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Reassessing the Standard of Living in the Soviet Union: An Analysis Using Archival and Anthropometric Data

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Abstract: Both Western and Soviet estimates of GNP growth in the USSR indicate that GNP per capita grew in every decade, sometimes rapidly, from 1928 to 1985. While this measure suggests that the standard of living improved in the USSR throughout this period, it is unclear whether this economic growth translated into improved well-being for the population as a whole. This paper uses previously unpublished archival data on infant mortality and anthropometric studies of children conducted across the Soviet Union to reassess the standard of living in the USSR using these alternative measures of well-being. In the prewar period these data indicate a population extremely small in stature and sensitive to the political and economic upheavals visited upon the country by Soviet leaders and outside forces. Remarkably large and rapid improvements in child height, adult stature and infant mortality were recorded from approximately 1945 to 1970. While this period of physical growth was followed by stagnation in heights and an increase in adult male mortality, the physical growth record of the Soviet population compares favorably with that of other European countries at a similar level of development in this period.

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I. Introduction

Despite the obvious and ultimately fatal shortcomings of the Soviet system of central planning, the Soviet growth model nevertheless achieved impressive rates of economic growth and promoted the rapid industrialization of the USSR, particularly in the decades from the 1930s to the 1960s. Both Western and Soviet estimates of GNP growth in the Soviet Union indicate that GNP per capita grew in every decade in the postwar era, at times far surpassing the growth rates of the developed western economies. By this measure – and according to the propaganda spread by Soviet promoters – the standard of living in the country rose concurrently with rising GNP per capita. Yet due to the highly restricted publication of data and the questionable quality of the data that were published, much remains unknown about the standard of living in the Soviet Union. Some trends, such as the decline in male life expectancy that began in 1965, suggest a deterioration of living standards; however this decline itself remains a puzzle, and little additional evidence has been available to assess other aspects of living standards in the USSR in the prewar or postwar periods. The question of whether the standard of living rose or fell in the Soviet Union during industrialization and in the postwar period is an important one, as our judgment of the Soviet growth model must rest not only on the rates of economic growth it achieved, but also on whether this growth translated into improved well-being for the population as a whole.

This paper reassesses the standard of living in the Soviet Union using a number of previously unexploited data sources. The focus is on alternative measures of well-being, in particular child and adult heights and infant mortality, each of which directly measures the well-being of a population in terms of nutrition and health status. These biological indicators are a useful supplement to traditional measures of living standards, such as real income or wages,

because the latter may be misleading if measured incorrectly and in any case can only measure the means by which the good health and nutrition of a population can be achieved. In addition, it is important to examine alternative measures of well-being in the Soviet Union because GNP and other economic data were of unusually poor quality and reliability in that country.

The data used in this paper comprise previously unpublished data on infant mortality across Russia's regions from 1956 to 1979, collected from the Soviet archives, and the results of anthropometric studies of children and adolescents conducted across the Soviet Union from the 1920s to the early 1990s. These data are supplemented by a study of trends in adult heights by year of birth which provides a window on living conditions in the early childhood years of each cohort. These data paint a picture of a society far behind other developed countries in the health status of its population in the prewar period. For example, in Moscow and St. Petersburg children reached no more than the 20th percentile of U.S. child growth prior to World War II. But substantial and rapid improvements in child height were recorded in subsequent years, and by the late 1960s children in some regions reached the 50th percentile of U.S. child growth. A period of stagnation followed, marked by a large and growing infant and adult mortality gap with western countries and by stable or declining child heights. Nevertheless the physical growth record of the Soviet population in the twentieth century remains an impressive one, particularly because it occurred across all republics of the Soviet Union, including the less developed republics of Central Asia.

The outline of the paper is as follows. Section II presents a brief overview of the estimates of economic growth and consumption in the Soviet Union. Section III describes the new data sources used in the paper; Section IV discusses the use of anthropometric data as an alternative measure of living standards and analyzes the data on child and adult heights. Section

V examines the trends in infant mortality in this period, Section VI tests several hypotheses regarding the causes of changes in height and infant mortality, and Section VII concludes.

II. Previous assessments of economic growth and well-being in the USSR

Economic growth in the Soviet Union was the subject of intense scrutiny for many years by the CIA and western Sovietologists, in part due to the importance of the issue for U.S. national security interests, but also due to the extraordinary effort required to make Soviet economic statistics comparable to U.S. measures and to correct for the deficiencies in the data published by TsSU, the Soviet statistical agency. This section of the paper briefly reviews the estimates of national income growth and consumption in the Soviet Union calculated by various investigators, to provide a background against which to assess the alternative measures of well-being presented in the following sections of the paper.

Before turning to the estimates of national income growth in the USSR, it is worthwhile to note the shortcomings of Soviet economic data; indeed, as Easterly and Fischer state, "the fundamental problem in evaluating Soviet growth is data quality" (1995, p. 341). The problems fall into three categories: incentives for misreporting; methodological differences between Soviet and Western national income accounting practices; and selective publication of data.[1]

Regarding incentives for misreporting, the work of all economic units, from factory floor to central ministries, was judged based on the fulfillment of plan targets established annually at all levels. Given this, the incentive to over-report pervaded the entire system, raising doubts about the credibility of most reported economic magnitudes. Equally problematic were the differences in methodological approaches to national income accounting between the USSR and

[1]See Ofer (1987) and Fischer (1994) for more detailed discussions of these problems.

developed market economies. For ideological reasons, for example, important components of national income, such as services and interest on capital, were excluded from the national accounts of the Soviet Union. The lack of market prices in the Soviet Union also complicated the task of researchers assessing Soviet growth, and particularly those wishing to compare Soviet growth with growth in developed countries in which prices more closely reflected shadow prices. The third major problem with Soviet economic data was selective publication, in which data considered to be embarrassing were simply suppressed, or definitions changed to suit the purposes of propaganda. The poor quality and questionable reliability of Soviet economic data means that a high degree of uncertainty surrounds the estimates of GNP growth in the country, and underscores the importance of examining alternative measures of well-being.

Keeping these data-quality caveats in mind, a range of estimates of national income growth for the Soviet Union is shown in Table 1. By any measure this growth record is impressive, particularly in the early postwar years when Soviet economic growth exceeded U.S. growth by a substantial margin, even using the more conservative Western estimates of Soviet growth. In later years growth began to slow, declining from an average annual rate of 6.0 percent in the 1950s to 2.0 percent in 1980-1985 (using the Bergson/CIA estimates). Comparing the Soviet growth record with that of the OECD and the United States, the growth rate of GNP per capita in the Soviet Union equaled that of the OECD for the 1950-1980 period (3.3 percent annual average) and exceeded that of the U.S. by a significant amount, at 3.3 versus 1.9 percent, respectively, from 1950 through 1980 (Table 2). In the last decade of the period, 1970 - 1980, GNP growth per capita was roughly similar in all three regions, averaging about 2 percent annually over those years. The sources of the slowdown in economic growth in the Soviet Union remain a topic of debate among scholars, with deteriorating productivity growth and poor

investment decisions likely the most important contributing factors.[2] While it is clear that Soviet growth rates declined after the 1950s, the Soviet growth record in the postwar period nevertheless compares reasonably well with that of the developed market economies.[3]

Household consumption data also support the picture of rising living standards throughout this period; the growth in per capita household consumption met or exceeded the growth rates of household consumption in the OECD and the United States over the entire 1950 - 1980 period (Table 2), as Soviet leaders allowed consumption to grow relatively rapidly until the early 1980s. According to Gur Ofer, this created a "radical change in the quality of life in the Soviet Union" (Ofer 1987, p. 1790), with an increased variety and quality of goods leading to significant improvements in the standard of living. This progress was further enhanced by the massive expansion of the public health care system and educational facilities across the country, with the vast majority of these services provided for free by the government.[4]

While the consumption growth record seems clear, it should be kept in mind that this growth took place in the context of a relatively low initial level of consumption, particularly in comparison with the U.S. and the OECD. As a result, even with rapid growth the absolute level of household consumption remained well below that of the United States throughout the postwar period. Estimates vary widely, but per capita consumption in the USSR likely reached no more than one-third that of the United States in the mid-1970s, and probably declined in subsequent

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[2]See the discussion of this issue in Ofer (1987), Easterly and Fischer (1994), and Allen (2001).

[3]See Allen (2003) for a reassessment of Soviet growth performance from 1928 to 1940. Harrison (2003) and Rosefielde (2003) provide further debate on the postwar growth record, and Khanin (2003) focuses on the high-growth decade of the 1950s. Ofer (2005) provides an overview of the new estimates of Soviet growth and the continuing debate among scholars over Soviet growth performance.

[4]Chernichovsky et al. (1996) and Tulchinsky and Varavikova (1996) provide useful overviews of the development of the public health service in the USSR.

years. Schroeder and Edwards (1981) estimate Soviet consumption per capita at 34.4 percent that of the United States in 1976, while Bergson (1991) calculates a proportion of 28.6 percent by 1985; even the Soviet statistical agency itself estimated that consumption per capita reached only 30 - 33 percent that of the U.S. in 1980 and fell to 22 - 26 percent by 1985 (Bergson 1991). Most investigators made herculean efforts to correct Soviet consumption measures for the important sources of bias – the persistent shortages of consumer goods, the cost of time spent in search, the poor quality of goods, and the lower level of retail services – but it remains likely that the actual level of consumption was even lower than the estimates given here, and the figures remain controversial. For example, Birman (1983) argues that actual Soviet consumption per capita reached only 22 percent of the U.S. level in 1976 when the data are properly adjusted for measurement problems.

Given the degree of controversy over these estimates it is difficult to draw conclusions regarding household consumption in the Soviet Union. Most analysts would likely agree that the level of per capita consumption in the USSR never exceeded one-third that of the United States, and that the level of consumption fell relative to that of the United States between the mid-1970s and mid-1980s. The lack of reliable information on Soviet consumption again underscores the benefits of examining alternative indicators of well-being in the USSR, such as anthropometric evidence and mortality, which are more objective measures of well-being than economic growth or consumption, and which are not subject to the data problems inherent in the conventional measures of living standards. Because the Soviet statistical agency ceased publication of infant mortality rates and other demographic data in 1974, these indicators of living standards were unavailable to researchers until the mid-1980s when publication of a limited amount of mortality data resumed. These data revealed that male life expectancy had begun to decline in 1965 and

that infant mortality rates started to rise in 1971, both nearly unprecedented developments in industrialized countries and both signals that, despite the continuous improvements in economic growth and consumption in the USSR in the postwar period, a significant deterioration in the health of some groups in the population was underway.

III. New data sources

The opening of the Soviet archives has provided researchers with new opportunities for investigating all aspects of life in the Soviet Union, including changes in health status, mortality, and the standard of living more broadly across the country.[5] The two archives in which the mortality and economic data are housed are the GARF archive (*Gosurdarstvennyi arkhiv Rossiiskoi Federatsii* (State Archive of the Russian Federation)) and the RGAE archive (*Rossiiskii gosudarstvennyi arkhiv ekonomiki* (Russian State Archive of the Economy)), both in Moscow. The infant mortality data in the archives are tabulated on standardized reporting forms and include data on births, stillbirths, and infant deaths (under 1 year) for urban and rural areas by region (*oblast*') of the Russian Soviet Federal Socialist Republic (RSFSR). Most of the data are hand-written onto the forms and are enumerated simply as the total number of births or deaths in each category. Almost without exception the number of births and infant deaths by region add up to the RSFSR total in the archives and also agree with the published aggregates, indicating that systematic misreporting of deaths did not occur at this level.[6] Births and infant deaths by oblast were collected for 1956 through 1979 from the archives and were used to

[5]See Gregory and Harrison (2005) for a comprehensive survey of the new findings on the Soviet economic system that have emerged from archival research.

[6]The specific location of each data series by *fond, opis* and *delo* is given in Appendix 1. Infant mortality data for 1969, 1974, and 1976 - 1978 are not in the archives. Other problems with Soviet infant mortality data are discussed in section V below.

calculate infant mortality rates (total number of deaths divided by total live births) by region in those years. These data are supplemented by archival data on average monthly wages and published data on health system capacity, urbanization, food consumption, crude birth rates and education levels. Data sources are detailed in Appendix 1.

The anthropometric data used in the paper are the average heights of children and adolescents collected by researchers across the Soviet Union in studies initiated in the 1920s and continuing through the present day. Many of these studies were published in a series of volumes under the auspices of the Semashko Institute of Public Hygiene in Moscow, itself the base of many leading researchers in child anthropometry in the Soviet Union and in Russia today; these volumes (Semashko Institute 1962, 1965, 1977, 1988, 1998) constitute the primary source of the child growth data used in this paper. Most of the studies were conducted in schools by trained researchers according to a standard methodology;[7] researchers in each region measured at least 100 children of each sex at each age for height and weight. The Semashko data are supplemented by other anthropometric surveys of children in the USSR conducted in schools by researchers and published in Soviet public health journals such as *Sovietskoye zdravookhraneniye* (*Soviet Public Health*) and *Zdravookhraneniye Rossiiskoi Federatsii* (*Public Health in the Russian Federation*); these sources are listed in Appendix 1. The data in these studies appear to be comparable to the Semashko data in terms of methodology, particularly in the standards used for measurement of children. All studies give the average height attained at each age in centimeters; most also give the number of observations in each age group and the

[7]The methodology is described as follows: "The body length is measured with the child standing with his back to a metal anthropometer, standing in a naturally upright position with hands lowered alongside the body, heels together and toes apart. The child's body should touch the rod at three points: heels, buttocks, and the area between the shoulder blades. The age of the child is determined by birth certificates and by the date of the exam (Seglenietse 1973)."

standard deviation of average heights. To enable comparisons across ages and regions, the average height data have been converted into percentiles of U.S. growth standards. These percentiles were calculated by Richard Steckel (1996) and are derived from the standard U.S. growth charts which are based on nationally representative surveys of well-nourished children in the United States taken in the 1960s and early 1970s; these growth charts are widely used and have been adopted by the World Health Organization (WHO) as the standard for evaluating child growth in developing countries.[8]

The Soviet anthropometric data provide a large, relatively untapped resource for examining the biological standard of living across the regions of the Soviet Union. One should recognize, however, that these data are potentially flawed for a number of reasons. First, the data are not representative of the RSFSR or of the USSR as a whole. Second, given the long period of time over which these studies have been conducted and the hundreds of researchers involved in these studies, it is unlikely that each study followed the measurement guidelines noted above, possibly resulting in inconsistencies and measurement error in the height reporting. Finally, it is likely that the height data overestimate the average stature of children in the Soviet Union. Researchers sometimes excluded children with "defects," chronic illnesses or who appeared to be poorly nourished, and this practice was openly acknowledged in the methodological notes (see Sukharev et al. 1965 for an example). In addition, better-off (and therefore taller) children were more likely to go to school and be included in these studies. This is less of an issue in the postwar period as schooling became compulsory in 1958, but is likely to bias the height estimates for the prewar period.

[8]See U.S. Department of Health, Education and Welfare (1976) for a description of the surveys and methodology for constructing the growth charts. While a new set of growth charts was issued in 2000, this paper uses the earlier growth charts since the period in which they were developed is comparable to that under study in this paper.

The child height data are supplemented with data on adult heights in Russia from the Russian Longitudinal Monitoring Survey (RLMS) and on female heights in Armenia, Kazakhstan, the Kyrgyz Republic, Moldova and Uzbekistan from the Demographic and Health Surveys.[9] For comparison, data on the heights of adults in southern Europe (Greece, Spain and Italy) are included in the analysis; these data are from Garcia and Quintana-Domeque (2007).

IV. Trends in child and adult heights in the Soviet Union

The anthropometric data are used to evaluate the health and nutritional status of the Soviet population over the course of the twentieth century, and, more broadly, to assess the standard of living across regions and in the country as a whole. This use of anthropometric data draws on the pioneering work of researchers such as Robert Fogel and Richard Steckel, which has demonstrated that anthropometric data can provide a wealth of information on the living standards of the past and present, and can be particularly useful when data on traditional measures such as GNP are absent or of questionable quality (Fogel 1986, 1991, 1994; Steckel 1979a, 1979b).[10] More specifically, the influences of past and current nutritional status are reflected in adult heights and body mass indices (a measure of weight for height): adult height is a cumulative measure of nutritional status in infancy, childhood and early adulthood, while the body mass index is an indicator of current nutritional status. Both adult height and the body mass index have been found to be strong predictors of the probability of dying, and the ideal measures of these appear to be constant over time and across countries.

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[9] A detailed description of the sampling design and implementation of the RLMS, as well as data access, is available at the RLMS website at http://www.cpc.unc.edu/rlms. The Demographic and Health Surveys are available at http://www.measuredhs.com. The surveys used here are Armenia 2000 and 2005, Kazakhstan 1995 and 1999, Kyrgyz Republic 1997, Moldova 2005, and Uzbekistan 1996.

[10] See Steckel (1995) for a survey of research in this area.

Stature as a measure of living standards has several advantages over more conventional measures. It is a measure of net nutrition in the sense that it takes into account not only the inputs to health – nutrition, health care – but the demands placed on an individual's biological system as well, such as through disease and work intensity in the growing years. Even a mild illness during the growing years will tend to slow growth, and although catch-up growth is possible it will depend on the availability of sufficient caloric and nutrient intake to enable such growth. Child height has an advantage as an indicator of welfare over adult height because child height is sensitive to environmental insults, especially in the years of rapid growth (infancy and the adolescent years, i.e. age 10 to 14). Indeed it appears that adult height is largely determined by age 3 to 4, and is affected even by nutritional inputs during the fetal growth period (Bogin 1999). While genetic influences in part determine individual height, at the population level nearly all differences in average height are the result of environmental influences, enabling one to compare stature across countries and over time. In other words, well-nourished populations tend to follow the same growth curves, whether the population is European, African, or North American in origin (Martorell and Habicht 1986). Because of the comparability of heights across populations and over time, and due to the clear link between height and nutritional status, stature is viewed as a useful index of the biological standard of living. A further advantage of anthropometric indicators is that they take into account that some economic activity is non-monetized and therefore unmeasured by conventional indicators of living standards. This is particularly beneficial for the Soviet Union, because, as is well-known, increasing shares of economic activity took place in the "second economy" of the USSR as macroeconomic imbalances intensified in the 1970s and 1980s.

Child height in the prewar period and during World War II

The child height data are presented in a series of graphs beginning with Figures 1 through 3b. The city with the most abundant child height data is Moscow; children in Moscow were likely to be the most well-nourished in the Soviet Union with access to the best health care in the country. The average height in centimeters by year of birth of 8-, 10-, 12-, and 14-year old boys in Moscow is shown in Figure 1. These same data converted into percentiles of U.S. growth standards are shown in Figure 2a for boys and in Figure 2b for Moscow girls. Figures 2a and 2b illustrate that in the prewar period Moscow children were remarkably short in stature, and their growth trajectories were sensitive to some of the cataclysmic events experienced in Russia and the Soviet Union in the twentieth century. Between the Revolution of 1905, World War I and the Civil War (1914 - 1921), and the famine of 1921 - 1923, children in Moscow reached only the 1st to 4th percentile on U.S. growth charts.[11] These extraordinarily low measures of the stature of children suggest that net nutrition was inadequate to support childhood and adolescent growth during this period, which is consistent with the conclusion of historians that the average Russian diet deteriorated in both quality and quantity in the first two decades of the twentieth century (Mironov 1995; Wheatcroft 1999).

Similar conditions characterized other cities of the Russian republic and the Soviet Union: in St. Petersburg, Nizhni Novgorod and Penza (Russia), Kiev and Kharkov (Ukraine), and Minsk (Belarus), children on average achieved no more than the 7th percentile of growth and in some cases much less in the pre-1925 period (Figures 3a and 3b). These extremely low heights are corroborated by several other sources of stature information for children and adult

[11]The raw data underlying Figures 1, 2a and 2b are given in Appendix Table 1. Data for other cities in the USSR are also provided in Appendix Table 1. Data for other Soviet cities shown in Figures 3a, 4 and 5 are available on request from the author. Sources for all data are given in Appendix 1.

men born in the early years of the twentieth century; these other indicators are shown in Table 3. For example, the average stature of male military recruits born in 1906 - 1910 was 167.5 cm (Mironov 1999), which is roughly the 8th percentile of the height standard for 18-year-old boys. The average terminal height of Russian men born in 1898 was approximately 166 cm (Wheatcroft 1999[12]); men in the United States had reached a height of 172.1 cm by 1910 (Costa and Steckel 1997). Czech children reached similarly low growth percentiles: based on an 1895 survey of approximately 100,000 children in the Czech region, 7-year-old boys attained an average height of only 114 cm, roughly the 3rd percentile of U.S. growth charts, and 14-year-old boys (146 cm) were at the 1st percentile (Vignerová et al. 2006).

Returning to the child height data, it is of great interest to examine child height and well-being during the significant and often cataclysmic events that occurred in the Soviet Union during the twentieth century, particularly the period of rapid industrialization (1929 - 1940), the famine of 1932-33, and World War II. Data spanning the years of rapid industrialization are very limited, however, with data available for only four cities in the Soviet Union, and are inconclusive. In St. Petersburg industrialization appears to have been costly to child health, with (for example) 7-year-old boys declining in height from an average of 117.2 cm for boys born in 1929 to 109.7 cm for boys born in 1938. Average heights also declined for 10- and 11-year old boys and girls in Moscow, and for 8-year-old girls in Nizhni Novgorod (Table 4). However, it should be kept in mind that education was expanding rapidly in this period and the composition of children in schools was likely changing, so part of the height declines may reflect a sample selection effect. In contrast, in Kharkov (Ukraine) the average heights of adolescent boys

[12]These data are based on relatively large surveys of individual height and size conducted by the Soviet clothing industry (see Wheatcroft 1999).

increased significantly during the industrialization period, albeit from a very low initial level.

The 1932-33 famine was one of the great famines of the twentieth century. The degree to which the famine was a deliberate policy of the Soviet regime or the result of forced collectivization and poor grain harvests is controversial,[13] but there is universal agreement that the famine was severe and extremely costly. New estimates based on painstaking archival research put the population losses due to the famine at 2.6 million people out of a population of approximately 34 million in Ukraine prior to the famine (Vallin et al. 2002). While the famine is most closely associated with Ukraine, it also struck the southern regions of the Russian republic (particularly the lower Volga and North Caucuses regions), Moldova and Kazakhstan. Urban areas were generally less affected than rural areas due to a rationing system that had been implemented in 1928-29 (Livi-Bacci 1993).

Because the famine was intense but brief, one can only assess its effect on child height by analyzing the results of single surveys of heights that span children born immediately before, during and after the famine. This type of data is available for eight regions, two of which were in the regions most affected by the famine: Rostov-on-Don in the North Caucuses and Kharkov, Ukraine. These data are illustrated in Figure 4 and are given in Appendix Table 2. As an example of how to read the information provided in Figure 4, the upper left graph shows the height percentiles of boys and girls aged 11 to 17 from a survey taken in Murmansk city schools in 1947; these children were born between 1930 and 1936. In most of the regions shown in Figure 4 there was a significant decline in the child height percentiles for children born during the famine years as well as in 1934, when infants would have been *in utero* during the famine.

[13]See, for example, Davies and Wheatcroft (2004, 2006), Ellman (2005) and Tauger (2006). A discussion of the 1932-33 famine and its place in the context of famine history is given in Ó Gráda (2007). The classic book on the famine is Conquest (1986).

This is consistent with recent findings on the 1959-61 famine in China which indicate that individuals born during the famine attained an adult height approximately 3 cm less than they would have in the absence of the famine (Chen and Zhou 2007). A gender difference is evident as well, with the relative decline in stature for girls exceeding that of boys in most regions; this is surprising because boys tend to be more sensitive to environmental insults than girls (Bogin 1999). The remarkably short stature of adolescent boys in Kharkov shown in Figure 4 is also noteworthy. Since no information is provided in the source on the number of boys surveyed it is difficult to assess the reliability of the data, but the boys in this age group not only suffered through the 1932-33 famine in infancy, but their adolescent growth spurt years occurred during the occupation of Ukraine in World War II (1941 - 43) which likely eliminated any possibility of catch-up growth for this cohort.

The difficult decade of the 1930s was followed by the invasion of the Soviet Union by Nazi Germany on June 22, 1941. World War II exacted a devastating toll on the Soviet Union: besides the massive losses of population, estimated at 26 to 27 million excess deaths or 13.5 percent of the prewar population (Andreev et al. 1990), the population that survived endured horrific conditions including disease, severe rationing and malnourishment, and dislocation. This toll was distributed unevenly across the country, with the eastern regions suffering the most devastation during the Nazi invasion and occupation. One would expect these conditions to be reflected in lower child stature for children born during the war years, but this is not universally the case. In Moscow in particular, among children born during the war and surveyed in 1950 (ages 7 - 11), average height increased from the 12^{th} to the 22^{nd} percentile between 1941 and 1943, and a similar increase in relative height occurred for Moscow girls aged 15 - 17 (Figure 5a). This is surprising given that rationing was implemented in 1941 and that the average daily

number of calories consumed by the urban population fell from 3,370 to 2,810 between 1940 and 1944, reaching a trough at 2,555 calories in 1942.[14] A possible explanation for the increase in child height in Moscow during the war is that rationing led to a more equal distribution of calories across the population, reducing the incidence of malnourishment and stunting during the war years.[15] It is also possible that shorter and weaker children died during the war, so that average heights increased, or that child heights increased after the war due to 'catch-up' growth when food supplies improved. It is worth noting that the experience of increasing child stature during World War II was not unique to Moscow; child height increased in most regions in England and Wales during World War II as well (Floud and Harris 1997).

Children living in other cities in unoccupied areas, however, generally experienced a stagnation or decline in relative heights during the war years: this is the case for Tula in the Central region of the RSFSR,[16] Penza in the Volga region, Kopeisk in the Urals, and Blagoveshchensk in the Far East (Figure 5a). As in the famine of 1932-33, the decline in relative heights for girls exceeded that of boys, although the girls achieved higher growth percentiles on average than boys.

Occupied regions show little evidence of relative increases in stature for children born during the war (Figure 5b). In most cities the percentiles of child height declined, in some cases dramatically. In Vilnius, Lithuania, for example, the average height of 17-year-old girls born in 1941 was at the 39th percentile of growth, while that of 13-year-olds born in 1945 was at the 21st

[14]Chernyavskii (1964), p. 179, cited in Barber and Harrison (1991), p. 79.

[15]Sen (1998) discusses improved access to food and health care as an explanation for the increase in life expectancy in England and Wales during the war decades of 1911-1921 and 1941-1951.

[16]Note that while parts of Tula oblast were occupied during the war, the city of Tula itself was never occupied.

percentile. As reported in Moskoff (1990), food rations in the occupied cities were inadequate: for example in Tallinn, Estonia, the basic daily ration in early 1942 provided 877 calories. Given the hardship conditions in the occupied regions one might have expected child heights to decline more, but it should be kept in mind that the children in these cities were surveyed after the war, and may have been evacuated from these cities during the war itself. The decline in relative heights for children born during the war years is consistent across most of the regions shown in Figure 5b, with the exception of Odessa in which the relative heights of boys increased slightly.

The final city to examine is St. Petersburg (then Leningrad). The scale of suffering in this city during the war is perhaps unmatched in modern history, with an estimated 750,000 civilians dying of starvation during the siege of Leningrad between 1941 and 1944; the death toll peaked at 500,000 people during the winter of 1941 - 42. During the siege, in which Germany blockaded Leningrad and cut off all food supplies, rations fell to starvation levels: at their lowest, rations provided 707 calories per day for workers and 423 calories per day for dependents (Barber 2005). In January 1945 the Leningrad Bureau of Health Statistics conducted a survey of preschool children attending child care centers and kindergarten; the survey is noteworthy because it distinguished between children who lived in St. Petersburg throughout the blockade and those who were evacuated at some point during the blockade. A total of 3207 children were surveyed, of whom 1533 lived in St. Petersburg throughout the entire blockade. The results of this survey were published in Shnitnikova (1963) along with results of other surveys of St. Petersburg children taken before and after the war; these data are reproduced in Table 5 with the average heights converted into percentiles. The extreme suffering embodied in these data is difficult to overstate. Boys who managed to survive the blockade reached the .4th percentile of height on average; boys who were evacuated fared little better, probably due to the starvation many

evacuees were already suffering when evacuated.[17] Compared to the average 7-year-old boy in 1936, a 7-year-old boy who survived the siege of Leningrad was on average 7 cm shorter. The same is true for girls although on average the female height percentiles are slightly higher than those for boys.

Did St. Petersburg children recover from the extreme trauma suffered during the war? The evidence indicates that some 'catch up' growth did occur. As illustrated in Figure 6, children born during the war were extremely short in stature when surveyed at a young age, but the same cohort surveyed in their teenage years had increased in relative height from approximately the .4th percentile to the 7th - 9th percentile for boys and the 14th - 20th percentile for girls. However, boys born during the war were significantly shorter in stature than those born even in 1945 (Figure 6).

Child and adult height in the postwar period

It is following World War II that a remarkably rapid and sizable increase in the stature of Soviet children occurred. From approximately 1945 to 1969, the average height of children increased from (roughly) the 10th to the 40th percentile of U.S. growth charts. These large gains in stature occurred across all of the Soviet republics for which data are available (Figure 3b), and also characterized the growth of children in many cities of the Russian republic (Figures 3a, 7a, 7b). Rural children grew dramatically during this period as well, but the rate of increase was slower and the average percentile attained was lower than that of urban children (not shown).

This extremely rapid increase in the stature of children appeared to halt or possibly regress slightly in the early 1970s. For example, while 10-year-old boys in Moscow had

[17]See the description of the evacuation of Leningrad in Frolov (2005).

increased in stature from the 21st to the 50th percentile between 1948 and 1959, by 1981 they had fallen to the 31st percentile. As is evident from Figures 7a and 7b, this pattern persists across several other cities of the RSFSR during this period, including Orel, Perm, Ulyanovsk, and Novosibirsk. Soviet researchers themselves commented on this break in the trend of previous decades, even observing that in some regions the change in average child stature had become negative (Maksimova and Yanina 1988). Note that there is no reason that the stature of well-nourished children could not exceed the 50th percentile of U.S. growth charts: the average adult stature of the U.S. population began to lag behind that of many developed countries in the postwar period and is now 3 - 7 cm below that of countries such as Germany, Sweden, Norway, the Netherlands, Denmark, and the United Kingdom (Komlos and Baur 2004).

The trends in child height in the postwar period are corroborated by a study of adult heights in Russia taken from the Russian Longitudinal Monitoring Survey. As noted above, adult height is largely determined in early childhood (i.e., age 3 to 4) including the fetal period; like child stature adult stature also reflects the cumulative effects of nutrition and exposure to disease in early childhood. Figure 8 illustrates the trend in adult heights by exact date of birth and by sex over the 1945 - 1980 period.[18] This graph supports the evidence from child heights of significant gains in stature among individuals born from the late 1940s through the late 1960s; the increase in stature averaged about 1.8 cm per decade for men and 1.5 cm per decade for women between 1945 and 1970, which is comparable to or exceeds the average rates of increase

[18]The samples used are for prime-age adults (age 21 - 50) and contain 5,184 observations for men and 5,449 observations for women. Individuals above age 50 are excluded due to the decline in stature that occurs above this age. The sample uses measured height by exact date of birth for Round 5 (1994) of the RLMS. The sample also includes new entrants to the surveys from rounds 6-13. Reported heights of less than 120 cm or more than 210 cm (2 observations) are excluded from the analysis. The graph illustrates locally weighted smoothing (or lowess) estimates of the relationship between stature and exact date of birth. Lowess is a nonparametric estimator that uses a small amount of data near the point in order to generate smoothed values of height. The procedure is described in Cleveland (1979).

in stature in countries at a similar level of development in the twentieth century (discussed below). By 1970 men in Russia reached an average height of about 177 cm, equal to that of U.S. men, and female height in Russia exceeded that of U.S. women by about one centimeter. The trends in Figure 8 also suggest a break in the secular increase in heights that begins around 1970, particularly for women.[19] The timing of this change in trend is the same as the timing of the stagnation in child heights discussed above, and is nearly identical to the timing of the increase in infant mortality rates in the Soviet Union (discussed below).

Given the Soviet Union's proclaimed commitment to equality, it is of interest to examine how the gains in health status reflected in the increase in stature were distributed across the population. To investigate this issue, Figure 9 illustrates the results of regressions of individual height on exact date of birth by percentile of the height distribution, converted into annual rates of growth. The figure indicates that the increase in height between 1945 and 1980 was remarkably evenly distributed across the population, with men and women at the 10th percentile of the height distribution gaining approximately .10 cm annually over this period, compared with .13 cm and .11 cm for men and women, respectively, at the 90th percentile. The only notable increase in height inequality occurs above the 97th percentile for men, where gains in height far exceed those at lower percentiles. This may be due to sampling variation, or could reflect the privileged access to food enjoyed by a small strata of elites in the Soviet Union.

A second approach to examining inequality in growth is to assess the changes in stature across the Soviet republics: were the gains in stature distributed equally across the Soviet Union? The child height data presented previously suggest that this is the case, and this is

[19]Mironov (2007) also reports an increase in female height for St. Petersburg women born between 1956 and 1972, followed by a slight decline for women born from 1973 through 1985, based on the records of over 15,000 women giving birth in St. Petersburg hospitals between 1980 and 2005.

generally corroborated by trends in female adult heights across the former republics. Figure 10 illustrates female heights by year of birth for women in the Soviet republics aged 21 to 49 and born between 1950 and 1980. These data are from the Demographic and Health Surveys (www.measuredhs.com) and are constructed in a similar fashion to the RLMS data. While stature increased across all the republics for which data are available, both the levels and rates of increase in stature for all of the republics except Moldova are well below those of the Russian republic. In Uzbekistan, Kazakhstan, the Kyrgyz Republic, and Armenia, the 1950s were a period of physical stagnation, and significant increases in stature only began in the 1960s. The data for most republics also suggest a slowdown in growth in the 1970s, although the data are insufficient to draw clear conclusions on the post-1970 period in these regions.

Table 6 summarizes the adult height data and compares it with that of several European countries which were at a similar level of development to the Soviet Union in 1950.[20] Men in the Russian republic recorded gains in stature at the same rate as Greece, .09 percent per year, only slightly below the rates of growth experienced in Italy and Spain. As discussed in Garcia and Quintana-Domeque (2007), these southern European countries (along with Portugal) had the fastest growth rates of stature in Europe in the 1950 - 1980 period. Northern European countries like Finland and Sweden had annual growth rates of .02 and .03 percent, respectively, although the average heights in these countries remain several centimeters higher than those in the southern European countries. The growth rate of Russian women was slightly faster than that of women in Greece and Turkey, but well below that of Russian men and below that of women in Spain and Italy. Overall the growth record appears impressive for Russian men when compared

[20]In Maddison (2007), the European countries with GDP per capita closest to that of the USSR in 1950 ($2,841) included Greece ($1,915), Italy ($3,502), Spain ($2,189) and Turkey ($1,623).

with other countries at a similar level of development, but less impressive for Russian women and for populations in some of the less developed republics of the Soviet Union.

To summarize, the evidence presented above indicates extremely small stature of Russian and Soviet children born in the prewar period; some height declines during industrialization, the 1932 - 33 famine and World War II; rapid growth in stature among individuals born in the late 1940s, 1950s and 1960s; and a slowdown or halting of growth for individuals born in the 1970s. These trends are consistent across many of the Soviet republics and Russian regions for which data are available. The substantial and rapid increases in height across most regions and birth cohorts in the USSR in the 1945 - 1969 period indicate that significant improvements likely occurred in the nutrition, sanitary practices, and public health infrastructure in the country in that period. The increase in heights occurred concurrently with the high economic growth rates of the 1950s and 1960s, but heights in most regions failed to increase during the high-growth years of 1929 - 1940 when the Soviet economy was transformed from a predominantly agricultural to an industrialized economy.

V. Trends in infant mortality in the USSR

Infant mortality rates supplement the anthropometric data because they are a reasonably good proxy for low birth weight and have been widely used as a measure of the quality of life across countries, and are available across all of Russia's regions for most of the years between 1956 and 1979. Infant mortality rates in the Soviet Union have attracted the attention of demographers and social scientists for years, particularly after 1986 when the Soviet statistical agency resumed publication of mortality data (see Anderson and Silver 1990), revealing a large

increase in infant mortality rates in the Soviet Union beginning in the early 1970s.[21]

Before the 1970s, however, the infant mortality rate in Russia fell rapidly: between 1940 and 1965 the infant mortality rate fell from over 200 to 26.6 per 1,000 births (see Figure 11, which compares infant mortality rates in the RSFSR and the United States).[22] This period of significant decline in the infant mortality rate is nearly identical to the period of rapid increase in child heights and adult stature documented in the previous section, just as the period of rising infant mortality rates coincides with the slowdown in the rate of increase of average stature in the population. This period of rising infant mortality is illustrated in Figure 12, which shows urban and rural infant mortality rates for the Russian republic from 1960 to 1990. Infant mortality rates rose in both rural and urban areas between 1971 and 1976, and the entire decade of the 1970s saw virtually no improvement in infant mortality overall. Thus, this evidence also indicates that the health status and living conditions of infants and children in the Soviet Union improved

[21]This increase in infant mortality rates is controversial among demographers; some argue that it was an artefact of improved birth and death registration in the less developed regions of the USSR, while others argue that it was real and reflected deteriorating conditions in the public health infrastructure (see, for example, Jones and Grupp (1983), Anderson and Silver (1986), and Velkoff and Miller (1995)). The archival data cannot resolve this issue completely, but they shed light on the controversy because they show the trends in infant mortality rates across all regions of Russia. If the increase in infant mortality rates was due only to improved registration of births and infant deaths, one would not expect infant mortality rates to have increased in the more developed regions of Russia which had achieved essentially complete vital event reporting decades earlier. The archival data indicate that infant mortality rates rose in many developed regions of the country, including Moscow which registered a 14 percent increase in infant mortality between 1971 and 1975. The largest increase in infant mortality was registered in Khabarovskii Krai (in the Far East), at nearly 60 percent, followed by Altaiskii Krai in Western Siberia at almost 50 percent. However there is no obvious regional pattern in the increases in infant mortality rates, with large increases registered in such diverse regions as Moscow, Novgorod and Saratov, and improvements recorded in other areas such as Leningradskaya oblast and Tyumenskaya oblast (in Western Siberia).

[22]Note that Soviet infant mortality rates are not directly comparable to Western infant mortality rates, because the Soviet data exclude live-born infants of less than 28 weeks gestation, less than 1000 grams in weight, and less than 35 centimeters in length who die within 7 days of birth (which are included in the WHO-recommended definition of infant mortality). Anderson and Silver (1986) estimate that Soviet infant mortality rates would be 22 to 25 percent higher if the data were adjusted to include these deaths.

dramatically from approximately 1940 to 1969, and stopped improving or began to deteriorate between 1970 and 1979.

VI. What caused the improvement in population health status?

What caused the improvement in population health status in the Soviet Union? The improvement in infant and child health is likely related at least in part to the development of the national health care system in the Soviet Union, which expanded significantly in this period and provided free health care in even the remotest regions of the country. While the Soviet health care system eventually earned a well-deserved reputation for poor quality and service, it was particularly effective at controlling infectious diseases which undoubtedly contributed to improved child health. The significant increase in female education levels in this period – the share of women with secondary or more education increased from 9.3 to 34.5 percent between 1939 and 1959 – likely also played a role in improving child health status. Other factors that may have contributed include urbanization, particularly the increase in the population with access to clean water and central heating, and the improvement in the caloric and nutrient content of the food supply.

Tables 8 and 9 give the results of regressions exploring the relationship between these variables and infant mortality and adult height, respectively; means of the variables used in these regressions are given in Table 7. Table 8 shows the results of fixed effects regressions with the (log) infant mortality rate as the dependent variable across Russia's regions over the 1960 - 1990 period, in five-year intervals. All regressions include a time trend to account for the secular improvement in infant mortality over the period; as shown in column (1) the time dummies are statistically significant and falling in all periods. Columns (2) - (6) all indicate that the increase

in education is related to falling infant mortality, although this effect is only significant for the population with secondary education. The increase in the capacity of the health care system, as proxied by the number of doctors per capita in each region, is negatively and significantly correlated with the decline in infant mortality between 1960 and 1990 (col. 3), as is the increase in urbanization (col. 4). When these variables are included in a regression together (col. 6), only the measures of changes in health system capacity and secondary education remain negatively and statistically significantly correlated with the log change in infant mortality rates. This suggests that the expansion of the health care and education systems did contribute to the decline in infant mortality rates in this period. Column 5 tests for a relationship between average monthly wages and infant mortality, but the coefficient is statistically insignificant. This may reflect that in an environment of growing macroeconomic imbalances and shortages of basic food supplies, along with free health care and education, monetary resources may not have been the primary means of accessing an improved biological standard of living.

A further test of the factors explaining the changes in population health status is to investigate the correlates of the stature of adults from the Russian Longitudinal Monitoring Survey. This survey asked respondents whether they currently live in the place they were born; for individuals who did not move, their adult height can be related to measures of urbanization, health system capacity, and so on for the region in which they were born in the year in which they were born. The results of these regressions are presented in Table 9 for men (panel A) and women (panel B).

The results are similar to those of the infant mortality regressions: education and the expansion of the health network (the latter for women only) are positively correlated with adult stature and are statistically significant in most specifications. Men born in regions with higher

infant mortality rates also tend to be shorter on average (col. 5 and 6), which is consistent with other studies showing a strong negative relationship between infant mortality rates and adult height across countries (Akachi and Canning 2006; Bozzoli et al. 2007). This relationship does not hold for women, however, suggesting that women are less sensitive to conditions in early life than are men. There is again no evidence of a relationship between regional wages and health status in these regressions (col. 4).

A final issue to explore regarding the improvement in infant and child health in the USSR is the role of increased food and nutrient supply. Unfortunately few data are available on the caloric or nutrient content of food by regions for this period, and data on food consumption is limited as well. Regarding the latter, data on per capita consumption of broad categories of food (e.g. meat, milk, eggs) are available by region for 1965, 1970, 1980 and 1990. Fixed effects regressions of the log change in the infant mortality rate for these years show little support for the hypothesis that food consumption (by this measure) mattered: all of the coefficients on food are statistically insignificant.

Time-series evidence on calories and protein supply over a longer time period is more supportive of the hypothesis. Estimates of available calories and available calories from animal sources indicate that child height increased as calories increased, and that the relationship between changes in calories from animal sources and child growth is particularly strong (see Figures 13a and 13b). This is especially evident during the famine of 1932-1933, when child height declined as calories from animal sources declined. Unfortunately it is impossible to test this hypothesis more extensively given the limited data available, so firm conclusions on the role of calories in the improvement in child health status cannot be made at this point.

Finally, it is of interest to note that the changes in life expectancy in Russia mirror the

changes in infant and child health status discussed previously. As illustrated in Figures14a and 14b, male and female life expectancy increased substantially between 1940 and the early 1960s (at least in part due to falling infant mortality); by 1965 female life expectancy nearly equaled that of U.S. women and male life expectancy fell below that of U.S. men by only 2.5 years. Around 1965, however, male life expectancy began to decline and female life expectancy failed to improve, resulting in a gap of nearly 8.5 years in life expectancy between Russian and U.S. men by 1980, and a gap of 4.3 years for women in that same year. The decline in male life expectancy was largest in the Russian republic, but a similar pattern of deterioration occurred in the other republics as well. The unfavorable trends in mortality and life expectancy in the Soviet Union in the postwar period have long been known and, some have argued (e.g., Eberstadt 1993), should have been taken as the first signal that the impressive rates of economic growth in the USSR either were exaggerated or failed to translate into an improved standard of living for the population.

VII. Conclusion

Did the standard of living rise or fall in the Soviet Union over the twentieth century? The conventional measures of GNP growth and household consumption indicate a long, uninterrupted upward climb in the Soviet standard of living from 1928 to 1985; even Western estimates of these measures support this view, albeit at a slower rate of growth than the Soviet measures. The alternative measures of well-being examined in this paper largely support the evidence of improving population welfare throughout much of the twentieth century, despite the many cataclysmic events that marked this period. Three different measures of population health show a consistent and large improvement between approximately 1945 and 1969: child height, adult

height and infant mortality all improved significantly during this period. These three biological measures of the standard of living also corroborate the evidence of some deterioration in living conditions beginning around 1970, when infant and adult mortality were rising and child and adult height stopped increasing and in some regions began to decline. The gains in height in the postwar period occurred across many regions of the Soviet Union, although growth was most impressive for men in the Russian republic. The significant improvements in population well-being before 1970 may in part be related to the expansion of the national health care system, public education, and improved caloric and protein supply during this period. While the Soviet experiment of the twentieth century clearly failed and in countless ways harmed the lives of Soviet citizens, the record of Soviet health achievement prior to 1970 remains an impressive one.

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Appendix 1: Data sources

Archival data:

Births and infant deaths by RSFSR oblast:

1956: RGAE, F. 1562, op. 27, d. 209
1957: RGAE, F. 1562, op. 27, d. 352
1958: RGAE, F. 1562, op. 46, d. 1561; d. 489
1959: RGAE, F. 1562, op. 27, d. 813; d. 826
1960: RGAE, F. 1562, op. 27, d. 1005; GARF F. A-374, op. 31, d. 7851
1961: RGAE, F. 1562, op. 27, d. 1170; GARF F. A-374, op. 32, d. 3034
1962: RGAE, F. 1562, op. 27, d. 1311; GARF F. A-374, op. 32a (vol. 2), d.7013, 7014
1963: RGAE, F. 1562, op. 27, d. 1445; GARF F. A-374, op. 32a, d. 11512
1964: RGAE, F. 1562, op. 37, d. 2610; GARF F. A-374, op. 35 (vol. 1), d. 3141
1965: RGAE, F. 1562, op. 44, d. 2603
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1970: RGAE, F. 1562, op. 47, d. 1399; d. 1421
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1972: RGAE, F. 1562, op. 49, d. 1833, 1834
1973: RGAE, F. 1562, op. 50, d. 1729, 1730
1975: RGAE, F. 1562, op. 56, d. 1928
1979: RGAE, F. 1562, op. 62, d. 1672

Average daily calories and average daily calories from animal sources (RSFSR): RGAE F. 1562, op. 44, d. 135 (1965); RGAE F. 1562, op. 47, d. 1949 (1970).

Wages, average monthly: GARF, F. A-374, op. 30, d. 7087 (1956); GARF F. A-374, op. 30, d. 10.407 (1957); GARF, F. A-374, op. 31, d. 2779 (1959); GARF, F. A-374, op. 31, d. 5814 (1960); RGAE F. 1562, op. 37, d. 3287 (1964); GARF F. A-374, op. 35, d. 6508 (1965); GARF F. A-374, op. 36, d. 2626 (1966); GARF F. A-374, op. 36, d. 6547 (1967); GARF F. A-374, op. 36, d. 10091 (1968); RGAE F. 1562, op. 48, d. 1668 (1971); RGAE F. 1562, op. 50, d. 2175 (1973).

Other data sources:

Calories (per capita daily calorie supply, total and from animal sources, 1910 - 1960): Wheatcroft 1999, p. 51.

Education variables: Tsentral'noye statisticheskoe upravleniye, *Itogi vsesoyuznoi perepisi naseleniya 1979 goda Tom III chast' I* (Moscow 1989), 190 - 287.

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Infant mortality, Russian republic: estimated: Andreev, E. M., L. E. Darskii and T. L. Kharkova, *Demograficheskaya historiya Rossii: 1927 - 1959* (Moscow: Informatika, 1998), 164-5; official: Goskomstat Rossii, *Demograficheskii ezhegodnik Rossii 2002* (Moscow, 2002), 55.

Life expectancy, Russian republic: estimated: Andreev, E. M., L. E. Darskii and T. L. Kharkova, *Demograficheskaya historiya Rossii: 1927 - 1959* (Moscow: Informatika, 1998), 164-5; official: Goskomstat Rossii, *Demograficheskii ezhegodnik Rossii 2002* (Moscow, 2002), 105.

Meat consumption, kilos per capita (1965, 1970): Treml, Vladimir and Michael Alexeev, "The Second Economy and the Destabilizing Effect of Its Growth on the State Economy in the Soviet Union: 1965 - 1989," Berkeley-Duke Occasional Papers on the Second Economy in the USSR, No. 36, November 1993.

Urban population: Goskomstat RSFSR, *Narodnoye khozyaistvo RSFSR*, various issues 1958 - 1985.

Child height data:

The year indicated after each city is the year in which the study was conducted.

Giguz et al. 2001:	Novosibirsk 2001.
Godina et al. 2003:	Moscow 1998.
Goppe 1972:	Kemerovo 1962, 1969.
Iampol'skaia et al. 1991:	Moscow 1961, 1974.
Iampol'skaia et al. 1993:	Moscow 1991.
Krasik et al. 1963:	Perm 1962; Novosibirsk 1962.
Lapitskii et al. 1969:	Murmansk 1965.
Matveeva et al. 1997:	Nizhni Novgorod 1937, 1946, 1970.
Millere 1962:	Murmansk 1951.
Mostovaya 1979:	Kiev 1927, 1955, 1960, 1967, 1972, 1977.
Narodnoe khoziastvo SSSR v 1960 gody:	Moscow 1925, 1938.
Naselenie SSSR 1973:	Minsk 1934; Moscow oblast 1938, Murmansk 1947, 1957; St. Petersburg 1928; Tblisi 1936
Orlik 1967:	Kharkov, 1923, 1926, 1946, 1950, 1955, 1959, 1964
Romenskii et al 1978:	Perm 1970.
Semashko 1962:	Blagoveshchenski 1958; Kharkov 1959; Kopeisk 1958; Moscow 1958, Minsk 1955, Novosibirsk 1958; Odessa 1956; Orel 1959; Penza 1956; Rostov-on-Don 1958; Rostov rural areas 1958; St. Petersburg 1959; Tula 1957.
Semashko 1965:	Nizhny Novgorod 1959, St. Petersburg 1961, Riga 1960, Baku 1959, Ulyanovsk 1962, Novosibirsk 1959; Vilnius 1958.

Semashko 1977:	Moscow 1969, Murmansk 1970, Minsk 1970, Novosibirsk 1970, Ulyanovsk 1965, Nizhni Novgorod 1966, St. Petersburg 1972, Kemerovo 1969
Semashko 1988:	Riga 1970, 1985, Baku 1974
Semashko 1998:	Nizhny Novgorod 1991, Kemerovo 1991, Orel 1991, Perm 1993, Ulyanovsk 1992
Shnitnikova 1963:	St. Petersburg 1936, 1945.
Sifman 1960:	Moscow 1950.
Tarasov 1966:	Murmansk 1961.

Zhenshchini i deti v SSSR (Moscow 1961): Rostov-on-Don 1946.

Table 1. Estimates of national income (GNP) growth in the Soviet Union, 1928 - 1985 (annual rates of growth)

	Khanin	Bergson/CIA	TsSU
1928-1985	3.3	4.3	8.8
1928-1941	2.9	5.8	13.9
1950s	6.9	6.0	10.1
1960s	4.2	5.2	7.1
1970s	2.0	3.7	5.3
1980-85	0.6	2.0	3.2

Source: Fischer (1994), Table 7.4.

Table 2. Comparisons of Soviet and Western economic performance, 1950 - 1980 (annual rates of growth)

	Soviet Union			E-OECD		United States	
	1950-80	1960-80	1970-80	1950-80	1970-80	1950-80	1970-80
GNP per capita	3.3	3.1	2.1	3.3	2.3	1.9	2.0
Household consumption per capita	3.7	3.2	2.6	3.2	2.6	2.1	2.3

Notes: Soviet data are Western estimates. Data for E-OECD and the U.S. are GDP rather than GNP. Household consumption is at established prices for the Soviet Union, at factor cost for E-OECD and the United States.

Source: Ofer (1987), Table 2.

Fig. 1 Height of boys in Moscow by age and year of birth, cm

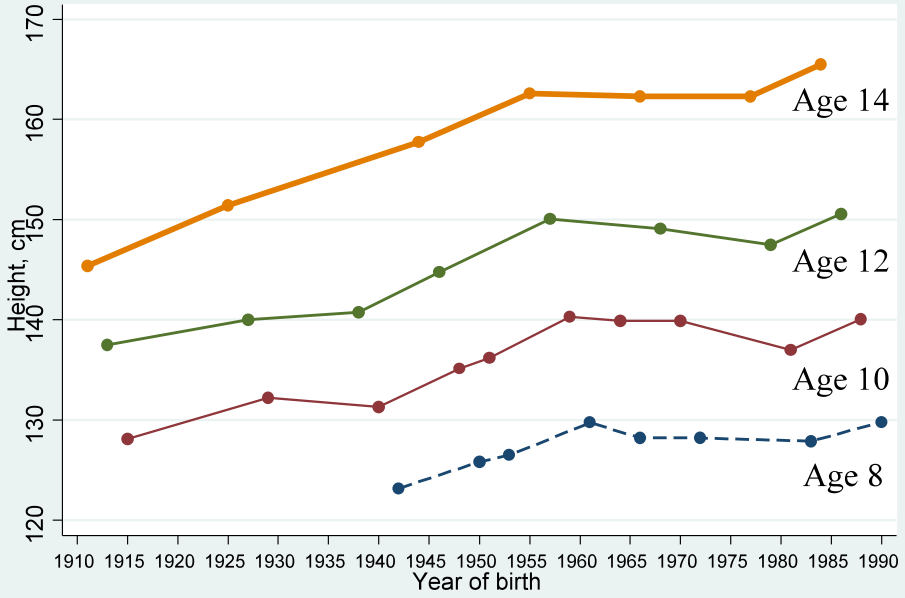


Fig. 2a Height of boys in Moscow by age and year of birth, in percentiles of US growth standard

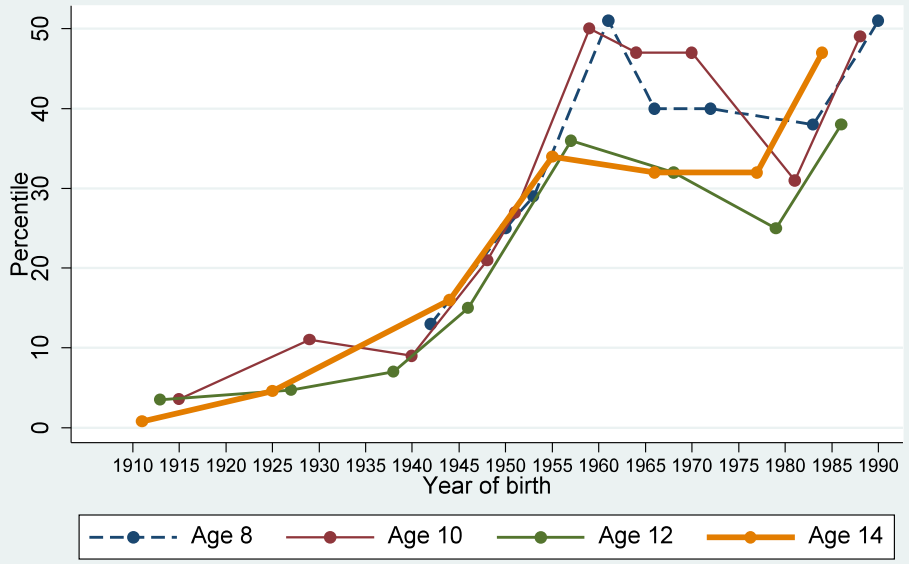


Fig. 2b Height of girls in Moscow by age and year of birth, in percentiles of US growth standard

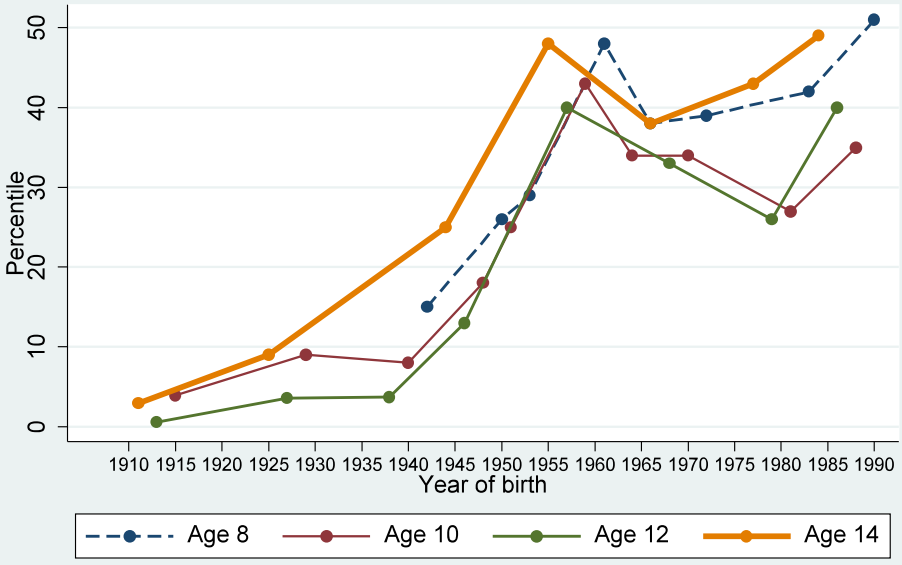


Fig. 3a Height of 13-year-old boys in RSFSR cities, in percentiles of US growth standard

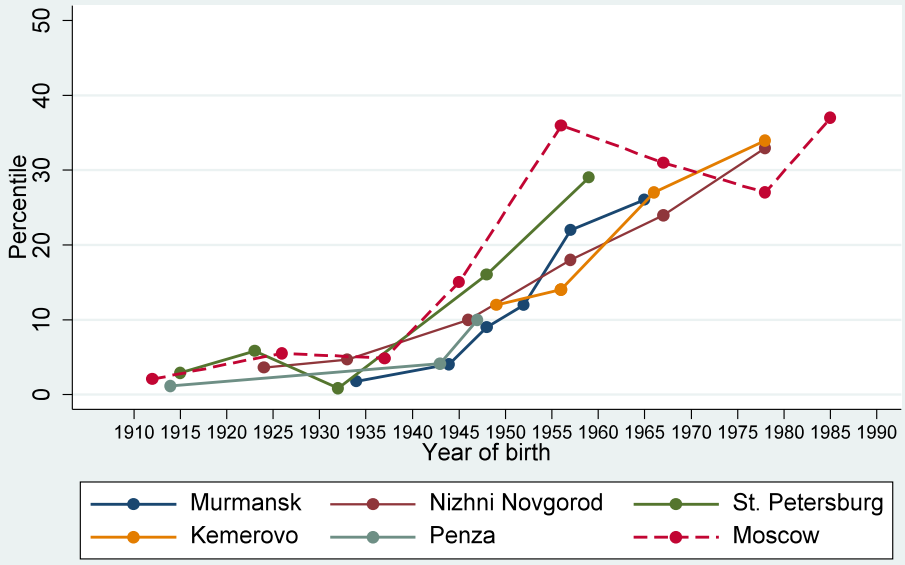


Fig. 3b Height of 12- to 15-year-old boys in USSR cities in percentiles of US growth standard

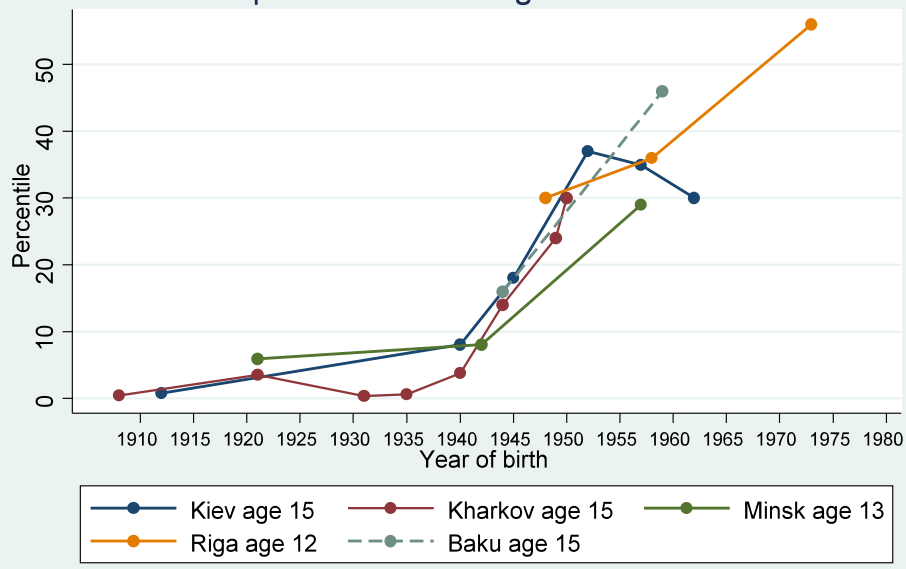


Table 3. Evidence on Soviet and East European heights from other sources

Population	Year of birth	Height in cm
1. Moscow men aged 20-29	1891 - 1909	168.2
2. Adult men in central regions of Russia, age 22 and over	1898	166
3. Russian military recruits	1906 - 1910	167.5
Moscow male workers age 25	1901 - 1905	167.3
Moscow male workers age 25	1906 - 1910	167.8
4. Moscow working youths age 18	1905	161.5
5. Moscow military recruits	1906	167.3
St. Petersburg military recruits	1906	167.0
Ukraine military recruits	1906	169.1
6. Kiev boys age 8 years old	1918	120
Kiev boys age 17 years old	1910	162
7. Czech boys age 7 years old	1888	114
Czech boys age 14 years old	1881	146
Czech boys age 14 years old	1937	159.5

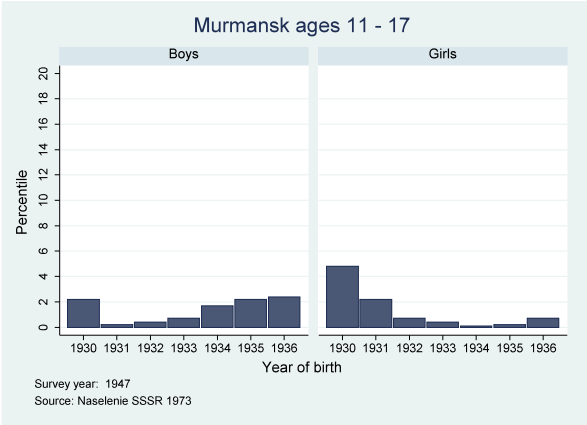
Sources by line:
1. Zhdanov and Nikityuk 1964, cited in Godina 1998 p. 358.
2. Wheatcroft 1999, p. 43.
3. Mironov 1999, p. 16.
4. *Naselenie SSSR 1973*, p. 194.
5. Kosarev and Kraval', *Molodezh' SSSR* pp. 308 - 309.
6. Glushchenko and Slepushkina 1959. p. 67.
7. Vignerová et al. 2006, p. 240, 243.

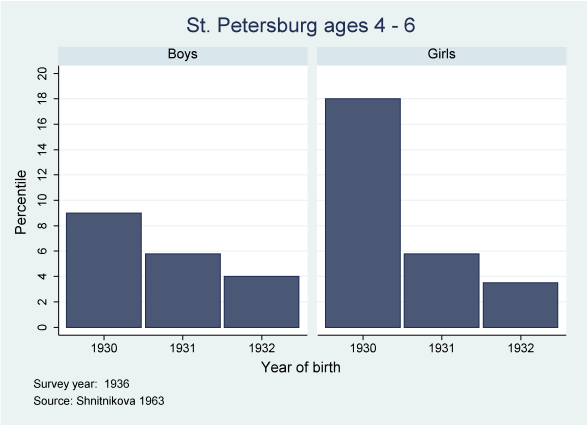
Table 4. Average heights and percentiles of growth during industrialization

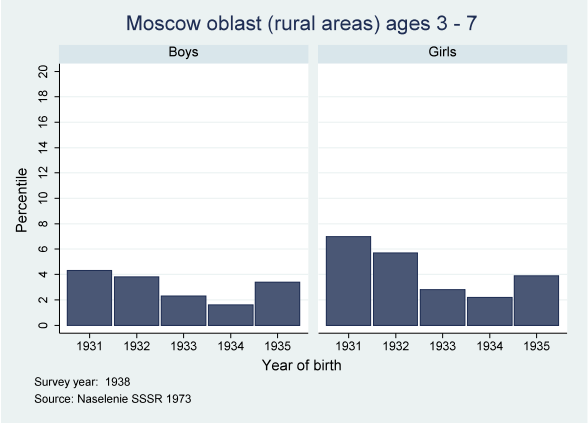
St. Petersburg									
Boys					**Girls**				
Year of birth	Age	N	Height, cm	Percentile	Age	N	Height, cm	Percentile	Source
1929	7	na	117.2	9	7	na	117.1	14	Shnitnikova 1963
1938	7	na	109.7	.4	7	na	109.7	1	
1930	6	na	111.9	9	6	na	112.5	18	Shnitnikova 1963
1939	6	na	105.3	.4	6	na	105.4	1	
1931	5	na	105.1	6	5	na	103.7	6	Shnitnikova 1963
1940	5	na	100.7	.7	5	na	99.5	.7	
Moscow									
Boys					**Girls**				
1928	11	na	136.6	9	11	na	136.5	6	*Narkhoz 1960**, Sifman 1950
1939	11	1,075	135.8	8	11	896	135.8	5	
1929	10	na	132.2	11	10	na	131.6	9	*Narkhoz 1960**, Sifman 1950
1940	10	889	131.3	9	10	831	131.1	8	
Nizhni Novgorod									
Boys					**Girls**				
1928	9	na	125.4	6	9	na	125.9	9	Matveeva et al. 1997
1937	9	na	126.0	7	9	na	126.0	9	
1929	8	na	123.6	14	8	na	122.8	16	Matveeva et al. 1997
1938	8	na	122.4	10	8	na	120.8	10	
Kharkov (Ukraine)									
Boys					**Girls**				
1928	18	na	161.8	1	na	na	na	na	Orlik 1967
1937	18	na	167.8	8	na	na	na	na	
1929	17	na	158.9	.4	na	na	na	na	Orlik 1967
1938	17	na	165.2	4	na	na	na	na	
1930	16	na	155.4	.2	na	na	na	na	Orlik 1967
1939	16	na	163.0	4	na	na	na	na	
1931	15	na	149.9	.3	na	na	na	na	Orlik 1967
1940	15	na	157.0	4	na	na	na	na	

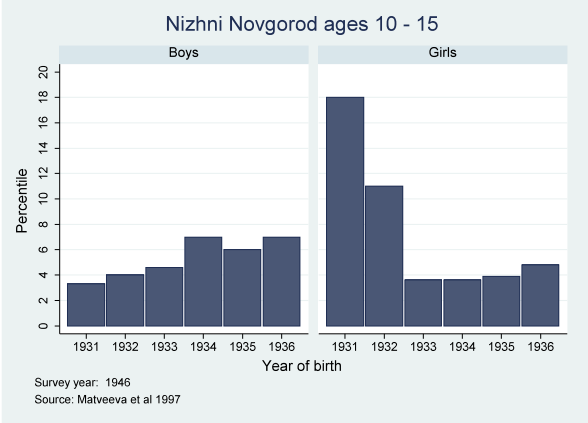
* *Narodnoe khoziastovo SSSR v 1960 gody.*

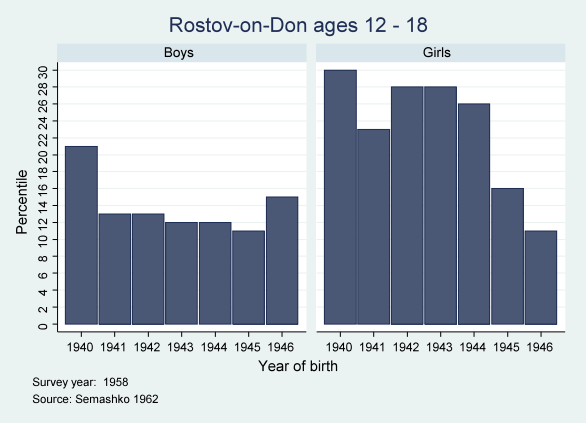
Figure 4. Height percentiles in the famine years

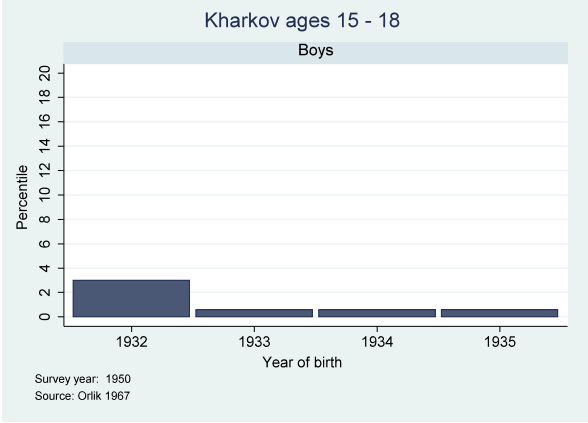












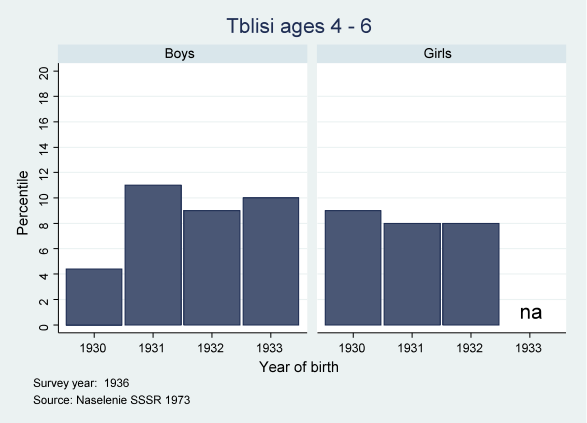
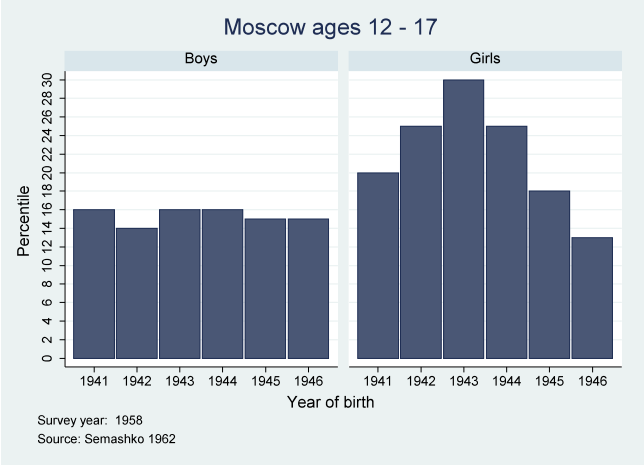
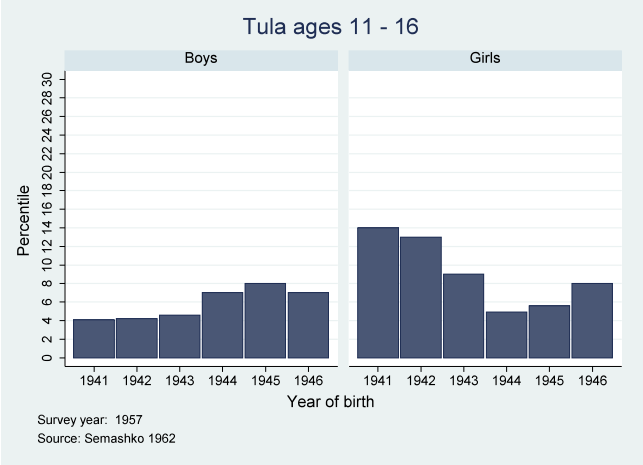
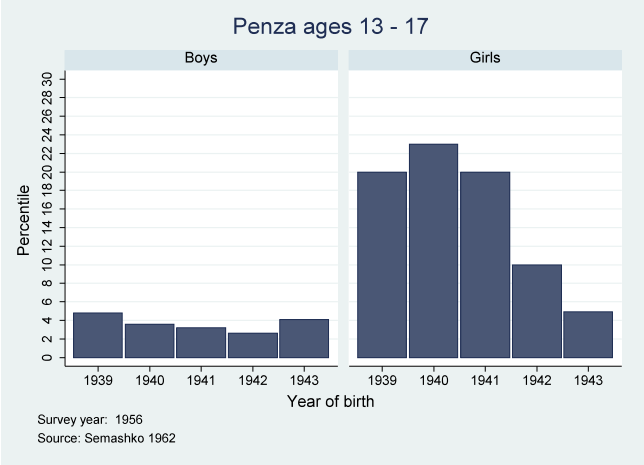
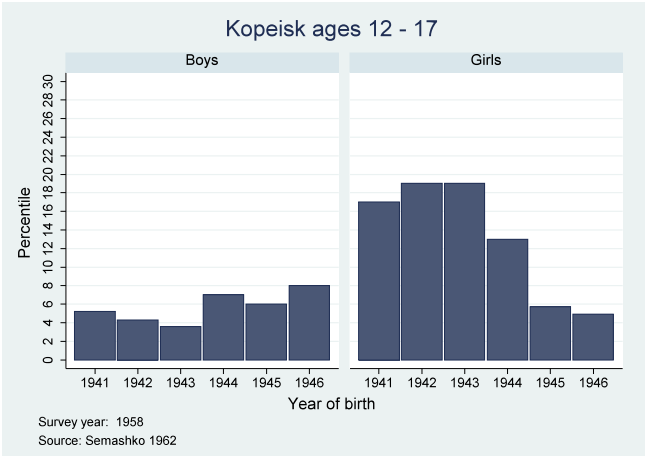


Figure 5a. Height percentiles during World War II, unoccupied cities









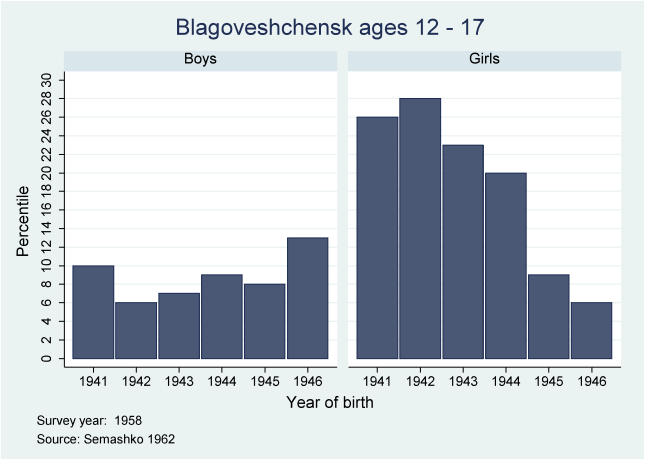
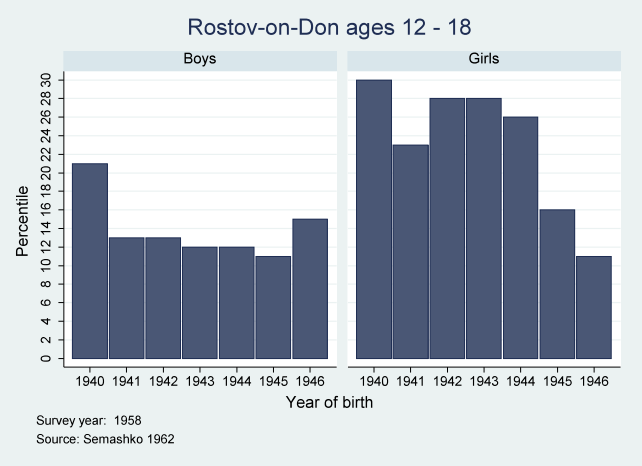
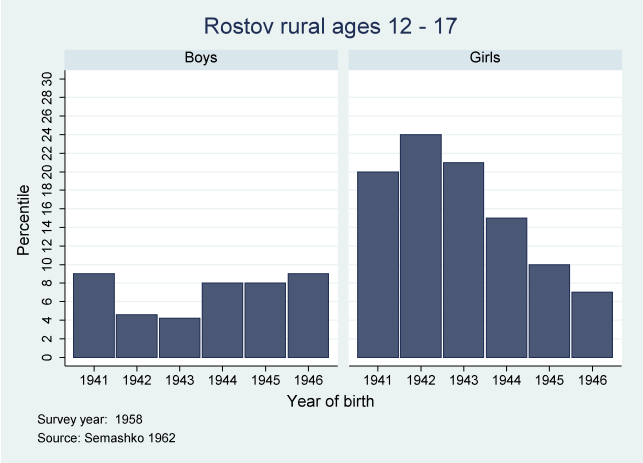
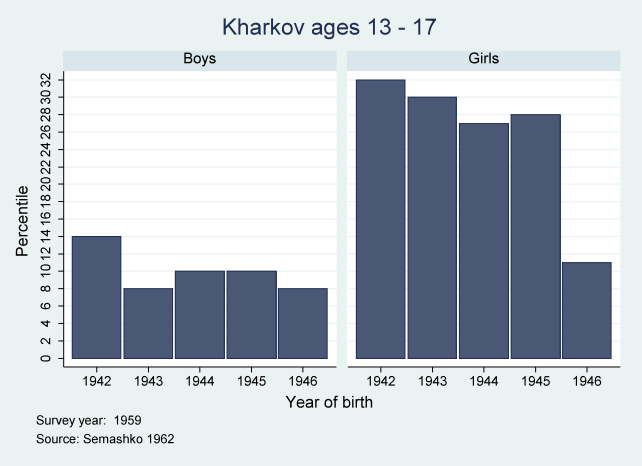
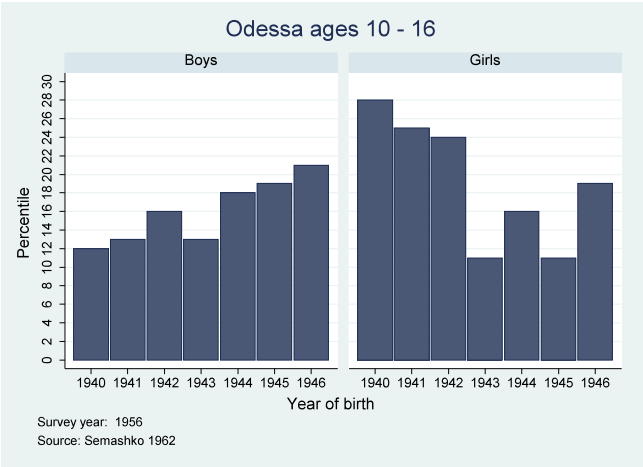


Figure 5b. Height percentiles during World War II, occupied cities and regions









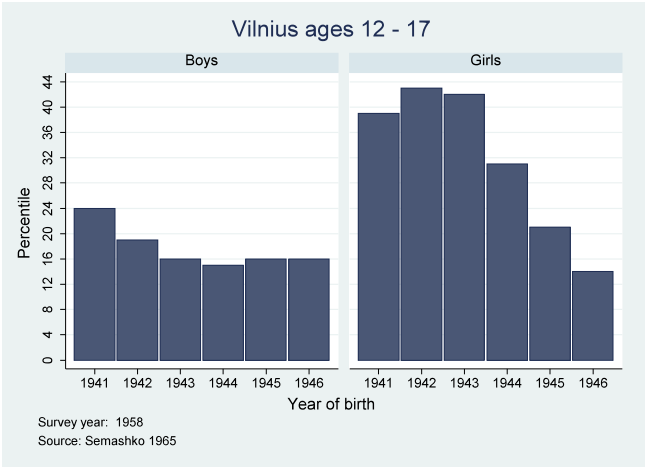
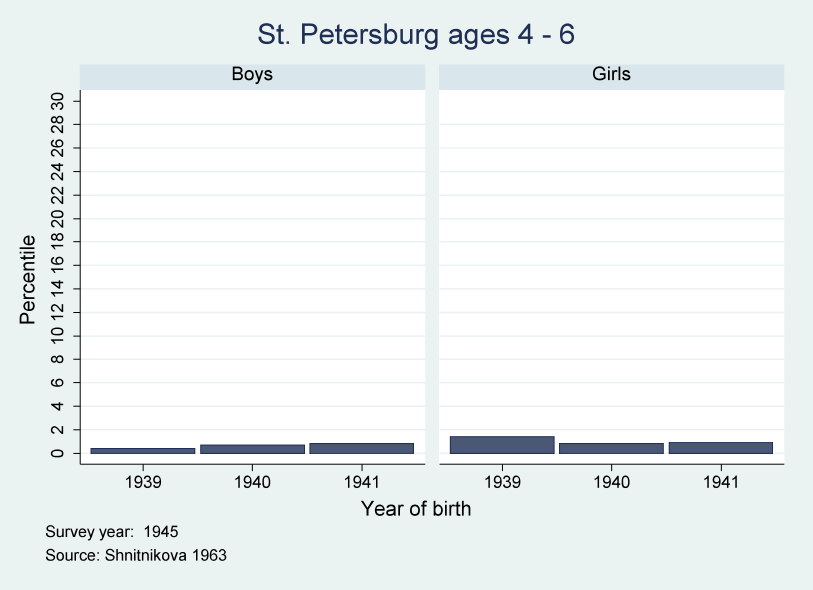


Table 5. Average heights of children in St. Petersburg by age and year of survey

Boys	1936-37		1945						1958	
			All children		Blockade children		Evacuated children			
Age	Height, cm	Percentile	Height, cm	Percentile	Height, cm	Percentile	Height, cm	Percentile	Height, cm	Percentile
4	97.8	4	94.8	.8	95.0	.9	94.7	.8	102.2	18
5	105.1	6	100.7	.7	99.8	.4	101.6	1.2	108.3	17
6	111.9	9	105.3	.4	104.8	.4	106.0	.6	115.0	22
7	117.2	9	109.7	.4	109.6	.4	109.8	.4	120.7	24
							3.7			
Girls										
4	96.3	4	94.1	.9	94.8	1.5	93.7	.7	101.6	23
5	103.7	6	99.5	.8	98.6	.5	100.3	1.2	107.8	22
6	112.5	18	105.4	1.4	104.6	.9	106.5	2.3	113.3	22
7	117.1	14	109.7	1.1	109.7	1.1	110.0	1.4	119.4	25

Source: Shnitnikova 1963.

Figure 6. Height percentiles of St. Petersburg children born during World War II



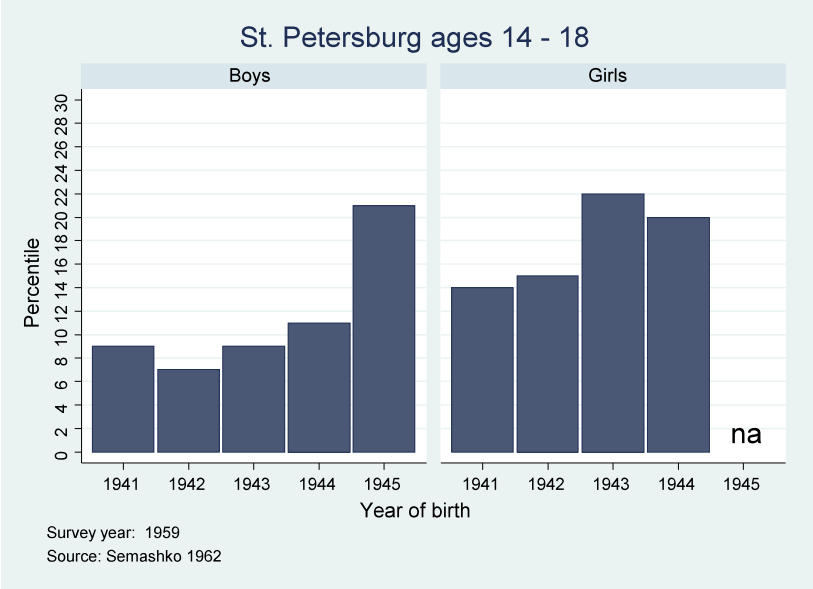


Fig. 7a Height of 13-year-old boys in RSFSR cities, in percentiles of US growth standard

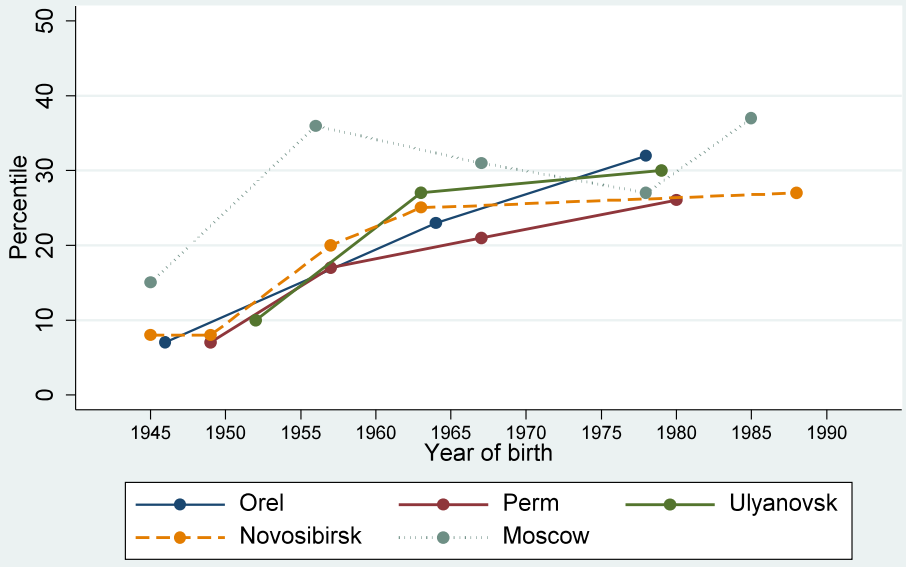


Fig. 7b. Height of 13-year-old girls in RSFSR cities, in percentiles of US growth standard

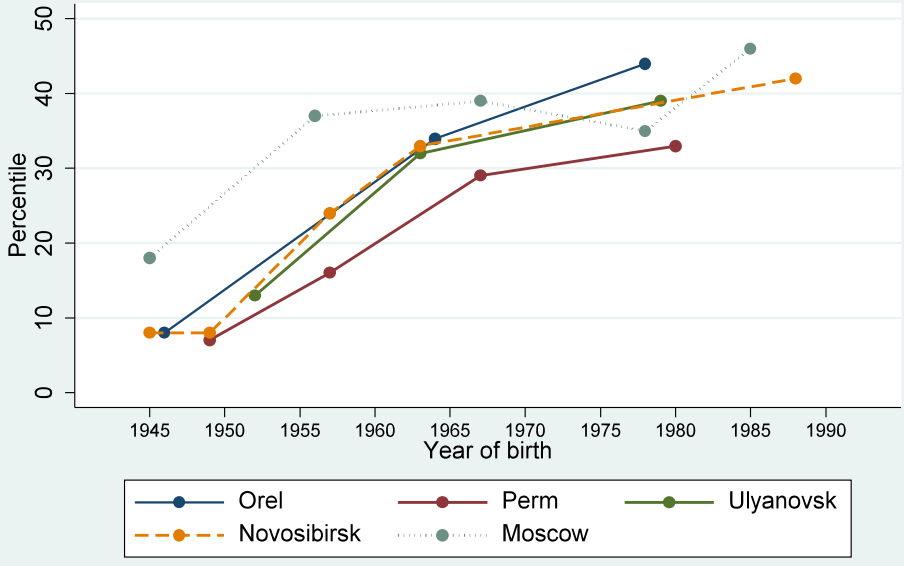
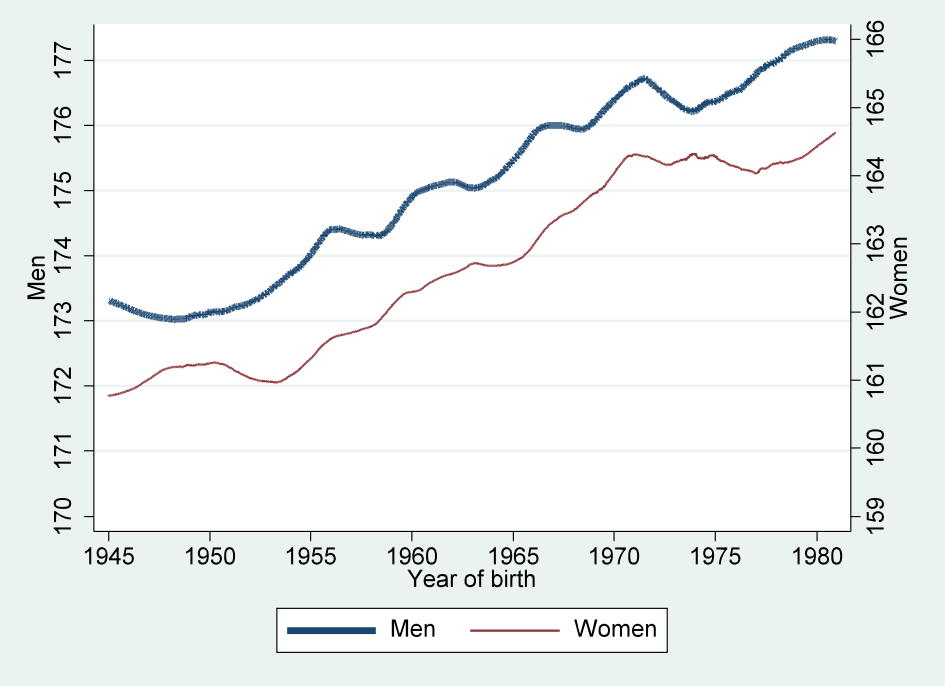
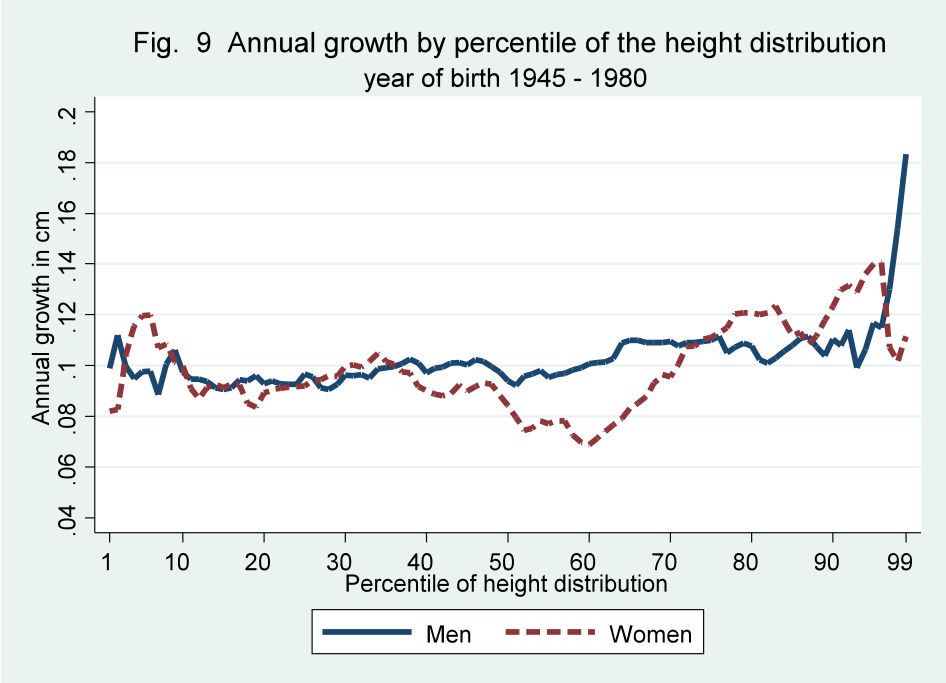


Figure 8. Male and female adult heights by exact date of birth, Russia, ages 21 - 50





Coefficients from regressions of height of men and women aged 21 - 50 on exact date of birth by percentile of the height distribution using Rounds 5 - 13 of the Russian Longitudinal Monitoring Survey, converted into annual rates of growth. Regressions include controls for the year in which the survey was taken.

Figure 10. Female adult heights by year of birth, USSR republics, ages 21 - 49

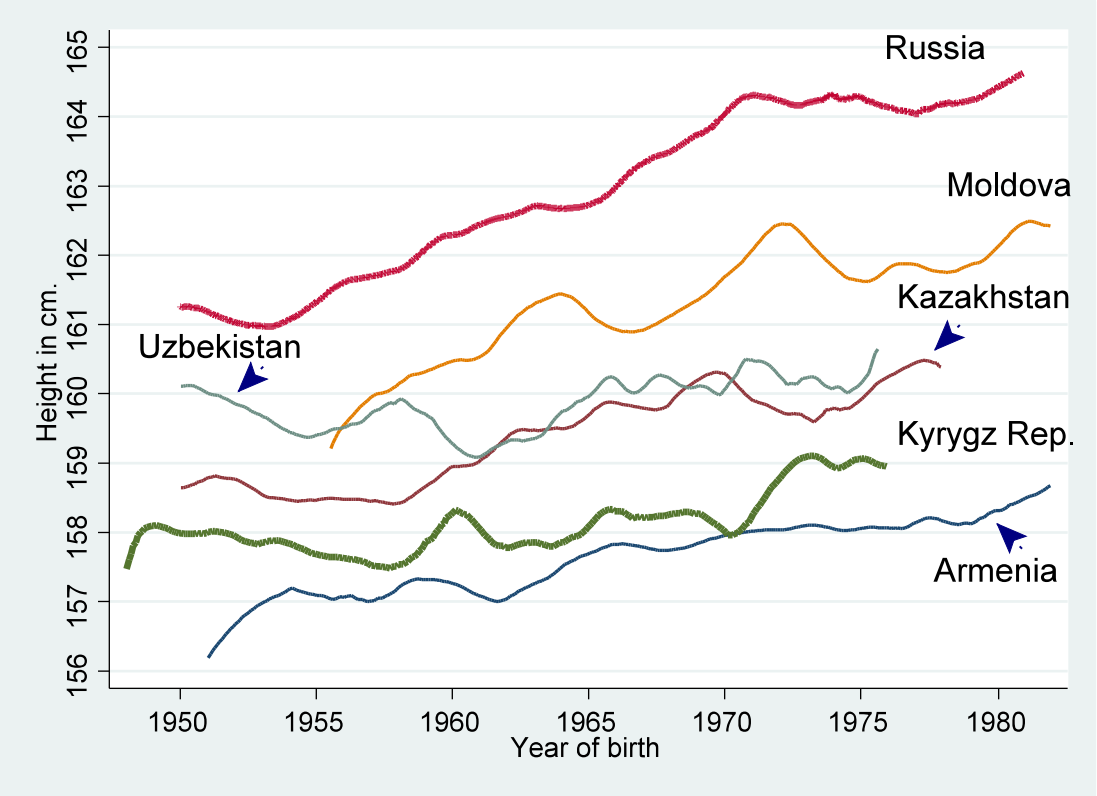


Table 6. Average heights and growth rates by year of birth, Soviet Union and Southern Europe, individuals aged 21 - 50

Country	Men			Women		
	Average height, cm		Annual growth rate, %	Average height, cm		Annual growth rate, %
	1950-1954	1976-1980		1950-1954	1976-1980	
Russia	173.3 (6.51) [N = 632]	177.2 (6.44) [N = 465]	.09	161.0 (6.18) [N = 719]	164.1 (6.57) [N = 525]	.07
Armenia	na	na	na	157.0* (6.06) [N = 608)	158.2 (5.83) [N = 1614]	.03
Kazakhstan	na	na	na	158.7 (6.31) [N = 752]	160.4+ (5.79) [N = 185]	.04
Kyrgyz Rep.	na	na	na	157.9 (5.98) [N = 375]	158.9^ (6.11) [N = 239]	.03
Moldova	na	na	na	159.6# (6.08) [N = 295]	162.0 (6.14) [N = 924]	.07
Uzbekistan	na	na	na	159.7 (6.31) [N = 396]	160.0** (5.79) [N = 264]	.01
Greece	174.7	178.6	.09	163.3	165.9	.06
Italy	172.5	177.1	.10	161.4	166.5	.12
Spain	171.3	176.1	.11	160.4	165.5	.12
Turkey	na	na	na	154.4 (5.94) [N = 125]	156.5++ (5.36) [N = 215]	.06

* 1951 - 1954; + 1975 - 1977; ^ 1975 - 1976; # 1955 - 1956; ** 1974 - 1975; ++ 1976 - 1977.

Sources: Russia: Russian Longitudinal Monitoring Survey; Armenia, Kazakhstan, Kyrgyz Republic, Moldova, Uzbekistan, and Turkey: Demographic and Health Surveys; Greece, Italy, and Spain: Garcia and Quintana-Domeque 2007. The annual growth rate is calculated (as in Garcia and Quintana-Domeque 2007) as $(((h_2 - h_1)/h_1)/n) \times 100$, where h_2 is the average height in the later period, h_1 is the average height in the earlier period, and n is the number of years between the midpoints of the cohort intervals.

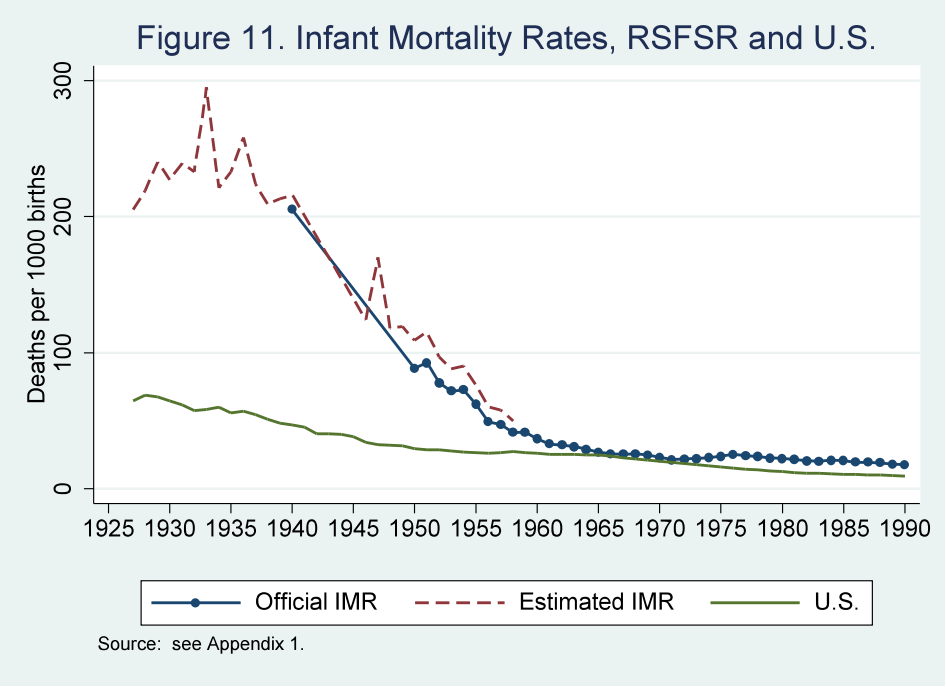


Figure 11. Infant Mortality Rates, RSFSR and U.S.
Deaths per 1000 births
0
100
200
300
1925 1930 1935 1940 1945 1950 1955 1960 1965 1970 1975 1980 1985 1990
Official IMR
Estimated IMR
U.S.
Source: see Appendix 1.

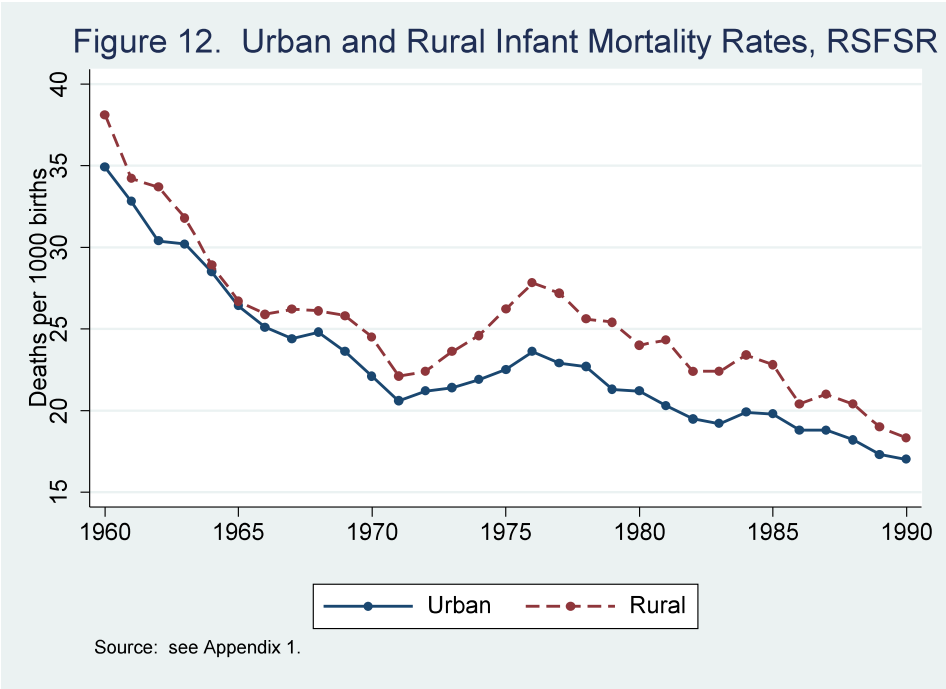


Figure 12. Urban and Rural Infant Mortality Rates, RSFSR
Deaths per 1000 births
15
20
25
30
35
40
1960
1965
1970
1975
1980
1985
1990
Urban
Rural
Source: see Appendix 1.

Table 7. Means of variables for fixed effects and RLMS regressions
(standard deviations in parentheses)

	Fixed effects regressions, 1960 - 1990	RLMS regressions on individual heights
Dependent variables:		
Infant mortality rate	25.32 (8.40)	–
Height in cm: Men, all	–	175.21 (6.78)
Men, non-movers	–	175.48 (6.96)
Women, all	–	162.73 (6.16)
Women, non-movers	–	163.36 (6.10)
Independent variables:		
Crude birth rate	17.82 (5.12)	–
Doctors per 10,000 pop.	30.89 (13.6)	31.04 (21.02)
% Urban pop.	59.00 (18.1)	62.87 (23.41)
Log(average monthly wage)	5.03 (0.50)	4.71 (0.30)
Infant mortality rate	–	38.45 (30.29)
Share of population with:		
Higher education	5.45 (3.45)	4.80 (.303)
Incomplete higher	1.20 (0.53)	–
Specialized secondary education	11.10 (5.43)	–
Secondary ed.	15.56 (8.34)	–
Incomplete secondary	23.63 (3.04)	–
Incomplete higher - Inc secondary	–	54.02 (28.69)

Table 8. Fixed effects regressions on log infant mortality rates, RSFSR regions 1960 - 1990 (5-year intervals)

Independent variables	(1)	(2)	(3)	(4)	(5)	(6)
Crude birth rate	**.027**	**.023**	**.025**	**.024**	**.025**	**.026**
	(.004)	(.004)	(.004)	(.004)	(.006)	(.004)
Doctors per capita	–	–	**-.007**	–	–	**-.005**
			(.003)			(.003)
% urban population	–	–	–	**-.004**	–	-.003
				(.002)		(.002)
Log(average monthly wage)	–	–	–	–	-.082	–
					(.195)	
Share of pop with:	–	.008	.021	-.005	.0004	.008
Higher education		(.013)	(.016)	(.013)	(.016)	(.015)
Incomplete higher ed.	–	.043	.047	.082	.109	.073
		(.076)	(.072)	(.078)	(.091)	(.074)
Specialized secondary ed.	–	.003	.007	.014	.008	.016
		(.011)	(.011)	(.010)	(.014)	(.010)
Secondary ed.	–	**-.016**	**-.016**	**-.017**	**-.020**	**-.017**
		(.006)	(.006)	(.006)	(.007)	(.006)
Incomplete secondary ed.	–	.003	.009	.001	-.001	.007
		(.007)	(.007)	(.007)	(.010)	(.007)
1965	**-.069**	-.077	-.063	-.058	-.053	-.050
	(.039)	(.047)	(.045)	(.047)	(.070)	(.045)
1970	**-.163**	**-.162**	**-.145**	**-.128**	-.111	**-.122**
	(.044)	(.074)	(.069)	(.074)	(.113)	(.070)
1975	**-.188**	-.129	-.107	-.079	-.044	-.076
	(.037)	(.108)	(.099)	(.111)	(.169)	(.103)
1980	**-.283**	-.173	-.142	-.124	-.068	-.114
	(.037)	(.140)	(.132)	(.144)	(.223)	(.135)
1985	**-.361**	-.203	-.187	-.158	-.088	-.169
	(.033)	(.171)	(.163)	(.177)	(.277)	(.167)
1990	**-.470**	-.269	-.257	-.235	-.114	-.249
	(.046)	(.212)	(.206)	(.216)	(.365)	(.206)
N	583	583	570	580	561	567
R2	.78	.78	.80	.78	.79	.81

Note: Robust standard errors clustered by region in parentheses. Bold: statistically significant at the 10% level or less. Omitted variables are year=1960 and share of pop. with primary or less education.

Table 9. Correlates of Adult Stature: RLMS Results, Individuals Born 1945 - 1980 (Age 21 - 50) who never moved from region of birth
Dependent variable: height in cm

	(1)	(2)	(3)	(4)	(5)	(6)
A. Men						
Doctors per capita in year and region of birth	–	.067 (.043)	–	–	–	.041 (.040)
% urban in year and region of birth	–	–	.006 (.020)	–	–	–
Log (avg monthly wage) in year and region of birth	–	–	–	1.58 (3.61)	–	–
Infant mortality rate in year and region of birth	–	–	–	–	**-.061** (.014)	**-.058** (.014)
Pop. w/higher ed. in year and region of birth	.202 (.142)	-.027 (.183)	.169 (.139)	.135 (.155)	**.256** (.129)	.115 (.163)
Pop. w/inc. sec., sec. or spec. sec. ed. in year, region of birth	**.027** (.011)	**.023** (.010)	**.022** (.013)	-.006 (.056)	**.023** (.010)	**.021** (.010)
N	2,117	2,114	2,046	1,688	2,107	2,104
R^2	.07	.07	.07	.05	.07	.08
B. Women						
Doctors per capita in year and region of birth	–	**.075** (.041)	–	–	–	**.071** (.042)
% urban in year and region of birth	–	–	.009 (.017)	–	–	–
Log (avg monthly wage) in year and region of birth	–	–	–	-.236 (1.92)	–	–
Infant mortality rate in year and region of birth	–	–	–	–	-.011 (.015)	-.008 (.016)
Pop. w/higher ed. in year and region of birth	**.227** (.112)	.008 (.155)	**.217** (.121)	**.318** (.144)	**.229** (.111)	.003 (.155)
Pop. w/inc. sec., sec. or spec. sec. ed. in year, region of birth	**.014** (.008)	.011 (.008)	.011 (.009)	**.063** (.032)	**.014** (.008)	.011 (.008)
N	2,128	2,124	2,064	1,701	2,116	2,112
R^2	.10	.10	.09	.08	.10	.10

Regressions include a full set of dummy variables for year of birth, the survey year, whether abortion was legal on the date of birth (defined as =1 if born after April 1, 1956), and large-region dummies. Omitted education variable is the share of the population with primary or less education. Robust standard errors corrected for clustering at the PSU level in parentheses. Bold: statistically significant at $\leq$ 10% level.

Fig. 13a Calories and child stature in RSFSR cities, 13-year-old boys

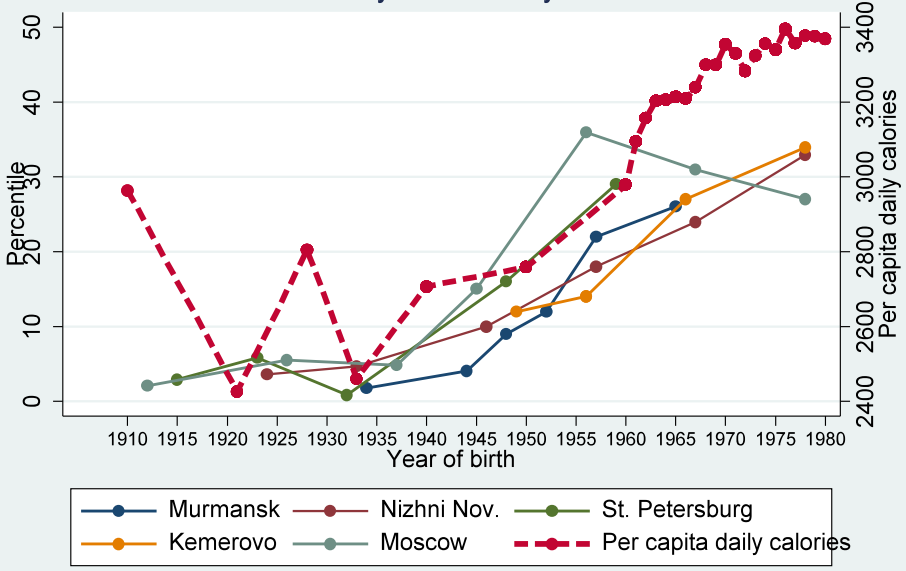


Fig. 13b Calories from animal sources and child stature, 13-year-old boys

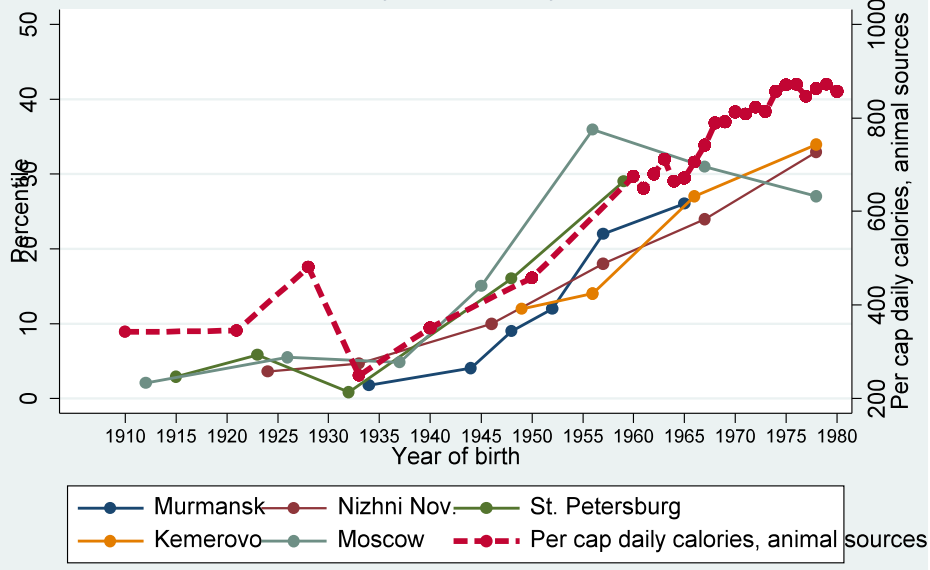
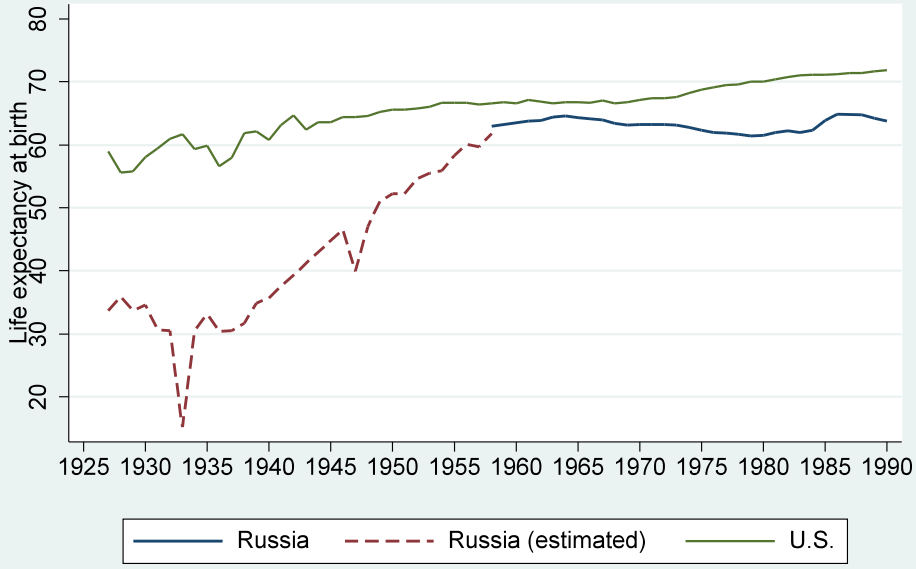
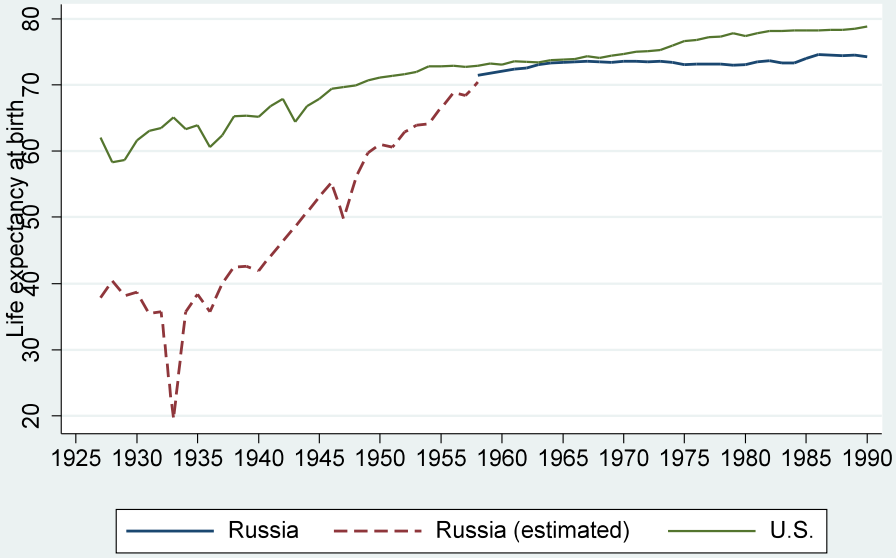


Figure 14a. Life Expectancy at Birth, Men, RSFSR and U.S.



Source: see Appendix 1.

Figure 14b. Life Expectancy at Birth, Women, RSFSR and U.S.



Source: see Appendix 1.

Appendix Table 1. Average heights and percentiles of growth by U.S. standards, USSR schoolchildren by age and year of birth

Moscow							
Boys age 8				**Girls age 8**			
Year of birth	N	Height, cm	Percentile	Year of birth	N	Height, cm	Percentile
1942	438	123.2	13	1942	440	122.5	15
1950	479	125.8	25	1950	478	125.1	26
1953	302	126.5	29	1953	288	125.7	29
1961	203	129.7	51	1961	198	129.0	48
1966	164	128.2	40	1966	157	127.3	38
1983	169	127.9	38	1983	165	128.0	42
Boys age 10				**Girls age 10**			
1915	na	128.1	4	1915	na	128.2	4
1929	na	132.2	11	1929	na	131.6	9
1940	889	131.3	9	1940	831	131.1	8
1948	595	135.1	21	1948	571	134.7	18
1951	321	136.2	27	1951	287	136.5	25
1959	179	140.3	50	1959	183	140.3	43
1964	185	139.9	47	1964	190	138.4	34
1981	121	137.0	31	1981	110	137.0	27
Boys age 12				**Girls age 12**			
1913	na	137.5	4	1913	na	137.0	0.6
1927	na	140.0	5	1927	na	141.3	4
1938	1074	140.8	7	1938	819	141.4	4
1946	695	144.8	15	1946	801	146.6	13
1957	109	150.1	36	1957	140	152.8	40
1964	230	149.0	31	1964	216	151.4	33
1979	151	147.5	25	1979	108	150.0	26
Boys age 14				**Girls age 14**			
1911	na	145.4	1	1911	na	147.8	3
1925	na	151.4	5	1925	na	152.0	9
1944	352	157.7	16	1944	388	156.6	25
1955	160	162.6	34	1955	153	160.9	48
1962	242	162.3	33	1962	229	159.2	38
1977	121	162.3	33	1977	123	160.0	43

Appendix Table 1. Average heights and percentiles of growth by U.S. standards, USSR schoolchildren by age and year of birth, continued

Kiev (Ukraine)							
Boys age 15				**Girls age 15**			
Year of birth	N	Height, cm	Percentile	Year of birth	N	Height, cm	Percentile
1912	na	152.3	0.7	1912	na	152.0	7
1940	na	160.3	8	1940	na	159.8	37
1945	na	164.3	18	1945	na	157.8	26
1952	na	168.9	37	1952	na	159.7	36
1957	na	168.4	35	1957	na	161.4	46
1962	na	167.3	30	1962	na	160.5	41
Minsk (Belarus)							
Boys age 13				**Girls age 13**			
1921	na	146.1	6	1921	na	147.9	5
1942	97	147.2	8	1942	141	150.1	10
1957	113	155.1	29	1957	140	157.3	40
Riga (Latvia)							
Boys age 12				**Girls age 12**			
1948	103	148.8	30	1948	100	148.5	19
1957	92	150.1	36	1957	139	150.1	26
1973	na	154.2	56	1973	na	154.1	47
Baku (Azerbaijan)							
Boys age 15				**Girls age 15**			
1944	104	163.9	16	1944	108	158.5	29
1959	103	170.6	46	1959	104	160.9	43

Appendix Table 2. Height percentiles during the 1932 - 1933 famine

City and survey year	Year of birth	Age	BOYS Height	BOYS Percentile	GIRLS Height	GIRLS Percentile
Murmansk (Northwestern region), 1947	1930	17	163.4	2.2	153.2	4.8
	1931	16	155.5	0.2	149.2	2.2
	1932	15	150.2	0.4	145.5	0.7
	1933	14	144.9	0.7	142.7	0.4
	1934	13	140.7	1.7	136.7	0.1
	1935	12	136.1	2.2	133.8	0.2
	1936	11	131.8	2.4	130.3	0.7
St. Petersburg, 1936	1930	6	111.9	9	112.5	18
	1931	5	105.1	6	111.9	6
	1932	4	97.8	4	96.3	4
Moscow, 1938	1931	7	118.4	13	116.8	14
	1932	6	111.9	9	112.1	16
	1933	5	105.7	7	105.2	10
	1934	4	98.3	5	96.9	4
	1935	3	91.1	5	91.3	7
Moscow oblast (rural), 1938	1931	7	114.9	4.3	114.5	7
	1932	6	109.4	3.8	108.9	5.7
	1933	5	102.9	2.3	101.8	2.8
	1934	4	95.8	1.6	95.5	2.2
	1935	3	90.1	3.4	89.8	3.9
Nizhni Novgorod (Volga region), 1946	1931	15	156.5	3.3	156.0	18
	1932	14	150.6	4.0	152.8	11
	1933	13	144.9	4.6	146.1	3.6
	1934	12	140.6	7	141.3	3.6
	1935	11	135.2	6	134.8	3.9
	1936	10	130.4	7	129.2	4.8
Rostov-on-Don (North Caucuses region), 1938	1931	7	116.8	8	118.3	19
	1932	6	111.8	8	111.6	14
	1933	5	105.4	7	104.7	8
	1934	4	99.2	7	98.3	7
Kharkov, Ukraine, 1950	1932	18	163.9	3	na	
	1933	17	160.5	0.6	na	
	1934	16	158.0	0.6	na	
	1935	15	152.0	0.6	na	
Tblisi, Georgia, 1936	1930	6	109.9	4	110.2	9
	1931	5	106.9	11	104.5	8
	1932	4	100.2	9	98.5	8
	1933	3	93.0	10	na	

Appendix Table 3. Height percentiles during World War II

City and survey year	Year of birth	Age	BOYS Height	BOYS Percentile	BOYS N	GIRLS Height	GIRLS Percentile	GIRLS N
St. Petersburg 1959	1941	18	167.8	9	270	157.3	14	128
	1942	17	166.9	7	337	157.1	15	215
	1943	16	166.1	9	241	157.7	22	139
	1944	15	162.0	11	352	156.5	20	98
	1945	14	159.4	21	109	na	na	na
Moscow 1950	1939	11	135.8	8	1,075	135.8	5	896
	1940	10	131.3	9	889	131.1	8	831
	1941	9	127.6	12	830	127.0	12	746
	1942	8	123.2	13	438	122.5	15	440
	1943	7	120.3	22	193	118.8	22	156
Moscow 1958	1941	17	170.2	16	171	158.4	20	262
	1942	16	167.9	14	130	158.4	25	242
	1943	15	163.8	16	215	158.6	30	237
	1944	14	157.7	16	352	156.6	25	388
	1945	13	151.0	15	468	152.8	18	464
	1946	12	144.8	15	695	146.6	13	801
City of Tula (Central region), 1957	1941	16	162.7	4	127	155.5	14	196
	1942	15	157.7	4	124	154.4	13	156
	1943	14	151.4	5	86	152.1	9	86
	1944	13	146.6	7	124	147.6	5	122
	1945	12	141.6	8	120	143.3	6	128
	1946	11	135.7	7	132	137.6	8	172
City of Penza (Volga region), 1956	1939	17	165.9	5	541	158.2	20	246
	1940	16	162.2	4	998	157.8	23	452
	1941	15	156.4	3	1,305	156.3	20	559
	1942	14	149.4	3	1,146	152.7	10	467
	1943	13	144.1	4	669	147.6	5	322
Rostov-on-Don, 1958	1940	18	171.5	21	75	160.7	30	61
	1941	17	169.4	13	140	158.9	23	228
	1942	16	167.4	13	124	158.9	28	164
	1943	15	162.4	12	110	158.2	28	169
	1944	14	156.0	12	135	156.8	26	112
	1945	13	149.3	11	186	152.3	16	192
	1946	12	144.7	15	298	145.8	11	317

Appendix Table 3, continued

Rostov oblast, rural areas, 1958	1941	17	167.8	9	100	158.3	20	125
	1942	16	163.4	5	104	158.0	24	102
	1943	15	157.6	4	111	156.7	21	103
	1944	14	153.8	8	101	154.3	15	103
	1945	13	147.2	8	115	150.3	10	107
	1946	12	142.2	9	169	143.9	7	174
City of Kopeisk (Urals), 1958	1941	17	166.2	5	123	157.6	17	225
	1942	16	163.0	4	121	157.0	19	231
	1943	15	156.9	4	189	156.1	19	249
	1944	14	153.2	7	173	153.6	13	198
	1945	13	146.3	6	233	148.1	6	266
	1946	12	141.4	8	331	142.9	5	366
City of Blagovesh-chensk (Far East), 1958	1941	17	168.3	10	97	159.5	26	125
	1942	16	164.5	6	116	158.9	28	157
	1943	15	160.1	7	119	157.0	23	129
	1944	14	154.6	9	145	155.6	20	153
	1945	13	147.7	8	164	149.8	9	157
	1946	12	143.8	13	106	143.8	6	184
Kharkov, Ukraine, 1959	1942	17	169.7	14	208	160.5	32	280
	1943	16	165.6	8	230	159.3	30	265
	1944	15	161.3	10	155	158.0	27	194
	1945	14	154.9	10	163	157.2	28	162
	1946	13	147.3	8	155	150.7	11	181
Odessa, Ukraine, 1956	1940	16	167.0	12	208	158.8	28	189
	1941	15	162.8	13	158	157.5	25	210
	1942	14	157.5	16	136	156.4	24	132
	1943	13	150.0	13	201	150.6	11	206
	1944	12	145.6	18	206	147.5	16	207
	1945	11	139.9	19	196	139.2	11	188
	1946	10	135.1	21	202	135.1	19	238
Vilnius, Lithuania, 1958	1941	17	172.2	24	100	161.7	39	131
	1942	16	169.1	19	101	161.5	43	132
	1943	15	163.7	16	110	160.7	42	121
	1944	14	157.1	15	118	157.9	31	105
	1945	13	151.3	16	108	153.5	21	117
	1946	12	144.8	16	104	147.1	14	115

Appendix Table 4. Average heights by year of birth from the Russian Longitudinal Monitoring Survey, ages 21 - 50

Year of birth	Men: N	Men: Height	Women: N	Women: Height
1945	53	172.7	52	160.2
1946	66	173.1	89	161.4
1947	92	173.2	106	160.5
1948	79	172.7	111	161.8
1949	99	173.3	105	161.4
1950	106	172.8	120	161.3
1951	107	173.3	123	160.8
1952	130	173.5	138	161.0
1953	134	173.1	170	161.0
1954	155	173.8	168	160.9
1955	167	174.2	171	161.6
1956	165	175.1	168	161.7
1957	145	174.1	181	161.3
1958	181	174.2	193	162.2
1959	153	174.7	184	162.2
1960	193	175.1	195	162.5
1961	192	174.8	159	162.1
1962	194	175.0	169	163.0
1963	163	175.3	173	162.7
1964	170	175.0	140	162.8
1965	162	176.1	168	162.6
1966	159	176.1	156	162.8
1967	156	175.8	158	164.2
1968	170	175.9	175	163.1
1969	147	175.6	162	163.9
1970	188	177.1	183	164.5
1971	200	176.8	169	164.2
1972	201	176.4	231	164.1
1973	194	176.4	219	164.3
1974	136	176.1	147	164.6
1975	125	175.9	111	164.6
1976	116	177.3	96	163.6
1977	101	176.4	111	163.8
1978	100	177.4	110	164.2
1979	78	177.7	118	164.1
1980	70	177.4	90	164.9