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Working Paper #73, 2022

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Abstract: The massive famines that resulted from the Soviet Union's ruthless introduction of collectivization, livestock seizure, and grain requisitions from 1929-1932 were felt most acutely in northern Kazakhstan, whose large nomadic population was especially vulnerable. While the resulting chaos makes it impossible to estimate precise population losses, it is generally accepted that a quarter to half of the population perished. This paper uses anthropometric data on the height of second-generation adults – women whose mothers were born during the famine – to explore important, disputed aspects of the famine, and specifically tries to assess where the famine was most intense. We find that children of ethnically Kazakh women born in rural Northern and Eastern regions suffered a nearly 5-centimeter reduction in height (0.8 standard deviations, or about 3% of the mean) relative to their peers, confirming those historians who point to this population as having borne the most tragic consequences.

Keywords: Famine, collectivization, Kazakhstan

JEL classification: N35, N45, P20

On the cover: Almaty city government memorial to victims of the sedenterization/ collectivization famine

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List of Acronyms

CHC	Cumulative Height Change
DHS	Demographic and Health Survey
FFYP	First five-year plan
NEP	New Economic Policy
SSRs	Soviet Socialist Republics

1. Introduction

The horrendous Soviet famines in the 1930s surrounding collectivization and harsh agricultural requisitions have drawn the attention of scholars in various disciplines including historians, demographers and economists. The famines took place in several Soviet Socialist Republics (SSRs), including Ukraine, Russia, and Kazakhstan, causing millions of deaths. With the dissolution of the USSR, archives opened up and restrictions on unconstrained analysis disappeared; an explosion of information followed, especially in Ukraine. While the famines in Ukraine and parts of Russia were horrendous and tragic, the highest mortality rate was in the Kazakhstan Autonomous SSR, with more than one third of population perishing. However, compared to the great famine in Ukraine, the Kazakh famine of 1931-1933 has received far less attention.

Reasons for the dearth of attention are obvious. Relative to Ukraine and Russia, Kazakhstan was more remote, less populous, and largely nomadic. Nomads are less easily counted than sedentary populations, especially as many fled the country. For these and other reasons, including the absence of a large diaspora in the West, famine losses in Kazakhstan have been far less well documented. While there is now voluminous archival evidence of the catastrophe based on reports to government and party authorities, the numeric assessments – that roughly one-third of the population perished – are based on crude intercensal comparisons. Moreover, the original estimates of these losses are in volumes unavailable online or in libraries outside Kazakhstan, so that accessible information is limited to second-hand, fairly cursory summaries of these works.

Given the enormity of the loss estimates – and the calamitous, panicked reports that serve as corroborating but imprecise evidence – we seek to identify additional empirical evidence of the famine, and, in particular, evidence that will suggest how extreme a disaster it was. We do not replicate census estimates, since any work we did in this regard would suffer from the same problems as earlier assessments. Rather, we follow an anthropometric approach, asking how adult heights were affected by the collectivization-induced famine.

We do not yet have detailed information on heights of individuals born during the famine (though these might be available from military records). However, we do have information on the heights of women whose mothers were born during and in years adjacent to the famine. While our samples are small, it is possible to distinguish the effect of being born during a famine-affected period in rural Kazakhstan, and being of Kazakh or other nomadic ethnicities relative to arguably "untreated" groups. In addition to Slavic populations, these "untreated" include (a) Uzbeks and other sedentary Central Asian populations, and, remarkably (b) nomadic Kyrgyz, who despite being virtually indistinguishable from Kazakhs – other than living further south – lived in the Kyrgyz SSR, which was not subject to the same harsh collectivization.

Our results are staggering: adult children of women born during famine-affected periods and in famine-affected regions are roughly 0.8 standard deviations shorter than those who were not treated, or nearly 5 centimeters, even though there is clearly a huge survivorship bias working against this finding. Even more remarkably, the results are highly robust and coefficient values are nearly invariant with respect to the choice of control groups.

2. Background

A feature of the Soviet famines in the early 1930s was that they almost certainly were caused by the misguided policies that were implemented during the late 1920s - early 1930s, reinforced by harsh implementation. These policies may have been exacerbated by relative disregard for the fates of those who were not ethnic Russians. Thus, in order to understand the underlying mechanisms of the famines, it is important to understand the background of Soviet policies at that time. During the first five-year plan[1], Stalin launched several campaigns to transform Soviet economy from an agrarian society into an industrial economy. Among these campaigns, dekulakization and collectivization emerged as the driving factors that led to chaos in agricultural production and food shortages afterwards.

2.1. Dekulakization and *osedanie* (sedenterization)

Soviet ideologues used the word "kulak" to refer to the supposed class of "wealthy, grasping peasant[2]" with excessive amounts of land and other forms of capital. Dekulakization was the process intended to erase the entire class of kulaks and to incorporate their land and assets into collective farms[3] (*kolkhozy*) or even vaster state farms (*sovkhozy*). However, the official Soviet portrait of kulaks has at best a tenuous factual basis. Historian Robert Conquest (1986) questions the existence of a large class of kulaks prior to dekulakization. He points out that "only a minority (of farms) owned four cows and two or three horses" and "only 1% of farms employed more than one paid worker" at that time[4]. Similarly, Krawchenko finds that the annual income of the wealthiest "kulak" household in 1924 was less than half of the average annual income of an industrial worker[5]. Therefore, it was very likely that the economic class of kulaks was an imaginary, ideological concept rather than a concrete truth.

Despite the divergence between portrayed conditions and the reality of life among the relatively less impoverished peasantry, the Soviet government still pushed dekulakization harshly. The government divided kulaks into three groups based on a household's wealth category, and treated each group differently[6]. The first group consisted of the richest kulaks with an estimated population of 100,000, and peasants who were classified into this group were either executed or imprisoned. For the remaining two groups, the punishment including exile and forced labor. The total amount of peasants who were affected by dekulakization was roughly 6 million[7].

As ethnic Kazakhs were mainly a nomadic population, they did not have a kulak class in the Ukrainian or Russian sense. Land was controlled at the extended family (*aul*) level for winter pasture and at the clan level for summer pasture[8]. However, livestock was owned at the family level, and there was remarkable inequality in ownership. Those at the top of society – the *bai* – thus became the target of Soviet authorities aiming to seize both herds and land; "de-bai-zation" occurred in placed of dekulakization, along with collectivization of the nomads (kochevniki), a process referred to as de-nomadization (*osedanie*). Excellent, detailed accounts in English appear in Cameron (2016, 2018), Kindler (2018), Ohayon (2013, 2016), Pianciola (2001, 2018), and Thomas (2015, whose dissertation offers

1 FFYP; 1928:32
2 Krawchenko, 1984:30
3 ibid
4 Conquest, 1986:118
5 Krawchenko, 1984:30
6 Conquest, 1986:120
7 Conquest, 1986:121
8 Guirkinger & Aldashev, 2016

a detailed account of the sovietization of Kazakhstan prior to and during the collectivization era; accounts in Russian worth reading include Aubakirov *et al*. (2012), Grozin (2014), Karaman (2016), Kazhenova and Sukhova(2015), Mardanova (2017), Orynbaeva (2017), and Rifiel' (2014).

Aldashev and Guirkinger (2012 and 2017) offer remarkable studies of rising land pressure and impoverishment of significant portions of the nomadic Kazakh population in the Tsarist era prior to collectivization. Briefly, European in-migration, especially to northern and eastern Kazakhstan, disrupted traditional herd migratory patterns, leading to land pressure, declining living standards, and movement of many Kazakhs away from purely nomadic lifestyles. Trends during the New Economic Policy (NEP) period (1921-28) are less certain, though there is no evidence of mass famine: the most notable pre-collectivization event was a famine in 1916 which, combined with conscription of Kazakhs into the Tsarist army, led to a widespread uprising[9].

On the heels of dekulakization and de-bai-zation, a collectivization campaign was launched by Stalin and the Communist Party's executive Political Bureau (*Politburo* KPSS) in the late 1920s. Specifically, this campaign aimed at transforming small-scale private farming into large-scale collective farming. The rate of collectivization was fast, and it affected a broad range of rural population across Soviet Union. According to Ladejinsky, only 4 percent of farms (with 4,666,000 people) were collectivized by June, 1929[10]. However, these numbers doubled after four months[11]. By 1930, "more than half of rural households had undergone some degree of collectivization, (including) more than 60 million people in all and more than 35 million adults[12]".

Following dekulakization and collectivization, famines started to emerge. Evidence from research suggest that mortality rose significantly across different regions in USSR in early 1930s. For instance, in Ukraine, the crude death rate reached 60.8 (per 1000 population) in 1933, which was more than 3 times of the normal death rate[13]. In Kazakhstan, it is estimated that 1,450,000 people, some 38 percent of the population, perished during the famine of 1931-1933[14]. Moreover, in the Urals Region, though it was not among the most severely affected regions, the death rate still exceeded the birth rate[15].

Among all the Soviet socialist republics (SSRs), Ukraine and Kazakhstan suffered the most from the famines in the early 1930s. A lengthy literature in both settings suggests that the implementation of catastrophic economic policies matched by inept administration at the local level, poor communications, and indifferent higher authorities together accounted for the Kazakhstani and Ukrainian famines[16].

While we do not explore the literature here, it is important to note that the introduction of soviet socialism to Central Asia's steppe and *debaization* resulted in all sorts of principal-agent problems in a setting where lineage generally took precedence over class and relative prosperity[17]. Further complications arose because of conflicts between the Kazakh and European populations: the latter usually (but not always) won out, as it was easier for them to influence and infiltrate overwhelmingly

9 Thomas, 2015

10 Ladejinsky, 1934: 25

11 Ladejinsky, 1934:25

12 Tauger, 2014:433

13 Meslé and Vallin, 2012; Livi-Bacci, 1993

14 Pianciola, 2001:237

15 Kessler, 2001:255

16 see the citations above along with Conquest, 1986; Krawchenko, 1984; Markevich et al., 2021; Naumenko 2019 and 2021; and both Pianciola, 2018, and Tokar', 2017, for studies of Ukraine

17 for extended discussions, see Ohayon, 2016; Cameron, 2018

European soviet officialdom[18]. The relevant implication for our empirical work below is that ethnic Kazakhs may been at special risk for the consequences of collectivization and herd seizure. This is true not only for those with large herds – the *bai* – but also for those in their extended families and clans that would have depended on them in times of shortfall. A second implication, which our small sample does not allow us to address, is that the variance in outcomes among Kazakhs should have been higher than for others, since some Kazakhs (and other non-European nationalities) were able to infiltrate themselves successfully into the soviet power structure[19].

2.2. Background literature and mortality estimates

There is substantial research on the famine in Kazakhstan induced by collectivization, herd seizure, and resettlement, though the amount is tiny relative to that for Ukraine, even acknowledging that some of these studies are politicized and arguably biased. Still, the opening of previously secret government and CPSU party archives has meant the release of massive amounts of information and, consequently, the emergence of outstanding histories of the tragic era. Cameron (2018) and Kindler (2018) offer detailed accounts; a set of papers based on the archives in Aubakirov, Ed. (2014) is also worth reading, especially Rifiel's (2014) chapter; see also Kazhenova and Sukhova's (2015) discussion of the famine in northern Kazakhstan. Kozlov (2012) emphasizes the importance of losses of non-Kazakh ethnicities; Orynbaeva (2017) argues that ethnic Kazakh losses were still higher.

Despite the outpouring of information, quantifying the tragedy has proved difficult. There are obvious reasons for the relative dearth of quantitatively-oriented scholarship: the setting was a chaotic one. Large numbers of Kazakhs fled to China; others moved north to Russia. Simultaneously, the region also had large influxes of prisoners and exiles, generally of other nationalities, along with some settlers. Conditions were difficult and death records were incomplete.

Consequently, most efforts to quantify the effect of the famine have done so by starting with the 1926 census, making assumptions about fertility, natural deaths, population inflows, and emigration. These numbers are then compared to "observed" numbers, which either meant the 1937 Census (repressed by Stalin because the figures were undesirably low) or the 1939 corrected Census (by which time the surviving census-takers had learned that overcounts were less fatal than undercounts). Not surprisingly, there is large variation in estimated population mortality, especially by nationality/ethnicity. Discussions of the issues and an idea of the range of loss estimates appear in Azerbayev and Murazbekova (2012) and Karaman (2016). Among the most sophisticated quantitative discussions we can identify is Pianciola (2004), who provides detail on livestock losses and changes in grain reserves, along with estimates of population losses; Orynbaeva (2017) also provides somewhat detailed figures.

Azerbayev and Murazbekova (2012) estimate losses by comparing 1926 and 1939 Censuses. Their figure: 1.3 million at a minimum, or nearly 37% of the base population. This number includes non-Kazakh nationalities as well, but that argue that the effects of mass sedenterization had the worst

18 Cameron, 2018

19 It is possible as well that marriage markets throughout the indigenous nationalities of Central Asia would have been disrupted by collectivization and dispossession of assets, and therefore removal of the inability to pay kalym (bride-price). Kalym was outlawed by the Soviets but, since brides were (and still are) valuable assets in the region's patrilocal settings, it is possible that there was considerable disruption and temporarily reduced marriage and births – all problematic for our empirical work that follows. For a discussion, see Ohayon (2016: 188).

effects[20]. A major problem in estimating the losses of other nationalities using census data is that there was a large inflow of exiled and imprisoned populations that would have offset losses.

Karaman (2016) discusses loss estimates based on the suppressed census of 1937 at 1.114 million based on the estimates of Shokai (1938). Surprisingly, the number is lower than those based on the 1939 census, even though the suppressed 1937 census had a smaller head count (and the estimates covered all of Turkestan. In contrast, an estimate provided by Tatimov *et al*. (1989) quoted in Karaman comes up with an estimated 2.635 million deaths based on the 1939 census. Most critically, Karaman also cites a work by Nurman (2004) showing that losses of other nationalities were as great or greater than those of ethnic Kazakhs[21].

Kozlov (2012) claims that the famine was not ethnicity/nationality-specific. To quote from his English summary: *Great human losses among the indigenous population were mainly caused by objective factors – peculiarities of the traditional nomadic cattle breeding that turned out [?] to be much more vulnerable in the process of socio-cultural changes in the end of the 1920s – the beginning of the 1930s.* He goes on to note that many areas in Russia suffered terribly, too – not just Ukrainians and Kazakhs. But forced collectivization of herds affected these nationalities in particular. Indeed, he argues that collectivization and sedenterization were regarded as synonymous by Kazakhs. Moreover, the migratory herding areas and semi-migratory areas were hurt the most since they had no traditions of raising non-migratory animals (poultry, pigs). Grain also was confiscated, raising the question as to whether loss of livestock or excess collectivization of grain was more catastrophic. He also quotes eye-witnesses and local party officials who say that Kazakhs suffered most and flooded to the towns. Citing Tatimov (1990), Kozlov then notes that sedenterization occurred elsewhere, not just Kazakhstan and among Kazakhs. Ultimately, Stalin's determination to export grain for foreign currency, especially in 1930-31, also meant disaster elsewhere. In short it was a catastrophe, but did not specifically target ethnic Kazakhs.

Rifiel (2014) quotes from confidential documents reporting the nature of the famines associated with collectivization and requisition norms imposed from above, along the lines of "we have met our delivery quotas and are starving. What should we do?" Many of those writing in desperation are ethnic Russian, which calls into question whether non-Kazakhs in the hardest-hit regions also would have been affected as well. This paper focuses on East Kazakhstan region around Ust-Kamenegorsk. The paper also quotes reports of Kazakhs fleeing to China as early as March 1928. As a summary estimate, Rifiel cites Tatimov's[22] estimate that 2,300,000 ethnic Kazakhs and 200,000 people of other nationalities died, presumably in what is present day Kazakhstan. Kondrashin (2009) makes a similar argument, claiming that Stalin's grain export policy was the base for the disaster.

20 To quote: Согласно результатам первой переписи 1926 г., на территории Казахской АССР проживало 3 млн. 628 тыс. коренного населения. Но уже через 12 лет в переписи 1939 г. фиксируется убыль в 1 млн 321 тыс. человек, т.е. приходит уменьшение совокупности на 36,7%. Но даже эту цифру, как считают историко-демограв, следует признать минимальной, требующей существенной коррекции в рамках факторного анализа. С его подключением исследователям удалось установить, что на середину 1930 г., когда количественный состав населения еще оставался относительно стабильным, численность коренных жителей в пределах сопоставимой границы республики составляла около 4 млн. 120 тыс. человек [3, с. 28]. Трудности в подсчете жертв коллективизации состоят и в том, что при регистрации умерших не указывалось, что они умерли именно от голода. Во-вторых, в число погибших от голода многие авторы включают и тех, кто [вы]был в этот период за пределы республики (откочевщики). И даже тех, кто умер естественной смертью более 20 лет спустя.

21 To quote: Благодаря проведенным исследованиям, можно подвести итоги о этнодемографической ситуации в 20-40 годах XX века в Казахстане. В 1937 году население республики сократилось по сравнению с переписью населения в 1926 году в 1,3 раза. Среди них казахи в 1,7 раза, украинцы в 1,6 раза, узбеки в 1,9 раза, киргизы в 2,1 раза, представители других национальности в 1,6 раза. В связи с усилением политики переселения численность русских увеличилось в 1,5 раза, немцев в 1,6 раз, татаров в 1,1 раз (Нурман Ш.Т., 2004).

22 Almaty, 1993

Kazhenova and Sukhova's (2015) brief survey of collectivization in northern Kazakhstan is perhaps the most shocking paper of all. They note they there was confiscation of animals even in already established collectives; there also were typhus and other epidemics. Most critically, they claim that losses were especially severe, amounting to 74.5% of all Kazakhs in northern Kazakhstan, though this figure appears to include those who fled and those who perished from a typhoid fever epidemic.

Finally, we come to the monumental Aubakirov (2014) volume of essays that spans nearly 600 pages. These essays are based on archival materials now generally available[23]. They are largely though not entirely about the famine: for our purposes, two studies stand out. Aupenova[24] notes that children of mothers born during 1942-44 would have been similarly disadvantaged, at least in part. This will be important for providing an upper date limit to the empirical work discussed below. In addition, Khanipova[25] discusses famine and child homelessness in the lower Volga region of Tatar ASSR in Russia. Her paper serves as a caution against turning indiscriminately to regression discontinuity models, since it is unclear where the discontinuities occurred.

The authoritative survey of the historiography of the 1932-1933 Kazakhstan famine and the preceding years appears to be Grozin's volume (2014). It traces the rise over time in the estimates of famine victims, and links the estimates to shifting, politically-driven motives (from whitewashing to creating a Kazakh national identity). The difficulties in establishing accurate loss estimates discussed above are all detailed; to these may be added apparent census undercounts, including in the base year (the 1926 census), which would lead to population loss undercounts. Guesses at natural fertility and hence child mortality will lead to large variance, though there is a good chance that infant and child losses were under-reported. Equal if not greater problems in assessing losses among the non-Kazakh population are also emphasized. Grozin also deemphasizes the possible impact of the *debaization* campaign and loss of their herds – the *bais* were typically exiled, and their herds remained. However, he does note the huge livestock losses later during the collectivization and famine period. Yet another key point is that, while he recognizes the greater population losses in northern and eastern Kazakhstan, Grozin also emphasizes that flight from these areas – to China, Tatarstan, the Altai, and Siberia – was easier, and therefore could have accounted for much of the difference[26].

To summarize, there is no debate as to whether a massive famine occurred. The magnitude is uncertain, and is driven by scope (area covered; years included), the census (1937 vs. 1939) employed, migration assumptions, birth rate assumptions, and many other factors. The three key unresolved questions involve (1) the extent to which the famine was particularly severe in northern and eastern Kazakhstan, the epicenters for sedenterization and collectivization, (2) whether town-dwellers were largely spared from the famine, and (3) whether ethnic Kazakhs suffered more than other nationalities. These issues are the focus of the empirical work that follows.

2.3. Comparing the Ukraine and Kazakhstan famines

In Ukraine, a series of detrimental economic policies were implemented before or during the famine, including collectivization and excessive grain requisition. Numerous research has revealed the sig-

23 see Absemetov's description on p. 15

24 Aupenova pp. 72

25 Khanipova pp. 539

26 The magnitude of the flight to China is uncertain. Piancola (2001:242) notes that "According to some estimates 200,000 fled to China." A Wikipedia article in Chinese "1932 年哈萨克斯坦大饥荒" ("The Great Kazakh Famine in 1932") claims that around 250,000 Kazakhs fled to China during the period of famine but there is no academic documentation for this claim. The existing literature in Chinese does mention the influx of Kazakhs into China during the famine; moreover, one paper (Tursun, 2016:290) suggests that many of those migrants were "Bai" or relatively wealthy due to Soviet de-bai-zation policy. However, we have not yet found any academic paper in Chinese with numerical estimates of Kazakh migrants into China during the famine period.

nificant association between those policies and famine. For instance, Krawchenko[27] argues that the excessive exploitation of grain surplus in Ukraine under Moscow's policy was the main cause of the famine. Similarly, Naumenko[28] finds evidence that poor government policies like collectivization played important roles in mortality increment during the period of famine. In addition, Naumenko (2021) rejects an alternative hypothesis attributing the Ukraine famine of the early 1930s to negative weather shocks.

However, Markevich et al. (2021) use a triple-diff approach with data on Russian and Byelorussian as well as Ukrainian district mortality, ethnic Ukrainian population share, 1928 grain production, political loyalty, and a host of weather and other controls. They find that ethnic bias against Ukrainians accounts for an overwhelming share of famine mortality in Ukraine. This sort of study works well for sedentary populations but is impossible to conduct for a dispersing, traumatized nomadic population. Our empirical focus on adult heights lacks the precision of Markevich et al. (2021), does not add to the huge – and hugely varying – estimates of Kazakh morality, and cannot identify precise motives. However, we do provide evidence of a horrendous crimes against a virtually defenseless population.

As with Ukraine, Kazakhstan's famine seemed to be the result of incompetent government policies and administration. As distinct from Ukraine, it is difficult to ascribe an ethnic motive to Soviet officials, since nationality and nomadism were almost perfectly correlated. Soviet authorities unquestionably were hostile to both large herdowners (the *bai*) and educated Kazakhs with nationalist passions who took Lenin's writings on nationalities seriously. For the large masses of nomadic and semi-nomadic Kazakhs, though, officials' behavior could as easily reflect indifference to suffering and zeal in carrying out orders as it could anti-Kazakh bias.

Pianciola[29] concludes that "the Politburo decision on meat and livestock procurements for 1930 was the crucial watershed that explains the magnitude of the famine in Kazakhstan." Ericlasun[30] also argues that policies were responsible for the huge loss in population in Kazakhstan during the period of famine. Moreover, research such as Loring[31] documents frequent protests and rebellions throughout Central Asia in the early 1930s; Cameron (2018) documents these in detail and argues that they came in response to damage brought by incompetent policies. Wheatcroft (2020) adds to this by emphasizing the criminally overoptimistic assumptions about food productivity gains associated with collectivization. Kazhenova and Sukhova (2015) also document the shocking dispatch of unprepared, inexperienced industrial workers from Russian cities to implement "sovietization of the auls," the rushed pace of sedenterization and collectivization, and the catastrophic initial policy of gathering animals in small areas that afforded inadequate pasture.

Despite similarity in the cause of famines of Ukraine and Kazakhstan, some crucial differences emerge. While Ukraine was a settled agrarian economy prior to collectivization, the Kazakhs were traditionally nomadic. More specifically, although by the late 1920s Kazakhstan had a large European peasant population and many ethnic Kazakhs had become settled agriculturists, it was still the case that the majority of the population consisted of "nomadic or semi-nomadic herdsmen[32]" who their living through non-sedentary animal husbandry instead of growing grains. The heterogeneity in economic structure in turn led to different policies.

27 Krawchenko, 1984:34

28 Naumenko, 2017:2

29 Pianciola, 2018:443

30 Ericlasun, 2017:39

31 Loring, 2008:185

32 Pianciola, 2001:237

In Kazakhstan, sedenterization was initiated in 1929-30 to complement collectivization. Soviet policy was to sedentarize nomadic Kazakhs permanently, extracting grain and meat for the benefit of the state[33]. During the process, nomads lost their livestock and were forced to settle in specific places[34]. As the result, huge numbers of nomadic Kazakhs perished due to malnutrition and subsequent diseases in 1931 and 1932 in the resulting *golodomor*[35] (famine). While the nomads lacked farming equipment and monetary assets that their kulak counterparts would have had, sedenterization enabled the Soviet state (and nearby collective farms) to seize both land and livestock with, apparently, significant redistribution from Kazakhs to European settlers[36]. The stunning decline in draught animals and other livestock that ensued is documented in Pianciola (2001).

2.4. Comparing the Chinese and Kazakhstan famines

As with Kazakhstan's *golodomor*, China's Great Famine in 1959 – 1961 was a man-made catastrophe under an authoritarian regime and a central-planned economic system. While many scholars have adopted the loss estimate that around 30 million people perished in this famine, the total number of famine-induced mortality could be as high as 45 million[37]. The political background under which the famine occurred was the "Great Leap Forward" movement launched by Chairman Mao Zedong in 1958. The movement aimed at transforming China from a predominantly agrarian economy to a developed industrial economy in a short period of time, much like the Soviet first five-year plan (FFYP) and resulting collectivization in Kazakhstan's steppe. To achieve that goal, the Chinese government implemented a series of policies to boost both industrial and agricultural outputs. In agriculture, significant effort was made across China to collectivize individual households' farmland into large communes for organizing large-scale agricultural projects[38]. Famine ensued in 1959 soon after agriculture became collectivized though, as Gráda (2011) notes, the historical accounts focused on officials' actions rather than possible adverse weather shocks and interactions.

Beyond collectivization, another salient feature of China's Great famine is its link with the central government's harsh food procurement policy. To support urban industrialization, the national government implemented an aggressive food procurement policy based on questionably high numbers of agricultural outputs reported by government officials at the municipal level[39]. As the result, famine-induced mortality spread unevenly across different regions in China. Remarkably, increased rural mortality rates were positively correlated with food productivity of that area during the famine; further evidence suggests that this unusual pattern could be explained by the inflexible and progressive food procurement policy[40]. Moreover, Kung & Chen (2011) find that the variation in the level of excessive food procurement was tied to political career incentives of Communist Party officials, as promotion to higher political ranks was positively linked to food deliveries. Naumenko (2018, 2019) documents similar patterns for Ukraine.

33 Cameron, 2016:125

34 Cameron, 2016:120

35 Pianciola, 2001:242. The tragedy has been recognized and publicized by the Kazakhstani government. Official memorials have been established in both the main city Almaty (a useful description of the event and comparison with other tragic events appears in Forbes.kz) and the capital, Nur-Sultan, where it was opened by then-President Nazarbayev, as well as in smaller cities such as Pavlodar. A complete (and remarkable) list of all monuments in Kazakhstan to the victims of the golodomor and other Soviet repressions can be found on the Sakharov Center website.

36 Cameron, 2018

37 Banister, 1987; Dikotter, 2010

38 Kung & Lin, 2003

39 Dikotter, 2010

40 Meng, Qian & Yared, 2015

The causes and long-term consequences of China's Great Famine also have been thoroughly studied and, along with other famines, are ably surveyed in Gráda (2007). By utilizing anthropometric measurement, Chen & Zhou (2007) find that the famine imposed a severe health consequence on survivors, especially for those who were in their early childhood during the famine, lowering their adult height by 3.03 cm. In addition, empirical evidence suggests that infants exposed to the Great Famine have significantly higher risk of incurring a metabolic syndrome in their adulthood. These findings are consistent with those of Cheng and Shi (2019), whose delineation of outcomes by cohort is conceptually similar to our approach, though their vastly larger sample makes for far more refined delineations than we provide below. The paper conceptually closest to ours is Li and An (2015), who explore the impact on achieved adult height for children whose parents were born during the 1959-61 Great Famine. They find that children whose parents were both born during the great famine are considerably shorter (roughly 1.8 cm for girls, or 0.37 standard deviations) than comparable peers whose parents were not born in a starvation period.

In a paper exploring long-run economic consequences and using an instrumental variables approach, Gooch's (2017) estimation reveals that areas hit hardest by the Great Famine have significantly lower GDP per capita half a century later. Finally, famine survivors have been shown to have persistent, elevated political distrust against the government[41]. To conclude, the long-term negative consequences of China's Great Famine on survivors are salient and persistent.

Taken together, the Chinese and Ukrainian famines, along with the weight of historical accounts from Kazakhstan, suggest several hypotheses related to the disputed issues outlined above. First, we expect that the famine will be greatly reduced or nonexistent in urban areas. Second, we anticipate that the famine will be most severe among the ethnic Kazakh population. Finally, while a vast area from Ukraine to the Uzbekistan border and Soviet Turkestan to Tatarstan were affected by the famine, we anticipate that the impact will be most severe in northern and eastern Kazakhstan.

3. Challenges in studying the economic impact of the Kazakh famine

Although the Kazakh famine has drawn more attention from scholars in recent years, the demo-economic impact of the great famine has not been fully addressed. Unsurprisingly, researchers have struggled to find reliable statistics for Kazakhstan during the famine period and the broader era. Official statistics are inherently les accurate during economic disasters, but this is especially true for poorly tracked nomadic populations (few of whom spoke Russian, and most of whom were illiterate), and all the more so when large numbers are in flight.

Beyond these inherent problems, the possibilities of deliberate misestimates also arise. For example, during the First Five Year Plan, there were huge losses of livestock due to collectivization and other incompetent economic policies. In 1933, the USSR published a volume of statistics for the FFYP covering topics including numbers of peasant households collectivized and tractor availability – but with no information on livestock numbers[42]. Though livestock data were released later, it is unclear whether these data were falsified[43]. Since Soviet official statistics might be modified to serve a political agenda, especially in the 1930s, any study of the economic impact of the Kazakh famine using official statistics has inherent limitations.

41 Chen & Yang, 2015

42 Bergson, 1953:13

43 Bergson, 1953:13

Distorted official statistics are compounded by a near absence of unofficial sources. Compared to Ukraine, the historical record of famine in Kazakhstan is relatively obscure. As historian Sarah Cameron[44] writes, "Kazakh culture was largely an oral rather than literacy culture, there are very few primary sources that the Party or the state did not produce." Moreover, while there is an oral-history project, it started late in Kazakhstan. As the result, many survivors passed away, and the remaining survivors were elderly and could not remember events that happened in their childhood clearly[45].

3.1. Anthropometric Measurement

Nevertheless, by utilizing a key anthropometric indicator of well-being, it is possible to supplement the rough estimates for the famine of human mortality from census data and livestock losses from agricultural censuses. We focus here on adult height. While individual genetic factors are the primary determinant of height for an individual, in a large population, genetic differences tend to cancel out with each other. Thus, variation over time in mean adult heights reflects population health status[46]. Furthermore, early childhood nutrition has been found to play an important role in determining adult height. According to US National Institutes of Health research, adult height is heavily dependent on the growth period from conception to 2 years of age, when "nutritional requirements are greater than at any subsequent time and when infections, particularly diarrheal diseases, occur most frequently[47]".

Compared to conventional measures of economic performance such as GDP, height has several advantages. First, Soviet economic statistics were hugely problematic and unreliable[48]. Height may serve as a good substitute for income or wealth data since the measure is far less likely to be falsified, but at the population level is highly correlated with measures of prosperity.

Second, even if the official statistics are reliable, height may still provide additional information on people's well-being during the period of famine. Conventional measures such as GDP are mainly related to production; this is even more true for Soviet gross material product estimates that neglected services (and did not aggregate using market prices). However, in order to have a thorough assessment of people's living standard, what matters is current consumption. Steckel[49] emphasizes that stature reflects consumption of basic necessities and, in particular, food and medical care, thereby reflecting access to resources.

Third, the negative effect of childhood malnutrition on adult height may persist across generations. Deaton and Drèze[50] argue that "it takes time for the heights of children to catch-up with the genetic potential, given the history of undernutrition." Briefly, a mother's nutritional conditions at birth (as proxied by birthweight) affect her adult weight and height; these characteristics then affect the nutritional status of her offspring. Thus, if a mother suffered severe malnutrition during her childhood (which imposed a long-standing negative impact on her nutritional status and height), then her children are more likely to have lower birth weights, which will further lead to their lower nutritional status, and, ultimately, will be manifested in their future adult heights.

44 Cameron, 2016:129

45 Cameron, 2016:129

46 Steckel, 1995:1903

47 Perkins et al. 2016:150

48 Brainerd, 2010:84

49 Steckel, 1995:1908

50 Deaton and Drèze, 2009:62

Thus, by tracking the anthropometric data of the descendants of famine survivors, we hope to recover a portion of the long-term effect of famine on people's well-being. Understanding this link is important in its own right: if the anticipated pattern is found, then it indicates that the sedenterization/collectivization famines effects may still exist today, some 90 years after the famine – a "long shadow" indeed. The emerging patterns also may shed light on the extent to which particular groups were at special risk.

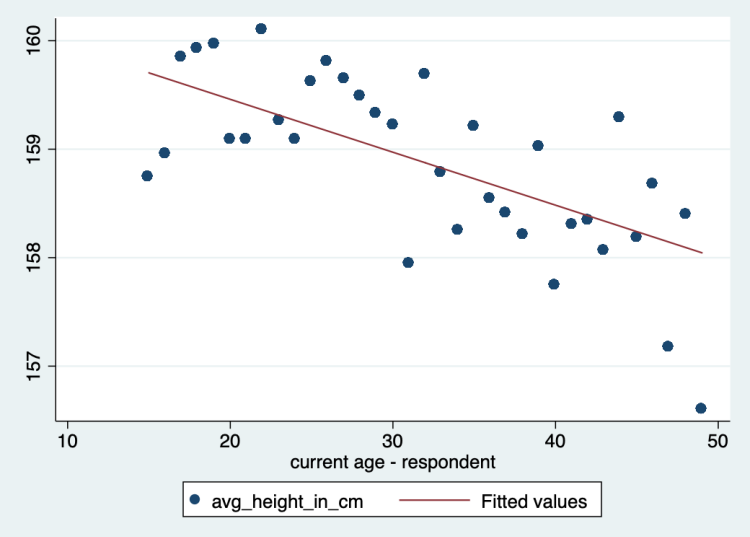
We also emphasize that any patterns found are almost surely a large understatement. In a *golodomor* where more than one-third of the population perished there will inevitably be a huge survivor bias: only those least affected are likely to have survived, to have been sufficiently fecund to reproduce during the famine, and to have given birth to children sufficiently robust that they survived. Furthermore, some women who reproduced later may have been permanently weakened during the famine.

4. A simple model of adult height

Our approach is similar to a standard difference-in-differences (D-i-D) framework. As we discuss below, there are two alternative populations that provide good comparators, and that were not subjected to severe sedenterization and collectivization. These groups are used to define baseline height trends. We then seek to compare outcomes for treated (or, more accurately, most acutely treated) and untreated (in reality: less treated) groups in Kazakhstan. In practice, demonstrating parallel trends is somewhat tricky, since some of the effects from the shock that caused the famine occurred before collectivization and were felt into the future. Put differently, the discontinuity is fuzzy.

A linear regression model is set up to study the second-generation effect of the Kazakhstan famine on children's adult height. The Z-score of height serves as the dependent variable. The height Z-score is computed as follows: Z-height = (adult height of Kazakhstani children – average adult height of reference population in the same period) / standard deviation of adult height of reference population in the same period. The reason for using a Z-score of height instead of height itself is that the average height of Kazakhstanis exhibits a secular increase over time due to nutritional improvements (Figure 1).

Figure 1. Mean Height by Respondent age, Kazakhstan 1995 DHS Survey



Given this trend, it is important to compare the heights of Kazakhstanis with the average height of a reference population of the same period. This reference population should be drawn from a country with similar ethnicities and socioeconomic conditions as Kazakhstan (so that they will have similar average height in the normal period) but without suffering from the famine. By constructing the Z-score, we are able to separate the effect of famine on height from the effect of being born in earlier, less prosperous eras, on height.

The independent variables include several indicator terms that represent characteristics of interest. Key among these is a region indicator. This variable indicates whether respondent mother's origin is from the Northern and Eastern region of Kazakhstan. It is well documented that these regions were the ones "treated" most severely. They were closer to Russia and Soviet population centers, had larger European populations but also large nomadic Kazakh populations, and were more agro-climatically suited to settled agriculture than the very low rainfall steppe further south and west, while still further southwest along the Syr Darya River there was already extensive settled agriculture. Thus, for decades Moscow viewed this region as tsyelina (virgin land and saw it as a key region in which to expand grain cultivation[51]. Consequently, we anticipate the famine would have been experienced most severely in northern and eastern Kazakhstan, and that these impacts should be reflected in children's adult heights.

A second key indicator is whether the respondent is from a rural area. While it may be the case that both town-dwellers and rural peasants and nomads would have been affected by the disruption and declining food availability associated with sedenterization and collectivization (including of the European population), the burdens are not likely to have been equal. In Kazakhstan, as in Ukraine, mandatory procurements/deliveries ensured food supplies to urban centers, leaving fledgling collective farms to fend for themselves with whatever was left over[52]. A common occurrence was for desperate kolkhozniki to eat grain set aside for planting in the following year, thus creating a lagged but ultimately worse famine. In sum, sedenterization by definition did not affect the urban population directly, while collectivization and forced procurements put rural populations at greatest risk, so that adult heights of children should be most affected for those born in rural areas.

Finally, of course, there is a famine indicator. This variable indicates whether an observation's mother was born during the critical years of famine. Historical accounts indicate that some areas began to experience famine as early as the spring of 1930; it then became widespread in 1931, and ended in 1933[53]. Thus, we adopt 1931-1933 as the time window for the Kazakh famine. However, the critical period of famine on early age nutrition might be even longer. We know that the nutrition level at age 0-2 as well as the prenatal period is crucial for height. Therefore, we ultimately adopt 1929-1934 as the critical period of birth (1931-2=1929, accounting for children who were born before the famine but still affected by the famine; 1933+1=1934, accounting for children who were fetuses during the famine).

To sum, the three indicator variables are: region, rural birth, and famine exposure. These three indicators and their interaction terms are included on the right-hand side of the regression. We also include an indicator for European ethnic groups to control for potential genetic differences in heights between European ethnic groups (Russian, Ukrainian, German, etc.) and non-European ethnic groups (mainly Turkic people). Thus, the linear regression model is constructed as follows:

51 Pianciola, 2001:238

52 Cameron, 2016:125

53 Pianciola, 2001:241

(1) Z-score of height = β_1 * European ethnicity indicator + β_2 * rural indicator + β_3 * region indicator + β_4 * famine indicator + β_5 * (rural indicator * famine indicator) + β_6 * (region indicator * famine indicator) + Ɛ.

The terms of greatest interest to us are the coefficients of the interaction terms β_5 and β_6, and the combined effect of them with β_4, the coefficient of famine indicator.

5. Data

The primary dataset used is the DHS (Demographic and Health Survey) 1995 dataset for Kazakhstan. DHS provides adult heights data of respondents, who were women aged 15-49. In addition, DHS also provides information related to the age of household head, as well as the relationship between household head and respondent. By restricting the relationship between household head and respondent to mother and daughter, and restricting the range of age of household head to 61 – 66, we are able to identify the observations whose own mothers were born during the critical period of famine[54]. By looking at the adult heights of offspring whose own mothers were born during famine years and comparing them with those whose mothers were born before or after the period, it is possible to reveal the second-generation effect of famine. Since DHS focuses on women of child-bearing age and limited information on their mothers, we lack information on second generation men and on the heights of fathers born during famine years. We also note that height diminishes with age for older adults, and adjust for shrinkage in our empirical work following Henderson (2019).

A key problem is that DHS does not provide the birth place of household head. In order to identify the famine zone, it is important to know the place where mothers were born during the period of famine. However, DHS does provide information about the childhood place of residence for each respondent, and almost certainly the places where respondents spent their childhood are positively correlated with their mothers' place of birth. Thus, the childhood place of residence is used to create the rural indicator. By the same logic, we use the *de jure* childhood region of residence of respondents as a proxy for mothers' region of residence to create the region indicator.

The height data for reference populations are alternately drawn from the DHS 1996 Uzbekistan dataset and the DHS 1997 Kyrgyz Republic dataset. Observations are restricted to members of the titular nationalities. Using the Uzbek population as the base of comparison enables a comparison with a population that is somewhat culturally similar to the Kazakhs (Moslem, Turkic language; long history of interaction) and that was also collectivized by the Soviets, but which was sedentary. Thus, the Kazakh-Uzbek distinction picks up the effects of sedenterization. In contrast, using the Kyrgyz population as the base of comparison picks up the effects of sedenterization plus collectivization. In a twist of fate that invites D-i-D estimation, the Soviets fairly arbitrarily divided the pastoralist populations of Central Asia into the Kazakh ASSR and the Kyrgyz ASSR – and only very gradually sought to collectivize and sedenterize the latter[55]. Brief descriptive statistics appear in Table 1.

54 Demographic and Health Survey, 1929-34

55 for a detailed discussion, see Pianciola, 2016; also see Cameron, 2018
After 60 years of being regarded as different nationalities under Soviet rule, the Kyrgyz and Kazakhs came to regard themselves as being somewhat distinct. However, prior to the division into two separate republics, all nomadic pastoralists in the region were referred to as "Kyrgyz," including those in northern and eastern Kazakhstan, far from what became the Kyrgyz ASSR and then the Kyrgyz Republic. Of course, from the nomads' perspectives, identification with their specific djuz (horde) was far more important than nationality.

Table 1. Adult Height of Different Groups Born During 1929-1934, DHS Data

Group	Observations	Mean	Standard Deviation	Min	Max
KZ	139	158.4	7.1	129.3	178.1
KZ rural	87	157.1	7.0	129.3	170.7
KZ N/E	14	155.8	9.1	143.5	178.1
KZ rural N/E	8	151.0	5.0	143.5	156.7
UZ	349	159.6	6.2	142.3	178.3
UZ sedentary	337	159.6	6.2	142.3	178.3
KG	266	158.0	5.5	140.6	176.0
KG sedentary	262	158.0	5.5	140.6	176.0

Note: UZ sedentary group excludes Kazakh and Turkmen ethnicities; KG sedentary group excludes Kazakh and Uighur ethnicities.

The reason for the policy difference is unclear: distance from Russia is a possible but uncertain explanation. A fascinating study by Piancola (2019) of the Great Famine around the shores of the Aral Sea finds a sharp delineation between the part in the Kazak ASSR and that to the south in the Karakalpak AO (Autonomous Region), now part of Uzbekistan. Briefly, no famine emerged among the Karakalpak (literally, "the people of the black hats"), while a horrendous famine was recorded in the Kazakh part. Pianciola links the difference to the presence of the Orenburg-Tashkent railway and subsequent development of a European population along the northern shore – and presumably greater ease of requisition, a point consistent with Naumenko's (2018, 2019) findings in Ukraine. What does not emerge as a potential explanation – and one that could be confounding – is differential agricultural potential. Indeed, if anything, parts of Kyrgyzstan such as the Chui Valley should have been ripe for collectivization. Most obvious, then, is the straightforward explanation that party leadership was less "enthusiastic" (as Roman Mogilevskii aptly puts it) in Frunze (Kyrgyzstan) and Nukus (Karakalpakstan).

The average height of respondents was computed by mothers' birth cohort (e.g.; the average height of women whose mothers were born in 1930). Choosing Uzbekistan and the Uzbek population as a comparator is natural for the reasons noted above; in addition, Uzbekistan and Kazakhstan are neighbors, and in fact there is a large Uzbek population in southern Kazakhstan. In addition, Kazakhstan and Uzbekistan were both ASSRs and shared similar socioeconomic conditions, though as a full-fledged Soviet Socialist Republic from 1925, Uzbekistan may have had marginally more self-governance than Kazakhstan, which, as Roman Mogilevskii notes, was an "Autonomous" SSR during this period.

However, using Uzbekistan as the reference population is not without problems. Like Kazakhstan and Kyrgyzstan, Uzbekistan was also hit by famine at least to some degree in the early 1930s. More specifically, "Soviet collectivization policies did not produce famine in Uzbekistan in 1930, 1931, or 1932, but in 1933, in the words of people who lived through that time, there was widespread hunger, and there were deaths due to starvation and typhus[56]". Though the degree of famine in Uzbekistan was not as serious as Ukraine or Kazakhstan, the estimation could be biased at least for the year 1933.

To address this problem, we project Uzbekistan's height 1933 data as a non-famine counterfactual by using the height data of the previous year (when there was no famine). In other words, we replace the average height of Uzbeks whose own mothers were born in 1933 with the average height of Uzbeks whose own mothers were born in 1932. Since the increment in average height is a long-term process,

56 Kamp, 2019:267

then the difference in average height between two adjacent years should be negligible in the absence of external shocks. Thus, this change is unlikely to bias the results that follow, and offers a cleaner counterfactual.

In addition, height shrinking is another potential source of estimation bias, given that human's height starts declining at around age 40[57]. To address this problem, we adjust the adult height of the DHS samples using the Cumulative Height Change (CHC) formula for women:

(2) CHC = −0.0027 ∗ age^2 + 0.1727 ∗ age − 2.7616.

The above formula is derived by public health researchers based on the data of 16 longitudinal studies which trace populations' change in heights as ages grow[58]. The results shown below are based on adjusted heights, which are computed by combining CHC with measured heights in the DHS samples.

6. Results

Table 2 provides our main results. Z-scores are reported using four reference groups: the whole Uzbek DHS sample (column 1), the sedentary Uzbek DHS sample (column 2), the whole Kyrgyz Republic DHS sample (column 3), and the sedentary Kyrgyz Republic DHS sample (column 4).

Table 2. Sedenterization-Collectivization Famine in Rural Kazakhstan

Height Z-score				
	Reference Population			
	All UZ (1)	Sedentary UZ (2)	All KG (3)	Sedentary KG(4)
European ethnicity	0.412*** (0.036)	0.406*** (0.035)	0.470*** (0.038)	0.472*** (0.038)
rural indicator	0.289*** (0.034)	-0.286*** (0.034)	-0.294*** (0.036)	-0.293*** (0.036)
region indicator	-0.051 (0.043)	-0.052 (0.042)	-0.056 (0.045)	-0.057 (0.045)
famine indicator	0.522** (0.213)	0.522** (0.211)	0.584*** (0.226)	0.583** (0.226)
rural indicator x famine indicator	-0.619** (0.302)	-0.618** (0.299)	-0.659** (0.320)	-0.658** (0.320)
region indicator x famine indicator	-0.761** (0.351)	-0.761** (0.347)	-0.821** (0.372)	-0.822** (0.372)
Intercept	-0.099*** (0.032)	-0.105*** (0.032)	0.139*** (0.034)	0.142*** (0.034)
Observations R2 Residual Std. Error (df = 3681)	3,688 0.083 0.946	3,688 0.083 0.936	3,688 0.088 1.004	3,688 0.088 1.004

Note: *p<0.1; **p<0.05; ***p<0.01 indicates significance at the 90%, 95%, and 99% level, respectively. Standard errors appear in parentheses.All coefficients are rounded to 3 decimal places.

57 E.A. Webb et al., 2008: 231

58 Sorkin et al., 1999:257; E.A. Webb et al., 2008:231

The rural indicator coefficients are negative and significant at the 1% level. This is a standard result as respondents from rural areas tend to have lower family incomes on average: Henderson (2019) finds similar results for Russia, though this does not appear to have been the case in industrializing Europe during the 19th century[59]. Thus, these respondents have a greater likelihood of experiencing malnutrition in their early childhood which would result in shorter heights. The exact causality is less clear, as both mothers and daughters are likely to have been born in rural areas, thereby making the specific generational effect impossible to ascertain. Note, too, that the results are insensitive to the control group. It is also worth noting that the sedentary Kyrgyz Republic DHS population is largely ethnically Uzbek. As they would have collectivized later than in Kazakhstan or Uzbekistan, the contrast in coefficients with this group and the Uzbekistan sedentary DHS reflects pure collectivization effects in the latter.

The coefficients of the two famine interaction terms are both negative and significant at the 5% level. The coefficient with respect to the interaction term of rural indicator and famine indicator suggests that mother being born in a rural area of Kazakhstan immediately preceding or during the famine era had a negative effect on the height of her observed daughter. The coefficient with respect to the interaction term of rural indicator and famine indicator suggests that mother being born in the Northern and Eastern Kazakhstan around the period of famine also had a negative effect on the height of the daughter. These two results support the hypotheses that those from rural, Northern, and Eastern Kazakhstan suffered the most from the great famine in 1931 – 1933 due to the collectivization and sedenterization policies that were strongest in these areas.

In contrast, the famine-era coefficient positive, which indicates that mother being born around the critical period had a positive effect on the height of the daughter. After checking the average height of respondents by rural/urban region, it appears that the observed positive effect may be caused by divergent growth trends in average height between rural and urban populations during famine era. Specifically, urban respondents whose mothers were born in the critical period have a much higher average height (over 7 centimeters) than those rural respondents whose mothers were born in the same period. Moreover, the average height of urban respondents whose mothers were born in the critical period is even slightly higher than the average height of urban respondents whose mother were born in non-famine yeas. By contrast, in rural areas, respondents whose mothers were born in the critical period showed a sharp decline in average height.

The combined effect (β_5 plus β_6) of having a mother born in a rural area and in northern or eastern Kazakhstan during the famine is to reduce an adult woman's height by 1.3 to 1.4 standard deviations, relative to control populations, with the exact sum depending on which control population is used. This far offsets the estimated β_4 coefficient of 0.5 to 0.6 standard deviations; the difference, roughly 0.8 standard deviations, implies a reduction in height of approximately 4.8 centimeters. This is an extremely large effect, and it seems to be remarkably robust to different specifications and samples: we did our best to make it go away, and failed to do so.

7. Limitations and Extensions

Robust results notwithstanding, there are several limitations to this study. The first of these is selection or "survivor bias." Angus Deaton[60] outlines an analytical framework that contrasts selection vs. scarring, which represent two opposite effects of early age malnutrition on adult height. Selection

59 We thank Cormac O'Grada for alerting us to this point.

60 Angus Deaton, 2007:13232

refers to the effect that a low-nutrition environment puts both weak adults and children at relatively increased risk of disease and death[61]. The resulting positive selection increases the proportion of tall and robust mothers in the population; they, in turn, will have taller and more robust children; among their children, those who are taller and more robust are also the ones more likely to survive. Scarring refers to the effect that those children who do survive will realize reduced adult height due to malnutrition in their formative years. Most studies find that scarring predominates over selection. However, selection may be stronger than scarring at high levels of mortality and low levels of income[62]. In our setting, the adverse selection effect weakens the overall impact that already appears to be very large.

The second limitation is small sample size. Although the DHS dataset for Kazakhstan includes more than 3,500 observations, it only includes 64 respondents whose own mother were born during 1929 – 1934. Among those 64 observations, roughly half respondents are from rural areas and the remaining ones are from cities/towns. Due to this small sample, there is low statistical power and it is impractical to add more refined measures of location or living conditions. If we put less restrictions on the observations when creating the indicator variables (e.g.; loosen the relationship between household head and respondent, so that they can also be father and daughter, father and daughter-in-law, et c.), sample size can be increased. However, by doing so, measurement error is introduced, thereby weakening the correlation between the birth year of household head and the height of respondents. We sought to increase sample size by including the 1999 Kazakhstan DHS survey but found only 6 observations. Multiple Indicator Cluster Surveys are available for Kazakhstan, but these only measure child height.

A third limitation is the validity of some of the data assumptions. We do not have exact information about the birth place of mothers who were born during the famine. As a substitute, we make several assumptions to link daughters' childhood residential information directly with their mothers. These assumptions have made further analysis possible, but they are not without flaws. The most prominent problem of these assumptions is the disregarding of both internal and external migration in Kazakhstan.

During the period of famine in 1931-1933, a large number of Kazakhs (with an estimated population of 1.5 million) fled from rural area to cities or surrounding regions including China, Siberia, the Urals, and other Central Asian countries[63]. The large-scale migration may weaken the validity of our assumptions. For example, it is possible that during the period of famine, the mother's family fled from rural areas to cities or towns and settled there. It is also possible that the mother's family fled to other countries, and came back to Kazakhstan after the famine but settled in a new place. In these cases, the place where mother spent her early childhood may not be the same as the childhood place of residence of the daughter. As the result, the estimated rural and region effect may be biased. However, these biases work to understate the effect of the famine: the fact that a large effect remains in the face of unrecognized migration and selection is our key finding.

Given the small DHS sample, we have collaborated with the Kogamdyk Pikir Instituty research institute to conduct a field survey of women who were born before, during, and after collectivization/de-nomadization and the ensuing famine. Generating a large, representative sample of those born in rural and urban areas, and in treated and untreated regions, is not a simple task, and the 200-individual pilot study is unbalanced in many respects. It also generates anomalous results that are inconsistent with Census data: for example, those born in urban areas (20% of the sample) have the same (insignificantly different) mean adult height as those born in rural areas; ethnic Russians (15%) have insignificantly different adult heights than ethnic Kazakhs (76.5%), as do their mothers. These patterns also hold when we limit observations to those born in the 1929-34 famine window.

61 Deaton, 2007:13233

62 Bozzoli et al., 2009

63 Pianciola, 2001:242

These limitations notwithstanding, several results do stand out from the pilot survey. Those born in rural areas during the collectivization/famine period are nearly 6 cm shorter than their urban counterparts. We also asked about birth prematurity. Only 6 of the 200 women sampled reported their mothers being born prematurely. Five of them were from Akmolinskaya oblast in the heart of the famine area (of a total sample of 12 mothers born in the region during the famine era); all were born in rural areas.

Equally telling is the sharp decline during the collectivization/famine era in number of respondent's mother's siblings according to mother's birth year. While small sample sizes limit statistical significance, the sharp decline is highly suggestive[64]. While sample sizes are tiny, this pattern also appears for women whose mothers were identified as nomads (mean number of siblings: 3.1) vs. not nomads (mean number of siblings: 4.4). In short, initial data from the pilot survey are far from conclusive, but are broadly consistent with the story told above, except that they do not permit inferences for the daughters' generation.

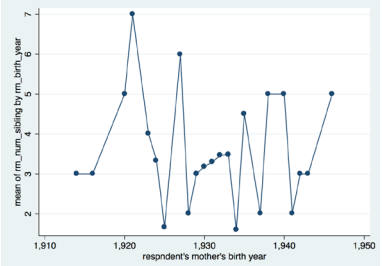
8. Conclusion and Future Directions

We conclude that having a mother born in rural or Northern or Eastern Kazakhstan during the sedenterization and collectivization era of 1929-1934 has large, negative impact on women's adult attained height. The only plausible explanation for this finding is that there was a catastrophic famine, a finding consistent with contemporaneous reports and population losses inferred from census data. However, limitations caused by selection bias, sample size, and incomplete data on birth locations of those born in the 1930s reduce the strength of our conclusions.

Nonetheless, our findings strongly suggest that those born in rural areas and in the epicenter of the sedenterization and collectivization drives suffered far more severely than those elsewhere. Furthermore, since the distinctive feature of this area relative to the Uzbekistan control region is that of seizing livestock and ending nomadic animal husbandry rather than collectivization, which occurred in both settings, it is only reasonable to conclude that this former aspect of the introduction of communism had the harshest impact. This is not to say that collectivization was benign: the larger negative coefficients associated with the Kazakhstan-Kyrgyzstan population comparison indicates that there were further height losses associated with collectivization, as Kyrgyzstan's sedenterization + collectivization occurred later and in less disorganized fashion. However, these were only about one-sixth of the losses associated with sedenterization alone.

If 30-40% of the population of Kazakhstan perished, then mortality must have exceeded half of the pre-famine population in the most affected regions, making the 1930s Kazakh famine one of the most horrendous in modern history. Yet, to use a Soviet term, liquidating the Kazakh people was not a policy objective. On the contrary, there is evidence that the Stalin's Soviet Union sought to envelope minority nationalities, including Kazakhs, and to build intelligentsias and local communist leaders

64 Mean number of respondent's mother's siblings by respondent's mother's birth year



within each ethnicity[65]. Thus, a large ethnically-Kazakh professional class now dominates Kazakhstan, and its roots can be traced to Soviet education and employment policy. In Soviet eyes, this achievement required destruction of traditional Kazakh lifestyles and suppression of traditional bais and the nascent indigenous intelligentsia. However, this success came at a catastrophic price.

65 for a voluminous account, see Martin, 2001

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