% ($.8 \times 3.9/7 = .45$) of the total famine deaths. Thus, ethnic Ukrainians, who were 21% of total Soviet population in 1926 constituted about 40% of all famine deaths. These estimates likely underestimate ethnic Ukrainian deaths because ethnic Ukrainian mortality was higher than those for other groups within Ukraine and many Ukrainians who lived in other republics also died.

Another way to assess Ukrainian famine mortality is to compare famine mortality rates in Ukraine to those in Russia. If total famine deaths is seven million and we subtract the deaths in Kazakhstan (1 to 1.5 million) and Ukraine (2.6 to 3.9 million), we are left with 1.6 to 3.4 million deaths for Russia if we assume no famine mortality in other republics. This implies famine mortality rates of 15 to 32 per 1,000 for the 106 million residents of Russia. A similar calculation for Ukraine yields a famine mortality rate that is four to five times higher than in Russia: 82 to 122 per 1,000.

In summary, any calculation indicates that Ukrainians suffered higher mortality rates during the famine than Russians. But we do not know if this is simply because Ukrainians lived more in agricultural regions which suffered a fall in production. We do not know if Ukrainians simply produced too little food in 1932 and would have suffered severe famine in 1933 even absent government procurement. The historical evidence indicates that the Bolsheviks were concerned about Ukrainian nationalism, but does not reveal whether they intended to procure more food from Ukrainians above and beyond other peasants in similarly productive lands. The historical narratives focus on the tension between Moscow and Ukraine, but say little about ethnic Ukrainians living elsewhere in the Soviet Union. The subsequent empirical analysis will address these and other issues.

3 Food Accounting

This section conducts a simple republic-level accounting exercise and documents that had there been no procurement from Ukraine, 1932 grain production in Ukraine was sufficient to avoid famine in Ukraine and production in the rest of the Soviet Union was sufficient to avoid famine there without grain from Ukraine.

⁴Conquest (1986) estimates total famine deaths to be 7 million. Davies and Wheatcroft (2009) estimates 5.5 to 6.5 million deaths. Ellman (2005) cites “‘about eight and a half million’ victims of famine and repression in 1930–33.” Kondrashin (2008) gives a range between 5 and 7 million victims. Russian historical demographers estimate 7.2 to 10.8 million famine victims (Polyakov and Zhiromskaya, 2000). In 2008, the Russian State Duma postulated that within the territories of the Volga Region, the Central Black Earth Region, Caucasus, Ural, Crimea, Western Siberia, Kazakhstan, Ukraine and Belarus, the estimated famine death toll was 7 million people (State Duma, 2008). The differences in estimates are driven by data limitations, and potential underregistration of deaths during the famine. Estimates deriving excess famine deaths from a comparison of the pre-1926 and post-1937 Soviet population censuses suffer from the problem of the underregistration of infant mortality (See Davies and Wheatcroft, 2009, for a detailed discussion).

Table 1 presents grain production, procurement, retention (production minus procurement) and compares retention to rural population food needs for years from 1927 to 1939. These data cover the entire Soviet Union. Panel I examines Ukraine. Rows (1) and (2) report total and rural populations measured at the beginning of each year. The 1933 population data are taken before the famine mortality peaks.⁵

Row (3) reports production. The main challenge for this exercise is that the official aggregate production data are widely believed to have been exaggerated during the early years of collectivization because they were publicly used as a marker of the success of Soviet economic policies. Davies and Wheatcroft (2009) provides a range for true aggregate production for the Soviet Union. We follow the spirit of this earlier study and use previously classified data to construct corrected province-level production, which we can then aggregate to the republic and Soviet Union levels. Specifically, we use grain procurement ratios (grain procurement as a share of production) and procurement stocks to back out true production. Procurement stocks were directly observed and counted by the government. Procurement ratios were reported in a candid evaluation of the First Five-Year Plan prepared by Gosplan and shown only to the highest ranking Soviet officials. The report was classified until after the fall of the Soviet Union and was only recently discovered by historians. Our correction assumes that changes in the procurement ratio reflects changes in production rather than changes in the ability to procure. The corrected production measures are lower than officially reported production during the years when production is believed to have been exaggerated. At the Soviet Union level, our measures are comparable to the production estimates provided by Davies and Wheatcroft (2009). See Appendix Section A for details.

Row (4) presents grain procurement, which includes urban consumption, exports and national reserves. Production and procurement are reported in millions of tons.

Row (5) reports actual rural retention, the difference between production and procurement, which includes seed stock intended for cultivation (since peasants consume seed stock during times of starvation). We report retention in kilograms per capita per day which we find to be more intuitive for considering subsistence needs. Row (6) reports a counterfactual retention for rural Ukrainians which assumes that no grain is procured from rural Ukraine. Row (7) reports a counterfactual retention for urban and rural Ukrainians which assumes that grain produced in Ukraine is distributed only to those living in Ukraine. This is simply production divided by the total population, converted into kilograms per capita per day units.

To understand whether retention is sufficient to avoid famine, we calculate population food needs (row 8). We conservatively use official Soviet guidelines for maximum caloric needs that vary by sex, age and occupation (Lositskiy 1926; 1928). We use data on sex, age and urban-rural population shares from the 1926 Census to adjust subsistence needs according to the demographic composition of each republic.⁶

The data show that grain production in Ukraine declined from 23.2 to 16.8 million tons from 1930 to

⁵For 1928–1933 we use official population estimates made by the Labor Sector of Gosplan. Andreev et al. (1993) argue that these numbers are exaggerated and offer lower numbers for the total Soviet population; they do not offer disaggregations by republic or by urban/rural. We therefore rely on the official numbers. These are what presumably the Soviet officials knew when they planned and implemented their policies. Moreover, higher population numbers bias our calculations against us – more people means less food per capita.

⁶The Soviet guidelines are more generous than international standards. For example, for a prime-age adult male, it is assumed that 3,750 calories are needed for heavy labor, and 2,750 calories for other type of works. We convert calories to kilograms of grain using the conversion offered by Lositskiy (1920), which is based on the typical grain consumption of Russian laborers.

1931, and further declined to 9.1 million tons in 1932 (row 3). Grain procurement from Ukraine remained stable at 7.7 and 7.3 million tons in 1930 and 1931; and decreased to 4.2 million tons in 1932 (row 4). The decline in procurement is consistent with the earlier historical discussion that the regime was unable to procure initial targets in the face of the production drop in 1932. Grain procurement declined with the drop in production in 1932, but not enough to prevent famine. Per capita grain retention in rural Ukraine declined from 1 kg per capita per day after the harvest of 1931 to only 0.5 kg per capita per day after the harvest of 1932 (row 5). This was 30% below the estimated food needs of 0.778 kg per capita per day (row 8). For another comparison, note that during the 1921-22 famine, famine occurred in regions with per capita retention below 0.628 kg per person per day (Bukhman, 1923).

The famine in rural Ukraine could have been avoided, or at least, greatly moderated if there was no procurement from rural Ukraine. If no food had been procured from rural Ukraine, rural retention would have been 1.01 kg per capita per day in 1932 (row 6), more than the recommended level of 0.778 kg per capita per day. Moreover, Ukraine produced enough food to feed all its citizens. If grain was procured from rural Ukraine only to feed urban citizens of Ukraine, average Ukrainian retention would have been 0.79 kg per capita per day (row 7).

Procurement from Ukraine was not necessary to avoid famine elsewhere. Panel II examines all other republics of the USSR. Row (11) shows that urban and rural grain retention would have been 1 kg per capita per day in 1932 if the production of other republics was distributed equally across their population. Appendix Table A.2 also presents the food accounting for Russia and the entire Soviet Union.

There are several important points to keep in mind for interpreting the accounting results. First, we focus on grain because it is the most important agricultural commodity for the Soviet economy and the main staple for consumption. 66% of peasant calories came from grain, 15% came from potatoes, 9% from dairy, and all other foods contributed only 10% together (Naumenko, forthcoming). We do not have disaggregated data for the production of other crops. Later, in the regression estimates, we account for this by controlling for the suitability for cultivating other staple crops, such as potatoes, as well as cash crops. The availability of other food would strengthen our point that there was enough food in aggregate to avoid famine. Second, our estimates do not take into account losses during transportation or storage because of data limitations. Lositskiy (1920) estimates such losses to be around 5%. Our threshold for food needs is generous since the amount calories needed for labor is more than the amount needed to avoid mortality. Thus, taking food losses into account should not overturn the result that famine could have been largely avoided if no food were taken out of Ukraine. Third, we do not account for food that the central government distributes back to regions after procurement. These data are not systematically available and they are unlikely to affect our results because the transfers were mostly sent to urban areas and rural workers not involved in grain production (e.g., forestry workers). The accounting exercise also excludes *ad hoc* famine relief efforts that we discussed in the Background Section. The small quantities of such relief mean that they are unlikely to overturn our result. Finally, the estimates in this section do not take into account the fact that about twenty percent of the population in 1926 in Ukraine are not ethnically Ukrainian, or that about 25% of ethnic Ukrainians lived outside Ukraine. We address this in the next section by inferring ethnic-specific mortality rates from the regression estimates.

4 The Causes of Ukrainian Famine Mortality

4.1 Ukrainian Bias, Production Fall and Other Factors

Motivated by the current debate on the causes of famine in Ukraine, we examine the contributions of Ukrainian bias and regional food production.

Our main measure of famine severity is the (excess) mortality rate. Province-level mortality data are available for each year in our sample for nineteen provinces from the three most populous Soviet republics: Russia, Ukraine and Belarus. These three republics include 84% of the 1926 Soviet population and 88% of the 1928 Soviet grain production. For brevity, we refer to these three republics as the Soviet Union or the USSR in the remainder of the paper. The average province in our sample has 6.5 million people in 1926. All data are mapped to their 1932 province borders.

Figure [1a](#) plots mortality from 1923 to 1940 for Ukraine and the other two republics. It shows that during non-famine years, mortality rates are lower in Ukraine (18 per 1,000) than elsewhere (22 per 1,000) and stable over time. However, mortality sharply increases during the famine. In Belarus and Russia, mortality increases in 1933 to approximately 30 per 1,000. In Ukraine, the increase begins slightly earlier in 1932 to approximately 22 per 1,000 and then spikes in 1933 to approximately 60 per 1,000. The earlier timing and larger magnitude of the total mortality increase in Ukraine are consistent with historical accounts that starvation began earlier in Ukraine and the greater intensity of the famine peak in 1933. There is significant variation in famine mortality across and within provinces (see Appendix Figure [A.1a](#)).

The data on ethnic Ukrainian population share is reported by the 1926 Population Census (the last census before the famine). 23.2 million ethnic Ukrainians lived in Ukraine and an additional 7.9 million lived in Russia and Belarus. Ukrainians constituted 21% of total Soviet population and made up the second largest ethnic group. Russians, the largest group, constituted 53% of the population. 89% of ethnic Ukrainians lived in rural areas. In regions that produced large food surpluses that the government designated as “grain-surplus” areas, Ukrainians were the largest group (43.8%) and Russians were a close second (41.9%). Since most non-Ukrainians in our sample are ethnic Russians, we sometimes refer to the reference group as “Russians”.⁷ Ethnicity is self-reported in the census and these data are widely accepted to be accurate. There was little reason to intentionally misreport.⁸ Later, we show that our results are similar when using alternative measures of ethnicity.

Next, we present bin scatter plots of mortality against the ethnic Ukrainian population share. The y-axis is the number of deaths per 1,000 people. The x-axis indicates which percentile a province is at in the distribution of 1926 Ukrainian population share. Figure [1b](#) shows that in non-famine years, the relationship is moderately negative: provinces with more ethnic Ukrainians experience slightly lower mortality. Figure

⁷Appendix Figure [A.1b](#) maps the share of ethnic Ukrainians in the rural population for each province as reported in the 1926 Census. Grain-surplus regions are shaded in crosses. Appendix Table [A.3](#) presents the correlates of 1926 Ukrainian population share and political, social and economic variables.

⁸The 1926 Population Census is commonly viewed as one of the highest quality Soviet censuses ([Andreev et al., 1998](#)). It is the last census before agricultural collectivization. After Ukrainians, the next largest ethnic group was an order of a magnitude smaller: Belorussians were 3.2% of total Soviet Union population and 3.5% of our sample. Appendix Table [A.1](#) Panel A lists the three largest ethnic groups in the entire Soviet Union, Panel B lists the three largest ethnic groups in our sample, and Panel C lists the three largest ethnic groups in the grain-surplus provinces of our sample.

Table C shows that during the famine, the relationship is strongly positive: provinces with more ethnic Ukrainians experience higher mortality.

The following equation characterizes the relationship between famine mortality, pre-famine ethnic Ukrainian population share and grain production.

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

Mortality in province i during year $t + 1$ is a function of: the interaction of the rural ethnic Ukrainian population share in province i in 1926, $Ukrainians_i$, and a dummy variable that equals one in the famine year, $Famine_t$; the interaction of per capita grain production, $grain_{i,t}$, and the famine dummy; and a vector of additional controls, X_{it} , which include the uninteracted grain production variable, urban population share and its interaction with the famine year dummy; province fixed effects η_i ; and year fixed effects δ_t . Since $Ukrainians_i$ is a time-invariant measure, the uninteracted term is absorbed by the province fixed effects. We define the famine dummy, $Famine_t$, to equal one in 1932 because 1933 was the year with the highest mortality rates and we assume that grain production in year t is used to sustain the population in year $t + 1$. Our results are qualitatively similar if the famine variable takes the value of one for 1931 and 1932. This is clear when we present the dynamic estimates later in the paper.

Given the nature of food production and famine, we allow the correlation of the standard errors to gradually decay across space to account for the movement of people, information and other factors across space. Later, when we use geographically smaller districts as units of observation, we estimate both standard errors that are spatially corrected and clustered at the district level. See Appendix Section C for alternative estimates.

β is the difference in the correlation of Ukrainian share and mortality between famine and non-famine years. If ethnic Ukrainians died at higher rates during the famine, then $\beta > 0$. γ captures the relationship between per capita grain production and famine mortality rates. If famine mortality was caused by low grain production, then $\gamma < 0$. We focus on the interaction coefficient, γ , because the relationship between production and mortality is likely to differ between famine and normal years, when production levels were higher. This is because the positive relationship between food consumption and survival exhibits strongly diminishing returns.

To account for urban-rural differences in food policies and other factors that affect famine mortality, X_{it} includes urban population share in province i during year t , and its interaction with $Famine_t$.

Table 2 presents the results. We measure grain production in several ways to address the concern that official figures from the early 1930s are exaggerated. In column (1), we use the corrected estimates based on previously classified documents as in the accounting exercise. However, the data we use for the correction are only available for a few years (1928 to 1933) and the correction is subject to assumptions discussed in Section 3 and Appendix Section A. Alternatively, column (2) presents estimates that control for production predicted by weather and geography. These data are available for a longer time horizon and allows us to avoid the assumptions needed for the corrected production measure. Predicted grain can be interpreted as a parsimonious way of controlling for weather and geography. See Appendix Section B for details.

In both columns (1) and (2), the interaction coefficient of Ukrainian population share and the famine

dummy variable is positive and statistically significant at the 1% level. For two provinces with the same per capita production in 1932 (and urbanization), the one with a higher share of ethnic Ukrainian population prior to the famine experienced higher famine mortality. This is consistent with anti-Ukrainian bias in famine-era policies contributing to famine mortality. In contrast, the interaction coefficient for grain and the famine dummy variable is positive. Because the positive interaction coefficient varies in precision and magnitude with the two measures of production (and the slightly different samples), we will cautiously interpret it as a null result. These estimates imply that for two places with the same ethnic Ukrainian population share (and urbanization), famine mortality was uncorrelated to production in 1932. This is inconsistent with the drop in production (and therefore, the drivers of production, such as earlier policies or weather) contributing to famine mortality. To maximize sample size, we henceforth focus our discussion and the remaining mortality regressions in this section on the estimates using predicted grain.

The implied magnitude of Ukrainian bias in famine mortality is large. Taken literally, column (2) implies that for two provinces that experienced the same weather, and which have the same degree of urbanization, famine mortality rate was higher by 51 per 1,000 in a province with 100% Ukrainians than in a province with no Ukrainians. Mean mortality rates are 21 per 1,000 during non-famine years and 31 per 1,000 during the famine. Another way to assess the magnitude is to examine the standardized coefficient, which is presented in italics. During the famine, increasing Ukrainian population share by one standard deviation would result in a 0.826 standard deviation increase in mortality relative to normal years.

Predicted grain productivity is a noisy measure of actual grain productivity, which can bias the estimates in column (2). The similarity in our findings when using corrected grain productivity in column (1) implies that this is unlikely to be a major issue. Nevertheless, to be cautious, we consider the possibility of non-random measurement error⁹. Conceptually, controlling for predicted grain production controls for production inputs such as weather and the geographic and climatic suitability for cultivating grain. However, if the relationship between these factors and production changes between the pre-Soviet era and the Soviet era, then the predicted estimates may be misleading. In our context, one may be concerned that earlier Soviet policies reduced the returns to production inputs so that predicted production overstates true production in Ukrainian regions.

We address this by controlling for the two policies that were most likely to have reduced agricultural productivity. In columns (3) and (4), we examine the sensitivity of the ethnic Ukrainian interaction coefficient to controlling for *dekulakization* and the loss in livestock that occurred just prior to the famine.

In the *dekulakization* campaign, approximately two million peasants (*kulaks*) were exiled to Siberia and other remote regions for actively resisting collectivization (Viola, 2007). *Kulaks* were often the relatively more productive peasants and their removal could have reduced the returns to the inputs we use to predict production. Between 1929 and 1932, the number of horses declined by 42% and cattle by 40% (Viola, 1996, p. 70). When peasants lost the property rights to their livestock, they responded by slaughtering, eating or simply neglecting the newly collectivized animals. Livestock was the main source of horsepower and manure was an important input for crop cultivation. The loss of livestock could have reduced productivity

⁹Predicted regressors may also bias standard errors. This is unlikely to be a major issue for our study given the similar findings when we use the grain productivity measure that is not predicted. See Table 2 column (1) and Appendix Table A.5 column (1).

and undermined the traditional way to avoid famine when harvests are low (by slaughtering and eating the animals).

We control for the number of *kulak* households exiled from each region in 1930-31 divided by the 1930 population (column 3) and the drop in per capita livestock between 1929 and July, 1931 (column 4). Since these variables are time invariant, we control for their interactions with the famine indicator. The interactions of Ukrainian population share and the famine dummy variable are similar to the baseline. Thus, the baseline result is unlikely to be confounded by systematic mis-measurement of production.

In column (5), we address the concern that province fixed effects absorb meaningful variation in ethnic Ukrainian share and famine mortality by including the uninteracted Ukrainian effect instead. The ethnic Ukrainian interaction coefficient in column (5) is nearly identical to the baseline in column (2). The uninteracted Ukrainian coefficient is -0.007 and statistically significant at the 1% level. This is similar to the mortality figures in showing that in non-famine years, ethnic Ukrainian population share is *negatively* associated with mortality. It is only during the famine that mortality is *positively* associated with ethnic Ukrainian population share. The sum of the interaction and uninteracted coefficients presented at the bottom of the table is positive and statistically significant at the 1% level.

To investigate the dynamic patterns of the mortality-Ukrainian gradient and provide evidence against spurious correlations, we replace the interactions with the famine dummy for 1932 with interactions with dummy variables for each year. The reference year is 1923. Figure [1d](#) plots the interaction coefficients and their 95% confidence intervals and shows a sharp temporal pattern that goes against the concern that the baseline estimate is confounded by spurious correlations (Appendix Table [A.6](#)). The correlation between Ukrainian population share and mortality becomes positive in 1932 and peaks in 1933. There is no correlation in other years.

One way to quantify the total contribution of Ukrainian bias in famine mortality is to conduct a simple back-of-the-envelope calculation using the estimates in Table [2](#) column (2). The regression predicts that the number of deaths is on average 2.72 million in non-famine years and 4.97 million in 1933. The number of excess deaths due to the famine is the difference between mortality during famine and non-famine years: $4.97 - 2.72 = 2.26$ million (with rounding error). We obtain the counterfactual famine mortality in a world with no anti-Ukrainian bias by setting the interaction coefficient of ethnic Ukrainian population share and the famine dummy variable in equation [\(1\)](#) to zero. When we do this, predicted deaths in 1933 is 3.23 million. The number of famine deaths without bias against ethnic Ukrainians is the difference between this number and the number of deaths in non-famine years, 0.51 million ($3.23 - 2.72 = 0.51$ million). Thus, bias against Ukrainians accounts for 77% ($1 - 0.51/2.26 = 0.77$) of famine deaths in our sample. Since most non-Ukrainians in our sample are Russians, who suffered much lower famine mortality rates, our results imply that total famine mortality would have been 77% lower if ethnic Ukrainians died at similar rates as ethnic Russians. When we repeat the calculation for only Ukraine, we find that bias against ethnic Ukrainians accounts for 92% ($1 - 0.12/1.51 = 0.92$) of famine deaths in Ukraine. The larger magnitude is due to the fact that ethnic Ukrainian population share in Ukraine is higher than for the three republics combined.

Later, we will use the production and procurement evidence to show that Ukrainian bias in famine

mortality is in large part due to anti-Ukrainian bias in policies that contributed to mortality. It is important to note that the main data used in our analysis were collected by the Soviet government and available to central planners. Our interpretation assumes that the estimate of Ukrainian bias is not confounded by spurious factors (e.g., variables that are correlated with pre-famine ethnic Ukrainian share and famine mortality, but unrelated to anti-Ukrainian bias in famine-era policy) and that anti-Ukrainian bias in policy led to famine mortality. We provide evidence for this later in the paper: we show that Ukrainian bias in famine mortality is unlikely to be confounded by omitted variables, and provide positive evidence that there is anti-Ukrainian bias in food procurement policy.

4.2 Ukrainian Bias Outside of Ukraine, Other Ethnic Minorities

In 1926, 25% of ethnic Ukrainians in our sample lived outside of Ukraine, which is one province in our sample. Column (6) of Table 2 examines the Ukrainian-mortality gradient in other provinces by omitting Ukraine. The Ukrainian interaction coefficient is positive and statistically significant. Thus, the bias against ethnic Ukrainians in famine mortality extends across the Soviet Union, beyond Ukraine.

In column (7), we add an interaction of the pre-famine share of non-Ukrainian ethnic minorities (e.g., Belorussians, Tatars, Mordvins, Chuvashs, Germans, Bashkirs, Jews, Poles and all other non-Ukrainians and non-Russians) with the famine dummy variable. If bias against Ukrainians was part of a larger policy of bias against all ethnic minorities, we should find that this interaction coefficient is also large, positive and statistically significant. Instead, we find that it is negative, negligible in size and only marginally significant. This interaction coefficient becomes insignificant in the district-level estimates presented later in the paper. Thus, we will interpret this as a statistical zero. These results only show bias in famine mortality against ethnic Ukrainians.

4.3 Robustness

1892 Famine The key concern for interpreting anti-Ukrainian bias in famine mortality is omitted variables. One may wonder if there are certain characteristics about ethnic Ukrainian society or the places they reside that make areas with large shares of Ukrainians particularly vulnerable to famine. For example, a recent study by Buggle and Durante (2021) argues that social capital can play an important role for surviving famines. Or, it may simply be that because Ukrainians are used to producing more food, they are less equipped to address harvest shortfalls. We investigate these possibilities by examining the 1892 famine, the last large famine in the Russian empire, with mortality from 1885 to 1913 shared with us by Charnysh (2022). Column (8) of Table 2 shows that famine mortality is not associated with ethnic Ukrainian population share. Thus, the Ukrainian-mortality gradient is specific to the Soviet famine of 1932-33 and unlikely to be explained by slow-moving features of Ukrainian culture or institutions.

Alternative Measures of Famine Severity Our analysis focuses on mortality as the main measure of famine severity. Here, we examine two alternative measures of famine severity. The first is natality. Live births should be decreasing in famine severity since starvation is negatively associated with the probability of a healthy pregnancy or birth, and is positively associated with the probability of miscarriage and stillbirths

(Dyson and Ó Gráda, eds, 2002). The second is birth cohort size measured in the 1939 Census as the dependent variable. Following the method of Meng et al. (2015), we use the place of residence and age in 1939 to create a synthetic panel of province-specific birth cohort sizes. The birth cohort size sample has more observations because provinces in the 1939 Census are smaller than those we use in the earlier samples. We do not have annual population data for these smaller units and therefore normalize cohort size with 1939 total province population. We control for 1926 urban population share interacted with the famine instead of time varying urban population share and its interaction with the famine.

Columns (9) and (10) of Table 2 present the natality and birth cohort size estimates from the baseline specification. The interaction coefficients are all negative and statistically significant at the 1% level. The estimates are consistent with the main finding of anti-Ukrainian bias in famine mortality. A back-of-the-envelope exercise using the natality and birth cohort size estimates show that anti-Ukrainian bias explains 54% of missing births and 50% of missing survivors in 1939 in Ukraine, and 26% of missing births and 14% of missing survivors in 1939 in Belarus, Russia and Ukraine.

In Appendix Section D, we present additional robustness checks, such as directly controlling for weather, using alternative measures of Ukrainian population share, controlling for the cultivation of other crops, demographic structure, administrative capacity, political zealotry and social norms. The robustness results taken together imply that our interpretation would only be confounded by a factor that is not accounted for by the large number of controls and which only matters in the Soviet regime (but not the Tsarist regime).

4.4 Within-Province Patterns

Soviet policies were centrally planned, implemented top-down by the bureaucracy and usually used similar allocation rules at various administrative levels. If the patterns we observe are driven by centrally planned policies, then we would expect to see positive famine-mortality-Ukrainian-share gradient across districts within provinces as well as across provinces. Our district-level panel consists of two years: 1928 and 1933. The majority of the data are manually collected from former Soviet archives. District-level mortality data are only available for Russia and Ukraine and we have fewer variables at this more disaggregated level (e.g., there are no data for production or procurement).

Table 3 column (1) re-estimates the baseline specification with district and year fixed effects instead of province and year fixed effects. Conceptually, famine mortality in this regression is the difference between 1933 and 1928 mortality rates. Since we do not observe production at the district level, the baseline controls for the suitability for grain cultivation from the FAO GAEZ database and its interaction with the famine year dummy; and weather (monthly temperature and precipitation in years t and $t - 1$).

Column (2) and all subsequent columns control for province-year fixed effects, which isolate the within-province variation and control for factors that vary by province and year (e.g., regional political competition, leadership differences across provinces). The spatial patterns are similar to the province-level estimates. Within provinces, famine mortality is increasing with ethnic Ukrainian population share.

Column (3) controls for an alternative measure of weather: the deviations from long-term (1900-1950) means of monthly temperature and precipitation in years t and $t - 1$. The results are similar. In column (4), we omit Ukraine and show that the patterns are similar in Russian provinces.

In column (5), we show that there is no bias for other ethnic minorities. The coefficient is small in magnitude and statistically insignificant.

The results are consistent with the presence of a centrally planned policy that targets ethnic Ukrainians.

The maps in Appendix Figures [A.1c](#) and [A.1d](#) illustrate the variation in ethnic Ukrainian share and famine mortality across districts within provinces. Appendix Table [A.8](#) shows that the results are qualitatively similar when we subject the district-level estimates to the same sensitivity checks as the province-level estimates.

4.5 Administrative vs. Ethnic Boundaries

Past discussions about Ukrainian famine mortality have focused on the difference between Ukraine and other republics. Yet, our estimates show that Ukrainian bias in mortality exists outside of Ukraine. In this section, we use the district-level data to directly investigate the importance of administrative borders by examining the change in district-level famine mortality as one crosses from Ukraine to Russia. We plot famine mortality, the difference between 1933 and 1928 mortality rates, against the distance to the border between Ukraine and Russia, together with the fitted lines and their 95% confidence interval. Figure [2a](#) shows that there is discrete decline in famine mortality rates as one crosses the border from Ukraine to Russia. Famine mortality rates are lower in Russia by 2.5 to 3.6 percentage-points (see Appendix Table [A.9](#) Panel A).

The border effect on mortality rates is consistent with survivor accounts of notably lower mortality across the border (e.g., [Applebaum, 2017](#), Ch. 10, 11). It also sheds light on the contribution of the migration ban on Ukraine imposed in January, 1933. To see this, consider the hypothetical scenario of free mobility. In that case, we should not observe discrete changes in famine mortality rates along any administrative border.

Figure [2b](#) plots the mortality residuals from a regression controlling for 1926 Ukrainian population share against distance to the border. There is no border effect once we control for the ethnic Ukrainians rural population share of each district. Conceptually, this accounts for the decline in ethnic Ukrainian share when crossing the border (see Figure [2c](#)). Thus, anti-Ukrainian bias was delineated along ethnic and not administrative lines.

5 Government Policy

5.1 Realized Procurement and Retention

Ukrainian bias in famine mortality is consistent with the presence of anti-Ukrainian bias in policy. In this section, we investigate whether there is bias in the most important policy for food distribution: centrally planned grain procurement. Such positive statistical evidence can help address the lack of conclusive documentary evidence.

Table [4](#) documents the relationship between Ukrainian population share, centrally planned procurement, retention and famine mortality. The sample size is smaller than the main analysis because of the limited availability of procurement and production data. In column (1), the dependent variable is realized procure-

ment as a share of realized production. We use our corrected grain production. The estimate is similar to equation (1), except that we no longer control for predicted grain and its interaction with famine because grain production is the denominator of the dependent variable. The Ukrainian interaction coefficient is positive, 0.18, and statistically significant at the 1% level. This implies that, all else equal, the share of production taken away from a province that was 100% Ukrainian was 18 percentage-points higher than a province that had no Ukrainians.

Column (2) examines per capita retention (production minus procurement) as the dependent variable. It shows that all else equal, a province with 100% rural Ukrainian population share retained 1.073 kilograms per capita per day less than a province with no Ukrainians. The Ukrainian interaction coefficient is positive and statistically significant at the 1% level. To examine the timing of anti-Ukrainian bias in food retention, we replace the interaction of rural ethnic Ukrainian population share and the famine dummy with the interaction of rural ethnic Ukrainian population share and year dummy variables. 1928 is the omitted reference group. Figure 1e (and Appendix Table A.6 column 2) shows that Ukrainian population share is uncorrelated with food retention for most years, but negatively correlated in 1932. These estimates show that there was anti-Ukrainian bias in centrally planned food procurement on the eve of the famine.

Columns (3) and (4) document the relationship between mortality and grain retention. In column (3), we regress mortality on realized grain retention and its squared term. Consistent with the positive and concave relationship between food consumption and mortality, we find that the coefficient for grain retention is negative and the coefficient for the squared term is positive. Both estimates are statistically significant at the 5% level. In column (4), we add the interactions of these variables with the famine dummy. The interactions are statistically zero, while the uninteracted terms are similar to column (3). This is a sanity check and reflects the fact that the biological relationship between food consumption and mortality is stable over time. The estimates support the interpretation that the Soviets procured a higher share of 1932 production from Ukrainians, which resulted in lower food retention and higher famine mortality.

To understand the importance of anti-Ukrainian bias in grain procurement policy for famine mortality, we conduct a simple quantification exercise that compares famine mortality when there is bias in retention to the counterfactual of no bias.

First, we estimate the relationship between mortality and grain retention so that we can predict mortality at different levels of retention.

$$mortality_{i,t+1} = F(\text{retention}_{it}) + \Gamma X_{it} + \eta_i + \delta_t + \varepsilon_{it}. \quad (2)$$

Equation (2) is conceptually similar to the estimates shown in Table 4, but with a more flexible functional form and fewer controls for parsimony. $F(\text{retention}_{it})$ is a flexible step function defined over 0.5 kilogram per capita per day intervals of grain retention, X_{it} includes province characteristics that may affect mortality (e.g., urbanization), and η_i and δ_t are province and year fixed effects. The estimates show that lower retention is associated with higher mortality. The results are robust if in addition to urbanization, we control for urbanization interacted with the famine indicator and the official 1928 grain production interacted with the famine indicator (see Appendix Figure A.3 and Appendix Table A.10).

Second, we estimate famine mortality with anti-Ukrainian bias in grain retention. This is the difference

between the number of deaths in 1933 predicted by realized 1932 retention and the number of deaths in non-famine years. The number of deaths predicted by realized retention can be obtained by applying 1932 realized grain retention to the estimates from equation (2) and Table 2 column (2): predicted 1933 mortality is 1.38 million deaths in Ukraine and 4.37 million deaths in the full sample. Average predicted mortality for non-famine years is 0.52 million for Ukraine and 2.72 million for the full sample. Thus, famine mortality with bias is 0.86 million for Ukraine ($1.38 - 0.52 = 0.86$) and 1.66 million for the whole sample ($4.37 - 2.72 = 1.66$).

Next, we estimate famine mortality for the counterfactual of no bias in grain retention. This is the difference between the number of 1933 deaths predicted by the counterfactual of no bias in retention and the number of deaths in non-famine years. To calculate the counterfactual 1933 mortality, we first predict counterfactual 1932 grain retention. We use the estimates of the relationship between retention and the interactions of Ukrainian population share and year dummy variables shown in Figure 1e. We set Ukrainian share to zero in 1932 to predict counterfactual grain retention for the famine. Then, we apply the counterfactual grain retention to the estimates from equation (2) to predict the counterfactual 1933 mortality: predicted 1933 deaths are 0.89 million in Ukraine and 3.83 million in the full sample. Thus, the counterfactual famine mortality is 0.37 million for Ukraine ($0.89 - 0.52 = 0.37$) and 1.11 million for the whole sample ($3.83 - 2.72 = 1.11$).

Finally, we estimate the contribution of bias in grain retention on famine mortality by comparing famine mortality when there is anti-Ukrainian bias to the counterfactual famine mortality of no bias in retention. It follows that anti-Ukrainian bias in grain retention explains 57% of excess deaths in Ukraine ($1 - 0.37/0.86 = 0.57$) and 33% of all excess deaths in our sample ($1 - 1.11/1.66 = 0.33$). Since overall anti-Ukrainian bias explains 77% and 92% of famine mortality in the whole sample and Ukraine, the estimates imply that approximately half of the total anti-Ukrainian bias effect on famine mortality takes place through bias in grain retention.

The magnitudes are consistent with the importance of grain procurement for determining food availability, but also leave room for other policies to contribute to food availability, such as procurement of potatoes and other non-grain agricultural products, migration restrictions or aid relief.

5.2 Production and Procurement Targets

To understand whether anti-Ukrainian bias in grain procurement was centrally planned and intentional, we examine grain production and procurement targets published before the famine. The First Five-Year Plan, published in 1928, laid out production and procurement targets for each province for the years from 1928 to 1933. In Table 4 Panel B column (5), we regress per capita production targets on the rural share of ethnic Ukrainians. We control for year fixed effects to account for the fact that the planners assumed a high rate of growth in all regions, and officially reported 1928 per capita grain production, which was the measure used by planners to account for regional agricultural productivity. We do not control for province fixed effects because of the limited variation in a five-year panel. The coefficients for Ukrainians and grain 1928 are both positive and statistically significant. For two places with the same observed production in 1928, the one with more ethnic Ukrainians was expected to produce more. This could reflect the regime's desire to be harsher

with Ukrainians or a belief that Ukrainian peasants were less productive than other peasants living in similar natural conditions and had more room to expand production.

Column (6) examines per capita procurement targets as the dependent variable, while controlling for production targets, which captures differences in perceived production capacities across regions. For two provinces assigned the same production target, the one with more Ukrainians is assigned a higher procurement target. Column (7) shows a similar pattern when we examine procurement as a share of production as the dependent variable. Thus, the regime intended to take more grain from Ukrainian areas after conditioning for factors such as production capacity. Since we control for production targets, the Ukrainian bias in grain procurement targets cannot be driven by the belief that Ukrainian grain production had more room to grow.

In column (8), we replace procurement ratios with per capita grain retention targets (the difference between the production and procurement targets) as the dependent variable. The coefficient for ethnic Ukrainian population share is -0.275 and statistically significant at the 1% level. For two places facing the same production targets, central planners intended for the one with 100% ethnic Ukrainians to have 0.275 kilograms of grain per capita per day less than the one with no Ukrainians. The magnitude of the discrepancy is sizable: it is approximately one-third of the official Soviet food requirement (see Section 3).

The target data show that as early as 1928, the regime had planned for Ukrainian areas to retain less grain than other regions with the same level of grain production. However, the data do not imply that the regime planned to kill Ukrainians because the production targets are much higher than actual grain production for all regions and the degree of unequal grain retention implied by the target data would not result in famine mortality at high levels of grain retention. Thus, the results leave open the question of the timing of the decision to let Ukrainians die. In one extreme scenario, the regime aimed to reduce the Ukrainian population size *ex ante* and set procurement targets in 1928 that would lead to high Ukrainian famine mortality. This assumes that the regime secretly knew what true 1932 production would be, but planned to enforce the procurement targets. In an alternative scenario, the regime aimed to penalize Ukrainians for being resisting Soviet agricultural policies by leaving them with less surplus without the intention to cause famine. Stalin was known to have advocated using the over-procurement of food to discipline peasants (Danilov et al., eds, 1999–2006; Davies and Wheatcroft, 2009), and to have rewarded loyal ethnic groups and penalized disloyal ones (Polyan, 2001). In this scenario, the regime intended for Ukrainians to retain less food than others, but planned for Ukrainians to retain enough food for subsistence; when production fell in 1932, the state made the decision to enforce higher procurement from Ukrainians. The truth may also be somewhere in between: the leadership knew that production targets were too optimistic, but did not fully predict the severity of the fall in production in 1932; and faced with the choice of giving up procurement versus letting Ukrainians die, they chose the latter. In either case, the regime is culpable for the high rates of Ukrainian famine mortality. The question is about the timing of the decision to allow Ukrainians to die from famine.

5.3 Motivation of Anti-Ukrainian Bias

As we discussed in the Introduction, the primary political economic explanation of Ukrainian famine mortality is that Ukrainians were repressed because of their importance to Soviet agriculture and their strong

resistance to Soviet rural economic policy. It is beyond the scope of this paper to provide conclusive evidence on the motivations of anti-Ukrainian bias. This section provides a speculative discussion and some clues for future research.

Ukrainians had a strong group identity that included their own language and culture, which facilitated collective action. The Ukrainian communist party was the largest national branch of the Soviet Communist Party and viewed itself as representing the interests of ethnic Ukrainians across the Soviet Union, including those who lived outside the boundaries of the republic. Strong political opposition from Ukrainian nationalists during the Civil War was central to the Bolsheviks' "national question". The Bolsheviks were concerned about controlling all peasants, but especially concerned about controlling the Ukrainian peasantry, the largest ethnic group in the grain-producing regions (Graziosi, 2015).

We provide two stylized facts consistent with this political-economic motive. The first is to validate the claim that ethnic Ukrainians offered stronger resistance to collectivization than other ethnic groups. We collect data on de-classified secret police reports about peasant resistance to collectivization. We find that the positive slope between collectivization (the share of households that have been collectivized) and resistance is steeper in the ten provinces with Ukrainian population share above the sample median than in the nine provinces with Ukrainian population share below the median, controlling for official 1928 grain production and urban population share. The data show that all else equal, Ukrainian peasants resisted collectivization more intensely.¹⁰ This is consistent with the Bolsheviks' fear that political resistance was stronger from Ukrainians, as well as our finding that anti-Ukrainian bias extended to ethnic Ukrainians across the Soviet Union.

Second, we document that the famine mortality-Ukrainian gradient is steeper in places that were more important for agricultural production. This implies that there was more intense targeting of Ukrainians in agriculturally productive places. We regress mortality on the triple interaction of Ukrainian population share, the famine dummy variable, and the importance of a region for rural economic production as perceived by the state (measured with official 1928 grain production). Table 5 shows that the triple interaction coefficient with 1928 grain production is positive and statistically significant at the 1% level. In column (2), we control for a parsimonious measure of administrative capacity and political zealotry (the first principal component of the share of votes for the Bolshevik Party in the 1917 Constituency Assembly election, the size of the Communist Party averaged over 1922, 1927 and 1931, and the number of the 1930 Party Congress delegates; we also examine these variables separately in Appendix Section D). The triple interaction coefficient with 1928 grain production is robust to the additional control, while the triple interaction coefficient with the administrative capacity proxy is small in magnitude and statistically insignificant. Thus, the Ukrainian-mortality gradient is steeper in places that are more important for agriculture, but does not vary with these other factors that are unrelated to agriculture. Column (3) repeats the estimate with district-level data. The triple interaction of Ukrainian population share, suitability for grain cultivation and the famine dummy is positive, large in magnitude and statistically significant at the 1% level. As we discussed earlier in the paper, finding similar patterns at different administrative levels supports the interpretation that the patterns

¹⁰We plot the fitted lines and residuals in Appendix Figures A.4a and A.4b. The p-value for the statistical difference between the two slopes is 0.09.

we observe are due to centrally planned policy.

Additional Mechanisms There are several complementary hypotheses for why the Soviet regime repressed Ukrainians for political economic reasons. A variation of the hypothesis discussed above stems from the well-known insights of Horowitz (1985). The logic is as follows. Given the need to control agriculture, the regime targeted ethnic Ukrainians because it lacked more precise information on the likelihood of subversion. Thus, ethnic Ukrainian population share was used as a crude marker on which central planners conditioned policies.

Another hypothesis is that anti-Ukrainian bias is partly driven by asymmetric information and rigidities in the command economy. Meng et al. (2015) first made this argument for the Chinese famine, which occurred in a centrally planned procurement system modeled after the Soviet one. They argue that the famine was partly due to the government's inability to adjust procurement because it did not trust local information. Farmers are not the residual claimants of production and therefore incentivized to under-report production or shirk. Local bureaucrats may over-report production to curry favor with the Party or under-report to build a local power base. Both are bad for the regime. Over-reporting can lead to over-procurement and famine, which can lower future production and be politically destabilizing. Under-reporting lowers revenues. Thus, the government will not lower procurement until they can verify that the production drop is not caused by peasants shirking (or if famine would be too politically costly). Information rigidities can explain the anti-Ukrainian bias in Soviet policy and famine mortality if the Bolsheviks were particularly distrustful of Ukrainians. This theory of famine is consistent with the Bolsheviks' primary objective to control agricultural production and under-reporting production can be viewed as a form of Ukrainian resistance that threatens the Bolsheviks.

Note that there are important differences in the political economic contexts of the two famines. The Chinese famine occurred in the rural political power base of the Chinese Communist Party, including the home provinces of the top Party leaders. In contrast, by the time of the Soviet famine, there had been a history of political conflict between the Ukrainian peasantry and the Bolsheviks, whose political power base lie in industrial areas (Castañeda Dower and Markevich, 2023). Agricultural production was also more important to the Chinese economy in 1959 (approximately 80% of GDP) than the Soviet economy in 1928 (approximately 50% of GDP).

The variants of the political economic motivation discussed in this section are not mutually exclusive; nor do they preclude other motivations for anti-Ukrainian bias.

6 Rural population and Grain Production after the Famine

This section examines long-run economic and demographic patterns in areas that had a higher share of Ukrainian population and suffered disproportionately high famine mortality rates.

First, we use all available population censuses from 1897 to 2002 to examine total rural population. We regress log rural population size on the interaction of 1926 ethnic Ukrainian share and (census) year fixed effects, controlling for province and year fixed effects. Figure 3a (Appendix Table A.11 column 1) presents

the interaction coefficients and its 95% confidence intervals. The figure shows that relative to areas with no Ukrainians, the rural populations in Ukrainian areas declined in size immediately after the famine and had not recovered by 1939. Rural population had recovered by 1959 in the first population census after the war.

In Figure 3b, we examine the rural population share of ethnic Ukrainians and ethnic Russians. The estimates are imprecise and should be interpreted as suggestive. Nevertheless, the patterns are striking: the share of ethnic Ukrainians declined after the famine and the decline was permanent. This goes against the concern that famine mortality in regions with high ethnic Ukrainian population share was driven by the deaths of other ethnicities and not that of ethnic Ukrainians (“ecological fallacy”). The statistical evidence is consistent with the fact that there are no known accounts of such mortality patterns.

Next, we examine grain production. As with the accounting exercise, we use corrected grain figures for the years 1928-1933 and official grain figures for all other years. We regress log total grain production for each province and year on the interaction of pre-famine ethnic Ukrainian population share and year fixed effects, controlling for the time-invariant measure of suitability for grain cultivation interacted with year fixed effects, 48 monthly temperature and precipitation variables for years t and $t - 1$, and province and year fixed effects. Figure 3c (Appendix Table A.11 Column 4) presents the interaction coefficients of interest. Consistent with the republic-level accounting exercise, we observe a larger production drop in Ukrainian areas. In addition, we observe that production in these areas remained lower than others for a total of four years and had recovered by 1936. Thus, production in famine-stricken areas recovered before the labor supply.

Agriculture in the early 1930s still mostly relied on traditional means of production and a key feature of Soviet economic policy was to mechanize agriculture. The most important mode of mechanization was the adoption of tractors, which were centrally allocated by Moscow. Thus, we examine the allocation of tractors to understand whether the regime increased mechanization in famine-stricken regions to boost production. We collect archival data on province-level tractors allocation for 1927 to 1939. In normal times, tractors were allocated based on sown area and the importance of a location for agricultural production. Thus, we regress total tractor horse power per hectare of 1928 sown area on the interaction of year dummy variables and the pre-famine Ukrainian population share, controlling for the time-invariant measure of suitability for grain production interacted with year fixed effects, and province and year fixed effects. Figure 3d (Appendix Table A.11 Column 5) shows small increases in the number of tractors allocated to regions that had a high pre-famine Ukrainian population share during 1927 to 1932, and a large increase during 1933 to 1939. Since the allocation of tractors may have been accompanied by other inputs such as better fertilizers, we interpret tractors as broadly reflecting the use of advanced inputs or the mechanization of agriculture. These estimates together with the results on rural population and production suggest that tractors were used to moderate the loss of labor and boost production in famine-stricken regions.

7 Conclusion

The Soviet Famine, in which 5 to 10.8 million people perished, is one of the most devastating human tragedies of the 20th century. Particularly controversial is the disproportionately high mortality of Ukraini-

ans. Approximately 2.1 to 3.15 million ethnic Ukrainians died. Between 1926 and 1939, the share of ethnic Ukrainians in the total Soviet population declined from 21.3% to 16.5%. In areas that the Bolshevik regime marked as important for grain production, ethnic Russians replaced ethnic Ukrainians as the largest ethnic group. By 1939, ethnic Russians constituted 48.1% and ethnic Ukrainians being 37.1% of the population in these regions. This paper provides the first systematic evidence that disproportionately high Ukrainian famine deaths were not an unintended consequence, but an outcome of anti-Ukrainian bias in Soviet policy. The Bolsheviks systematically over-procured food from ethnic Ukrainians, leading to higher Ukrainian mortality during the famine province by province, district by district, within and outside of Ukraine. Anti-Ukrainian bias in the grain distribution policy and migration restrictions both contributed to high Ukrainian famine mortality.

We hope that the rigorous empirical evidence provided in this paper will establish a ground truth for future research and public discussions.

Our findings suggest several interesting questions for future research. One is to better understand how other policies contributed to Ukrainian mortality. Another is to understand the political-economic tradeoffs of mass repression for the regime. The existing evidence is ambivalent in our context. On the one hand, rural production recovered within a few years of the famine and the Bolsheviks remained in power for another fifty years. On the other hand, the famine had long-lasting economic and political consequences for the Ukrainian-Russian relationship (Korovkin and Makarin, 2023; Rozenas and Zhukov, 2019). Relatedly, it is interesting to understand the role that the repression had in perpetuating ethnic conflict. Prior to the famine, there was little hostility between ethnic Ukrainians and ethnic Russians. Did the economically motivated repression inadvertently deepen ethnic division? The fact that Russian officials removed the commemorative memorial of the victims of the *Holodomor* to combat “political disinformation” when they occupied Mariupol in 2022 highlights the importance of the legacy of the 1932-33 Soviet famine today.¹¹

Data Availability Statement

The data and code underlying this research are in a replication package available on Zenodo at <https://doi.org/10.5281/zenodo.10983057>.

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¹¹See RIA Novosti channel in telegram, October 19, 2022, https://t.me/rian_ru/182454. Accessed October 24, 2022.

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Table 1: Grain Availability

	1927	1928	1929	1930	1931	1932	1933	1937	1939
	I. Ukraine								
(1) Total population (mln)	29.0	29.6	30.3	30.8	31.1	31.5	31.9	28.4	29.6
(2) Rural population (mln)	23.6	24.6	24.9	25.1	25.0	24.8	25.0	18.8	18.7
(3) Production (mln tons)	.	14.9	18.7	23.2	16.8	9.1	16.3	.	.
(4) Procurement (mln tons)	4.0	2.0	5.3	7.7	7.3	4.2	6.1	.	.
(5) Rural retention (kg/person/day)	.	1.436	1.477	1.693	1.042	0.538	1.115	.	.
(6) Rural retention, no procurement (kg/person/day)	.	1.662	2.060	2.531	1.838	1.005	1.786	.	.
(7) Rural and urban retention, no procurement (kg/person/day)	.	1.379	1.696	2.065	1.477	0.791	1.398	.	.
(8) Food needs for labor (kg/person/day)	0.78	0.79	0.78	0.78	0.78	0.78	0.78	0.76	0.75
	II. USSR – no Ukraine								
(9) Total population (mln)	118.0	120.8	124.0	126.7	129.4	131.7	133.9	133.7	135.9
(10) Production (mln tons)	.	58.5	53.1	60.1	47.8	48.0	50.9	.	.
(11) Rural and urban retention, no procurement (kg/person/day)	.	1.326	1.172	1.299	1.011	0.999	1.042	.	.
(12) Food needs for labor (kg/person/day)	0.78	0.78	0.78	0.78	0.78	0.77	0.77	0.76	0.76

Notes: Data for population and procurement are official statistics. Production is revised by the authors using archival sources. See the text and Appendix for details. Retention is the difference between production and procurement. Food needs are calculated by the authors and take into account the demographic composition (e.g., age, gender, rural/urban) as reported in the population censuses. They are based on official guidelines for caloric needs for each group as reported by [Lositskiy, ed \(1926, 1928\)](#). Panel I includes Ukraine. Panel II includes all other republics in the USSR.

Table 2: Famine Mortality and Ethnic Ukrainian Population Share – Province-level Estimates

	Dependent Variable:									
	Mortality in Year $t + 1$					Natality in Year $t + 1$				
	Control for Corrected Grain Production (1)	Baseline (2)	Kulaks \times Famine (3)	Livestock Change \times Famine (4)	Omit Province FE, control for Ukrainians (5)	Omit Ukraine (6)	Other Minorities \times Famine (7)	1892 Famine (8)	Natality in Year $t + 1$ (9)	Cohort Size in Year $t + 1$ (10)
Ukrainians \times Famine	0.050 (0.002)	0.051 (0.006)	0.054 (0.005)	0.053 (0.005)	0.051 (0.005)	0.086 (0.007)	0.049 (0.007)	-0.0002 (0.003)	-0.014 (0.003)	-0.009 (0.001)
<i>Standardized Coef.</i>	0.813	0.826	0.870	0.858	0.831	0.840	0.790	-0.004	-0.432	-0.608
Grain	0.001 (0.001)	0.0002 (0.0002)	0.0002 (0.0002)	0.0002 (0.0002)	-0.0002 (0.0004)	0.0003 (0.0002)	0.0002 (0.0002)	0.0004 (0.0004)	0.0005 (0.0002)	0.00003 (0.0001)
Grain \times Famine	0.007 (0.003)	0.0004 (0.003)	-0.003 (0.003)	-0.001 (0.003)	-0.0001 (0.003)	-0.003 (0.002)	0.001 (0.003)	0.002 (0.003)	-0.001 (0.001)	-0.001 (0.0003)
<i>Standardized Coef.</i>	0.275	0.023	-0.137	-0.067	-0.005	-0.183	0.031	0.046	-0.047	-0.120
Additional Control (column heading)			1.805 (1.367)	0.016 (0.015)	-0.007 (0.002)		-0.007 (0.004)			
Observations	107	337	337	337	337	319	337	1,297	337	1,296
R-squared	0.838	0.776	0.791	0.784	0.420	0.758	0.780	0.864	0.820	0.768
Ukrainians + Ukrainians \times Famine: Coef. p-val.					0.044 <0.0001					
<i>Dep. var. mean, non-famine years</i>	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.031	0.039	0.025
<i>Dep. var. mean, famine year</i>	0.031	0.031	0.031	0.031	0.031	0.029	0.031	0.040	0.028	0.017

Notes: The sample includes Ukraine, Russia and Belarus. Observations are at the province and year level. In column (1), the sample includes years from 1928 to 1933; in columns (2)-(7) and (9), the sample includes years from 1922 to 1939; in column (8), the sample includes years from 1885 to 1913; in column (10), the sample includes years from 1922 to 1937. Mortality is the number of deaths divided by the total population. Natality is the number of live births divided by the total population. Cohort size is the birth cohort size reported by the 1939 census divided by the total 1939 population. Ukrainians is the 1926 rural Ukrainian population share. In columns (1)-(7) and (9)-(10), famine is an indicator that equals one in 1932 and zero otherwise; in column (8), famine is an indicator that equals one in 1891 and zero otherwise. All estimates control for per capita grain and grain \times Famine; in column (1), grain is for production estimates revised by the authors using archival data (see text), in columns (2)-(10) grain is per capita grain production predicted by exogenous factors. Columns (1)-(9) control for urbanization (the urban population share) and urbanization \times Famine, column (10) controls for urbanization 1926 \times Famine. In addition, column (3) controls for the number of kulak households exiled during 1930-31 per 1930 population interacted with the famine indicator. Column (4) controls for the drop in livestock (horses and cattle) per capita between 1929 and 1931 interacted with the famine indicator. In column (7), "other minorities" include all ethnic groups except Russians and Ukrainians, so the omitted category is Russians. Columns (1)-(4) and (6)-(10) control for province and year FE; column (5) controls for year FE. The standard errors in parentheses are adjusted for spatial correlation within 1,500 km.

Table 3: Famine Mortality and Ethnic Ukrainian Population Share — District-level Estimates

	Dependent Variable: Mortality				
	(1)	(2)	Monthly Temp and Rain Deviations for Year $t-1, t$ (3)	Omit Ukraine (4)	Other Minorities (5)
Ukrainians \times Famine	0.034 (0.006) [0.006]	0.024 (0.007) [0.007]	0.024 (0.007) [0.007]	0.024 (0.008) [0.008]	0.026 (0.007) [0.007]
<i>Standardized Coef.</i>	<i>0.438</i>	<i>0.311</i>	<i>0.311</i>	<i>0.209</i>	<i>0.334</i>
Other Minorities \times Famine					0.010 (0.007) [0.007]
Observations	3,274	3,274	3,274	2,498	3,274
R-squared	0.797	0.812	0.812	0.783	0.813
District FE	Y	Y	Y	Y	Y
Year FE	Y	N	N	N	N
Province-Year FE	N	Y	Y	Y	Y
<i>Ukrainians</i>					
<i>Mean</i>	<i>0.255</i>	<i>0.255</i>	<i>0.255</i>	<i>0.070</i>	<i>0.255</i>
<i>Std. Dev.</i>	<i>0.374</i>	<i>0.374</i>	<i>0.374</i>	<i>0.171</i>	<i>0.374</i>
<i>Dep. var. mean in 1928</i>	<i>0.019</i>	<i>0.019</i>	<i>0.019</i>	<i>0.020</i>	<i>0.019</i>
<i>Dep. var. mean in 1933</i>	<i>0.039</i>	<i>0.039</i>	<i>0.039</i>	<i>0.031</i>	<i>0.039</i>

Notes: The sample includes Ukraine and Russia. Observations are at the district and year level; the sample includes two years – 1928 and 1933. Mortality is the number of deaths divided by the total population. Ukrainians is the 1926 rural Ukrainian population share. Famine is an indicator that equals to one in 1933 and zero otherwise. All regressions control for grain suitability \times famine, urbanization and urbanization \times famine. Columns (1)-(2), (4)-(5) control for monthly temperature and precipitation in years t and $t - 1$ (48 additional controls). Column (3) controls for deviations in monthly temperature and precipitation from the long-term (1900-1950) means in years t and $t - 1$ (48 additional controls). In column (5), “other minorities” include all ethnic groups except Russians and Ukrainians. The standard errors in parentheses are adjusted for spatial correlation within 400 km. Standard errors clustered at the district level are presented in square brackets.

Table 4: Procurement, Retention and Mortality

	Dependent Variable: Production, Procurement, Retention (kg/person/day) and Mortality							
	A. Realized Amounts				B. Centrally Planned Targets			
	Procurement Share = Procurement/Production	Retention = Production - Procurement	Mortality in Year $t + 1$		Production	Procurement	Procurement Share = Procurement/Production	Retention = Production - Procurement
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Ukrainians \times Famine	0.180 (0.017)	-1.073 (0.186)						
Ukrainians					0.776 (0.191)	0.275 (0.071)	0.165 (0.020)	-0.275 (0.071)
Retention			-0.027 (0.012)	-0.026 (0.010)				
Retention ²			0.008 (0.004)	0.008 (0.003)				
Retention \times Famine				-0.016 (0.027)				
Retention ² \times Famine				0.004 (0.009)				
Official Grain Production 1928					0.907 (0.052)			
Production Target						0.540 (0.035)	0.285 (0.016)	0.460 (0.035)
Observations	107	107	107	107	90	90	90	90
R-squared	0.937	0.781	0.627	0.637	0.691	0.814	0.844	0.723
<i>Dep. var. mean except 1932</i>	<i>0.222</i>	<i>1.018</i>	<i>0.021</i>	<i>0.021</i>	<i>1.648</i>	<i>0.257</i>	<i>0.085</i>	<i>1.390</i>
<i>Dep. var. mean in 1932</i>	<i>0.254</i>	<i>0.918</i>	<i>0.031</i>	<i>0.031</i>	<i>1.798</i>	<i>0.323</i>	<i>0.106</i>	<i>1.474</i>

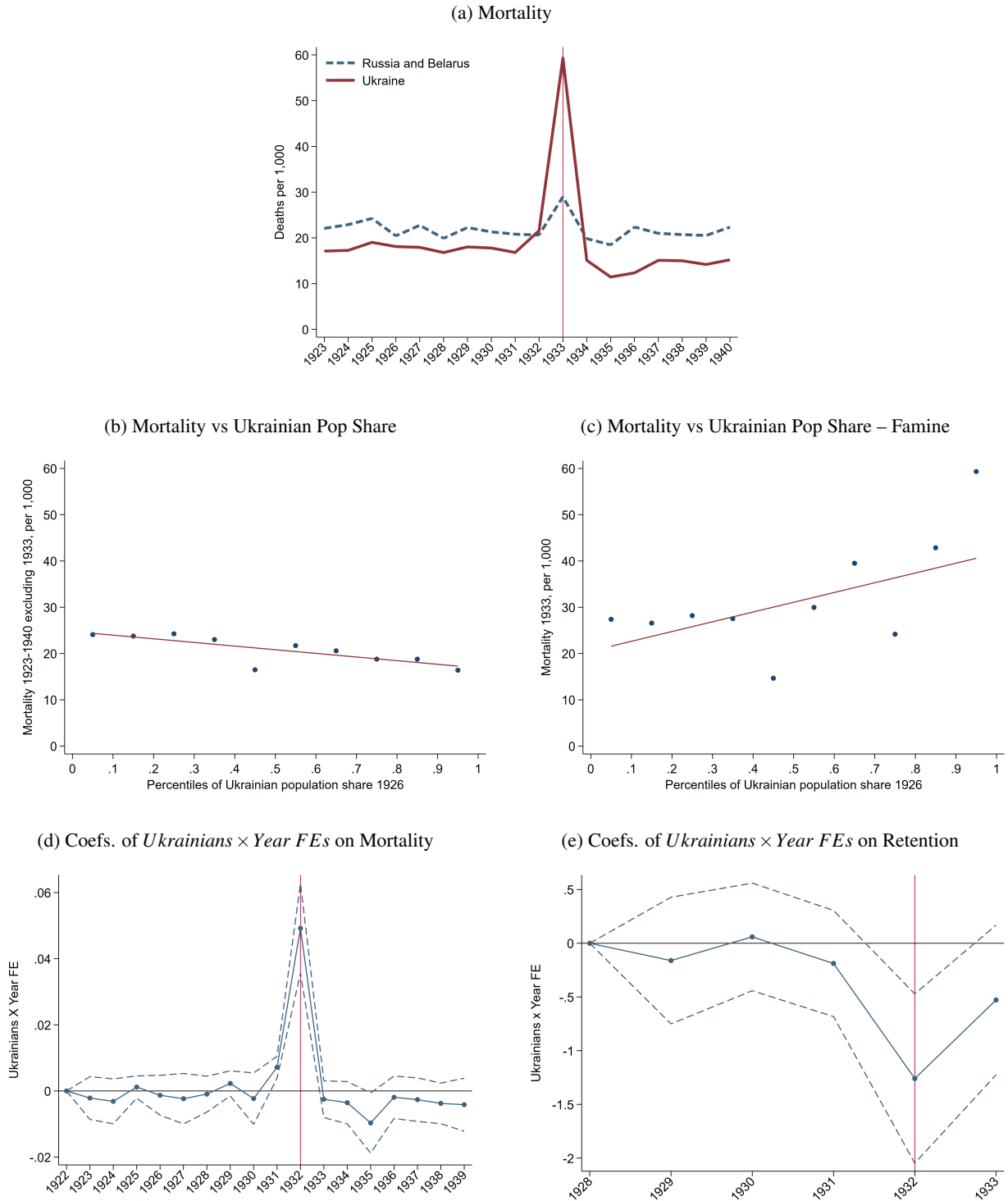
Notes: The sample includes Ukraine, Russia and Belarus. Observations are at the province and year level for the years from 1928 to 1933. Ukrainians is the 1926 rural Ukrainian population share. Panel A: Production is revised by the authors based on archival documents (see text). Retention is measured in kilograms per person per day. Mortality is the number of deaths divided by the total population. All estimates control for urbanization, urbanization \times famine, and province and year fixed effects. The standard errors in parentheses are adjusted for spatial correlation within 1,500 km. Panel B: Official grain production 1928, production, procurement and retention targets are measured in kilograms per person per day. All estimates control for year fixed effects. Huber-White robust standard errors are in parentheses.

Table 5: Heterogeneous Effects of Grain Productivity on Famine Mortality in Ethnic Ukrainian Areas

	Dependent Variable: Mortality in Year $t + 1$			
	Province-Level		District-Level	
	(1)	(2)		(3)
Ukrainians \times Official Grain Production 1928 \times Famine	0.300 (0.051)	0.263 (0.081)	Ukrainians \times Grain Suitability \times Famine	0.070 (0.022)
Ukrainians \times Famine	-0.174 (0.035)	-0.065 (0.156)	Ukrainians \times Famine	-0.010 (0.017)
Official Grain Production 1928 \times Famine	0.0002 (0.002)	0.001 (0.002)	Grain Suitability \times Famine	0.005 (0.006)
Ukrainians \times Admin. Capacity \times Famine		0.022 (0.027)		
Admin. Capacity \times Famine		-0.001 (0.001)		
Observations	337	337	Observations	3,274
R-squared	0.845	0.846	R-squared	0.784

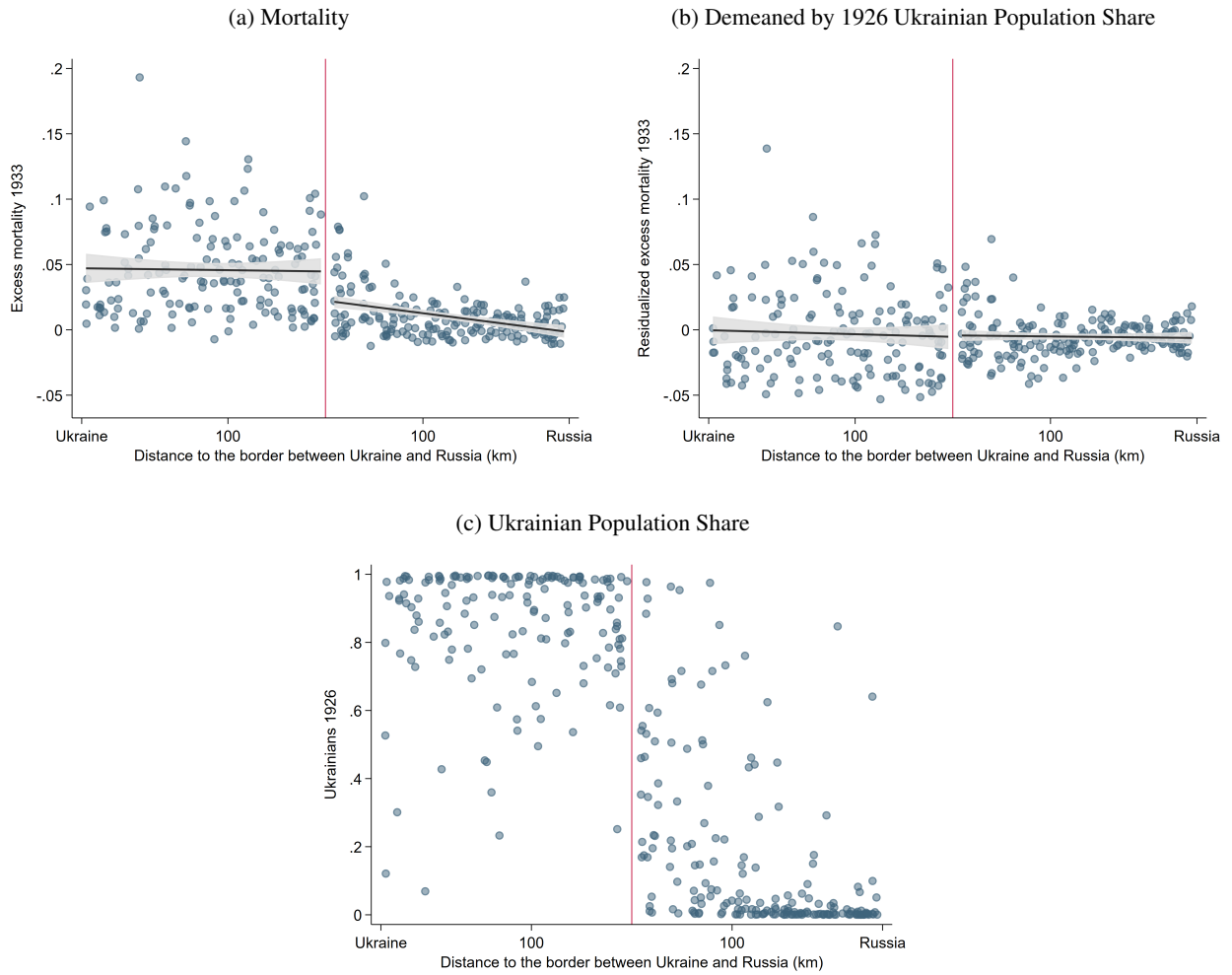
Notes: The province sample includes Ukraine, Russia and Belarus; the distinct sample includes Ukraine and Russia. Cols (1) and (2) control for urbanization, urbanization \times famine, Ukrainians \times urbanization \times famine, grain (per capita grain production predicted by exogenous factors), grain \times famine, Ukrainians \times grain \times famine; and province and year fixed effects. In col (2), Admin. Capacity is the first principal component of the share of votes for the Bolshevik Party in the 1917 Constituency Assembly election, the number of Communist Party Members per 1,000 individuals in each province, and the number of delegates at the 1930 Party Congress. In cols (1) and (2), the standard errors in parentheses are adjusted for spatial correlation within 1,500 km. Col (3) controls for urbanization, urbanization \times famine, Ukrainians \times urbanization \times famine, and district and province-year fixed effects. The standard errors in parentheses are adjusted for spatial correlation within 400 km.

Figure 1: Famine over Time



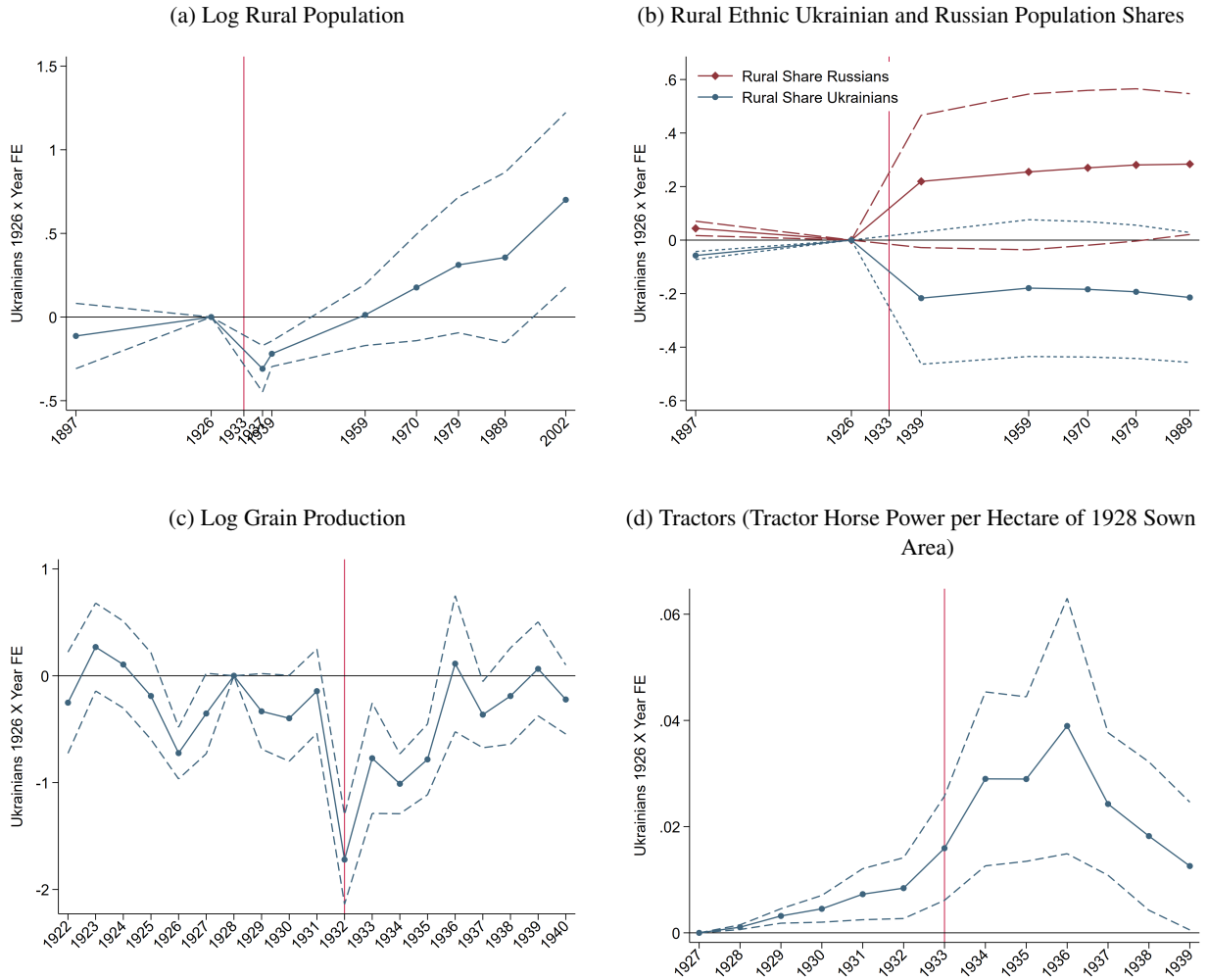
Notes: Mortality is the number of deaths divided by the total population. Figures [1b](#), [1c](#) show binned scatterplots of provinces' Ukrainian population share (in percentiles) and mortality; Figure [1b](#) uses all years from 1923 to 1940 except 1933, and Figure [1c](#) uses only 1933 mortality. Figures [1d](#), [1e](#) plot the interaction coefficients of Ukrainian population share and year dummy variables with their 95% confidence intervals. The coefficients and their standard errors are presented in Appendix Table [A.6](#)

Figure 2: Famine Mortality at the Ukrainian-Russian Border



Notes: The figures plot excess mortality against distance to the Ukraine-Russia border and the fitted lines and their 95% confidence intervals for each district in Ukraine and Russia. Excess mortality is the difference between 1933 and 1928 mortality for each district. In Figure 2b, excess mortality is demeaned by the share of ethnic Ukrainians in each district. The estimated magnitude of the border effect is presented in Appendix Table A.9

Figure 3: Rural Population, Grain Production, Mechanization After the Famine



Notes: All figures plot the interaction coefficients of 1926 Ukrainian population share and year dummy variables in a regression that controls for province and year fixed effects. Figure 3c also controls for grain suitability interacted with year fixed effects and monthly temperature and precipitation for years t and $t - 1$. Figure 3d also controls for grain suitability interacted with year fixed effects. Appendix Table A.11 reports the coefficients and their standard errors. Figures 3a and 3b use population censuses. See the text for data sources of other figures.