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Uncounted Costs of World War II: The Effect of Changing Sex Ratios on Marriage and Fertility of Russian Women

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Abstract: The Soviet Union suffered devastating population losses during World War II, currently estimated at 27 million or nearly 14 percent of the prewar population. The disproportionate deaths of young men resulted in a drastic change in sex ratios among the population surviving the war. For example, the ratio of men to women in the 20-29 age group declined from .91 to .65 between 1941 and 1946. I use this large, exogenous change to identify the effects of unbalanced sex ratios on marital, fertility and health outcomes among women in the Russian and Baltic republics in the postwar period. The results indicate that women in cohorts or regions with lower sex ratios experienced lower rates of marriage and fertility, and higher rates of out-of-wedlock births and abortions than women in cohorts or regions less affected by war deaths. Men in cohorts with high sex ratios invested in more human capital than men in low sex ratio cohorts. The evidence is also suggestive of second-generation effects, with the male children of women in high-sex ratio cohorts attaining better health and nutritional status (as measured by adult height) than the children of women in low-sex ratio cohorts.

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I. Introduction

In many ways the Soviet Union was built on the backs of Russian women. Pulled into the labor force by the intense industrialization drive of the 1930s and indispensable for fueling the Soviet war machine of the 1940s, the experience of Soviet and Russian women of the twentieth century was profoundly different from that of women in other industrialized countries. These differences are evident in the high female labor force participation rates, low fertility rates, and strikingly high abortion rates recorded in the Soviet Union over its history. Yet beyond these aggregate trends, much remains unknown regarding the changing lives of Soviet women over the past century. For example, why was the 'fertility transition' accomplished so early and so rapidly in the Soviet Union? How did abortion become the primary means of contraception in the country and how did this affect the subsequent fertility and well-being of women? Why was the proportion of out-of-wedlock births so high in the postwar period?

This paper examines the effect of one cataclysmic event, the massive loss of life in World War II, on the subsequent marital and fertility careers of Soviet women. For women in the age cohorts most affected by the war, these losses resulted in extremely unbalanced sex ratios (the number of men divided by the number of women) in the population: for women in the 20-29 age group, for example, the ratio of men to women in the population fell from .91 in 1941 to .65 in 1946. Using previously unpublished census data and vital statistics registration data collected from the Soviet archives, combined with recent household survey data and micro-level 1989 Census data, this paper uses this large, exogenous change in the sex ratio to identify the effects of highly unbalanced sex ratios on the marital, fertility and health outcomes of the Soviet population in the postwar period. The results indicate that women in age cohorts or regions with lower sex ratios experienced lower rates of marriage and fertility, and higher rates of out-of-wedlock births,

than women in cohorts or regions less affected by war deaths. The evidence also suggests that unbalanced sex ratios increased the number of abortions reported by individual women and may have negatively affected the health and well-being of children of women in cohorts with highly unbalanced sex ratios.

Beyond illuminating the effects of unbalanced sex ratios on women's lives in the Soviet Union, the results in this paper are also relevant for understanding the effects of unbalanced sex ratios in other populations. For example, any country experiencing large-scale emigration or involved in war will likely encounter unbalanced sex ratios among younger cohorts, given that both emigrants and soldiers are disproportionately young and male. Unbalanced sex ratios also characterize some populations within the United States, such as the high and increasing number of women relative to men obtaining a college education and the low ratio of available men to women in the African-American population resulting from the high incarceration and mortality rates of young African-American men.[1] Most previous research on unbalanced sex ratios (discussed below) examines the impact of high sex ratios, i.e. a larger number of men than women, in the population. One contribution of this paper to the literature is that it provides evidence on the effects of low sex ratios in the population. The results of the paper also suggest that the long-term effects of war on society are underestimated, given that few if any such estimates take into account the negative impact of war on future family formation and bargaining power within the household.

The paper proceeds as follows. The next section discusses what is currently known about the impact of World War II on the Soviet population, including the effect on sex ratios, the

[1]See Goldin, Katz and Kuziemko (2006) for an analysis of the gender gap in U.S. higher education. Wilson (1987) discusses the causes and consequences of unbalanced sex ratios in the U.S. African-American population.

regional distribution of war losses, and the immediate demographic consequences of the war. This section also describes the Soviet Union's changing policies on abortion, divorce, and family allowances that may have affected marriage and fertility decisions in the prewar and postwar periods. Section III reviews the economic theory on the effects of changing sex ratios and the recent literature examining the effects of changing sex ratios in other populations. Section IV describes the identification strategy and data used in the paper and presents the results of the cross-regional regressions. Section V presents the results of regressions using the 1989 Census and recent household surveys, and Section VI concludes.

II. The impact of World War II on the Soviet population

a. Overall losses and the effect of the war on sex ratios

On June 22, 1941, Hitler's *Wehrmacht* invaded the Soviet Union to initiate what would become the most brutal and costly war between two countries in history. The surprise attack on the woefully unprepared Red Army led to devastating losses for the Soviet Union in the early phase of the war: within the first six months, the Red Army had lost nearly 5 million men – the size of the Soviet Union's entire prewar army – and had lost territory equal to the size of the United States between the East Coast and Springfield, Illinois (Glantz 2005).

The Soviet Union mobilized all possible resources in its subsequent fight for survival and ultimate victory. The need for manpower dictated a significant loosening of the age and nationality restrictions on conscription of Soviet citizens; it is reported that men "well under" the age of 18 and exceeding 55 years of age were conscripted into the Red Army, with Russians and non-Russians alike required to serve (Glantz 2005). Over one million women served in the war as well, many in the medical services, but the figure also includes over 500,000 women soldiers

(Glantz 2005). Including individuals serving at the beginning of the war, a total of 34.5 million people were drafted into the armed forces during the war, of which nearly 8.7 million died in combat (Krivosheev et. al. 1997).

The total losses sustained by the Soviet Union during World War II remain a topic of controversy among scholars, and an exact accounting of the deaths may never be known. The most reliable and widely-cited figures were reported in the findings of an expert commission established by Mikhail Gorbachev in 1989. These authors estimate the total population loss at 26 to 27 million, out of a population of 196.7 million on the eve of World War II in 1941, or roughly 13.5 percent of the prewar population (Andreev et. al. 1990).[2] The losses in the Russian republic, by far the largest republic in the Soviet Union in terms of population and the primary region of interest in this paper, were similar in magnitude: approximately 13.6 million died, or 12.3 percent of the 1941 population. The change in population in Russia is illustrated in Figure 1. To put these losses in context, the total civilian and military casualties in Germany during World War II were between 5 and 7 million (6 - 9 percent of the 1939 population), followed by France (600,000) and England (400,000 - 500,000), both less than 2 percent of the prewar population for those countries.[3]

Although people of all ages fell victim to the war, whether due to death in military operations, at the hands of occupiers, or due to the widespread undernutrition and disease that

[2]These losses relate to the 'excess deaths' that occurred between 1941 and 1945, i.e. total deaths during the war minus the deaths that would have been predicted to occur in the absence of war. It is likely that the 26-27 million figure also includes the estimated net wartime emigration of 2.7 million people who left the Soviet Union during the war (Harrison 2003). For the debate on how Soviet war deaths should be counted and related issues, see Ellman and Maksudov (1994), Harrison (2003) and Haynes (2003a, 2003b).

[3]German population figures for 1939 are from Statistik des Deutschen Reichs, Band 552, 2 (German Census, 1939).

accompanied the war, the wartime casualties were nevertheless heavily concentrated among young men; it is estimated that 20 million of the 26 to 27 million excess deaths were male (Ellman and Maksudov 1994). Russian demographers calculate that the probability of surviving between 1941 and 1946 for men aged 25 to 34 fell from .96 – the probability in the absence of the war based on 1940 mortality rates – to .61 (Andreev et. al. 1993). By 1946 women aged 20-39 outnumbered men in the Soviet Union by approximately 10.2 million (Andreev et. al. 1993). This resulted in large changes in the sex ratio among some groups of the population. This is illustrated in Figure 2, which shows the ratio of men to women by 5-year age group in 1941 and 1946 by year of birth in Russia.[4] The cohorts most affected by the war were those entering their late teenage years or early twenties at the beginning of the war, i.e. individuals born in 1917 to 1926, and extended to include those in their thirties, born in the first decades of the twentieth century. An alternative view of the change in sex ratios is given in Figure 3, which illustrates the sex ratio in the 20-24 and 20-29 age groups faced by an individual at age 20 by year of birth. While women in the prewar Soviet Union already contended with sex ratios below 1.0 – likely due to the revolutions of 1905 and 1917, World War I (1914-1917), civil war (1918-1922) and the political purges of the 1930s, all of which disproportionately affected men – the sex ratio fell dramatically for individuals born around 1925, from .91 to .65 for the 20-29 age group. The sex ratio at this age returned to approximately 1.0 for those born in 1940 and after.[5]

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[4]The data and figures in this and following sections are for the Russian republic (the RSFSR) rather than the Soviet Union as a whole, since the empirical analysis uses Russian census data and primarily focuses on the Russian republic. The sex ratios in Figures 2 and 3 are calculated using the yearly estimates of the distribution of the population by sex and five-year age group from Andreev et. al. (1998). The regional sex ratios in Figure 4 are from data collected from the 1959 Census contained in the GARF archive in Moscow (see Appendix 1 for details).

[5]The sex ratio at birth is approximately 1.05. This ratio typically declines over time within cohorts due to higher male mortality.

b. Regional distribution of losses and population redistribution

The war profoundly changed the regional distribution of the population along with the age and sex structure of the population. The western regions of the Soviet Union experienced the bulk of the fighting and occupation by German forces – an estimated 45 percent of the Soviet population lived under German occupation at some point during the war (Goskomstat SSSR 1990) – and also experienced the greatest war losses.[6] The losses in the western regions combined with the evacuation of tens of millions of people eastward contributed to an overall population shift eastward during the war: the share of the population in the western Soviet Union declined by 3.6 percentage points between 1939 and 1951, while the share in the eastern Soviet Union rose by 3.6 percentage points (Rowland 1997). In addition over 1,500 factories were relocated from the western regions to east of the Volga River during the war. Most of the evacuated people and factories were relocated to the Urals, Western Siberia and Kazakhstan (Barber and Harrison 1991).

Limited data are available to assess in detail the regional redistribution of the population due to the war. Prewar regional population data are available from the 1939 Census, but the earliest postwar regional population estimates are for 1951 (published in Goskomstat SSSR 1988). The first detailed regional population data, i.e. the age and sex structure of the population by region, only become available with the first postwar census taken in 1959. Based on the 1939 Census and 1951 population estimates, the greatest population losses occurred in Kaliningrad oblast, in which the population fell from over 1 million in 1939 to 455,000 in 1951; the city of Leningrad, in which approximately 700,000 civilians died during the 900-day siege of the city;

[6]The line of furthest German advance extended from the northwest Caucuses and North Caspian region in the south, to Rostov and Stalingrad (now Volgograd) in the Central and Volga regions, to a few miles west of Moscow, and extended to Leningrad (now St. Petersburg) and a few miles east of the Finnish border in the northwest. A map showing this line is shown in Appendix Figure 1.

mostly due to starvation (Cherepenina 2005); and Smolensk oblast which was located on the main invasion route between Poland and Moscow.[7] Appendix Table 1 shows the change in population in each region between 1939 and 1951. Regions experiencing population growth in this period were primarily those in the east, particularly the Urals, Western Siberia and the Far East, due to the evacuation of people and industries to those regions. Positive population growth also occurred in the northwestern region of Komi, likely due to the increase in coal production in that region, also the site of a forced labor camp at the Pechora Coal Basin (Rowland 1997).

Despite the elapsed time between the end of the war and the first postwar census, the census data nevertheless document the profound impact of the war on the age and sex structure of the population at the regional level. This is illustrated in Figure 4, which shows the variation in sex ratios by region for 1959 for individuals aged 25-29 and 35-39 in that year. Sex ratios for the 35-39 year-old cohort are significantly below one in most regions and are much lower than those for the age 25-29 cohort that was largely unaffected by war deaths. Sex ratios for both groups are highest in the North, East Siberia and Far East, which attract disproportionately male workers to work in the natural resource sectors of the economy located in those regions. Appendix Table 1 provides sex ratios for these age groups by region.

c. Immediate demographic consequences of the war

Besides the massive loss of civilian and military lives during the war, an additional demographic cost was the decline in births during the war years. Given the large-scale mobilization and lack of home leave during the war for all soldiers, it is not surprising that the

[7]Besides war losses, the population decline in Kaliningrad also reflects the emigration of 500,000 Germans from the region, formerly East Prussia, during the war (Rowland 1997).

birth rate fell sharply between 1940 and 1945, from 34.6 per 1,000 population in 1940 to 26.0 in 1946 (see Figure 5). Analysts estimate that approximately 11.5 million babies were not born in the Soviet Union during the war who would have been otherwise (Ellman and Maksudov 1994). Demobilization after the war took three years, which further delayed the return to any type of normal family-formation patterns until well into the late 1940s and early 1950s. This is evident in the sharp increase in age at first marriage for Russian women in the cohorts most affected by the war: women born in 1915, for example, married at an average age of 23.2, while women born in 1921 were slightly older than 25 at first marriage (Figure 6). An additional likely consequence of the 'male deficit' was an increase in the spousal age gap, but no data are available on this issue until 1959, at which point the average age gap between men and women at first marriage was approximately two years; this gap persisted with little change well into the 1990s (Avdeev and Monnier 2000).

The data in Figure 6 also indicate that women in the cohort most affected by the war – those born in the mid-1920s – did not have markedly lower rates of completed fertility than women in neighboring cohorts. Some Russian demographers argue, in fact, that the war ultimately had little impact on the marital and fertility careers of Russian women: most women eventually married and had two children on average (Scherbov and Van Vianen 2001). The analysis presented below suggests in contrast that the unbalanced sex ratios from the war likely did significantly affect these aspects of fertility and family formation, as well as out-of-wedlock births, female headship and abortion rates.

d. Family policies, divorce and abortion in the Soviet Union

Alarmed at the devastating population losses suffered by the country and the continually

declining birth rate, the Soviet government implemented a strongly pro-natalist family policy in 1944. This legislation imposed a tax on single people and married couples with fewer than three children, excluding those who lost children during the war or those attending school full-time. 'Motherhood medals' and special privileges were bestowed upon women with five or more children. A modest program of child benefits for married women with large families implemented in 1936 was expanded to include married women with smaller families as well as unmarried mothers with one or more children. Far from discouraging out-of-wedlock births, in fact, the 1944 law absolved fathers of any financial or legal responsibility for children fathered outside of marriage; unmarried mothers were prohibited from naming the father or claiming financial support for their children. Instead, the state provided unmarried mothers with a monthly payment for each child until the child reached twelve years of age.[8] The 1944 Family Code also made the procedure for divorce so much more expensive and complicated that it has been described as effectively a "prohibition on divorce" (Avdeev and Monnier 2000).

Soviet policies on divorce and family had been radically different during much of the prewar period. When the Bolsheviks came to power in 1917 they intended to break down the traditional 'bourgeois' structure of the family to equalize the status of men and women and implemented a number of policies toward this end in subsequent years. The 1918 Family Code secularized marriage and made divorce obtainable upon the request of either spouse (Engel 2004). In 1920 the Soviet Union became the first country in the world to legalize abortion; the

[8]In contrast, married women received a lump sum at birth for the third and subsequent children, and monthly payments from the first through fifth birthdays for the fourth and subsequent children. Child payments for married and unmarried children implemented under the 1944 law were halved in 1948 and remained at the same nominal level until 1974, falling to approximately 8 percent of the annual wage in that year. For details on the payments received by number of children and mother's marital status, see Heer 1977. The tax on single people and married couples with fewer than three children was repealed in 1957 (Avdeev and Monnier 2000).

procedure was legal and free if performed in a hospital, and the practice became widespread in the 1920s (Engel 2004). Some analysts trace the current extensive use of abortion in Russia to this early legalization of abortion, which in the absence of alternative contraception options became widely accepted as the country's primary means of fertility control (Popov 1993).

The political climate began to change dramatically by the mid-1930s, however, and the 1936 Family Law outlawed abortion and made divorce more complicated. In the same year a secret directive ordered that all contraceptive devices be withdrawn from sale (Engel 2004). It was not until 1955 that abortion was again legalized, largely in response to the widespread use of illegal abortion and high mortality rates from abortion (Popov 1993). Because the state failed to increase the availability of contraceptives as a substitute for abortion (Engel 2004) – and in fact in 1974 the Ministry of Public Health effectively prohibited the use of the pill except in cases of medical necessity (Popov 1993) – abortion became one of the primary means of birth control for women in the Soviet Union and abortion rates rose to extremely high levels. For example, in 1975 (the first year in which comparable data are available), the number of abortions per 1,000 women aged 15-49 was 126.3 in the Soviet Union and 21.7 in the United States. Table 1 provides a summary of some of the key dates relating to family legislation and fertility in Soviet history.

III. Effects of sex ratios on social and economic outcomes: theory and recent evidence

A change in sex ratios like that experienced in the Soviet Union will first and foremost affect the marriage market. As emphasized by Gary Becker in his 1981 model of marriage and family formation, the sex ratio is a key determinant of the marriage prospects and distribution of the gains from marriage between men and women. A decrease in the sex ratio will reduce the

demand for wives, leading to a decrease in female marriage rates, an increase in male marriage rates, and a transfer of the surplus generated by marriage from women to men. As further noted by Angrist (2002), even if marital status is ultimately unaffected by a change in sex ratios, a change in the probability of marriage alone may lead to changes in individual behavior. For example, less competition in the marriage market among men may induce men to invest less in characteristics that are attractive to mates, such as education, while a woman facing less favorable marriage prospects may invest more in labor market skills under the presumption that she will be less likely to rely on a spouse for support.

The significant improvement in men's bargaining position in the marriage market and women's weakened bargaining position resulting from the decrease in sex ratios likely affected fertility behavior as well. Since fertility primarily occurs within marriage, if low sex ratios led to reduced female marriage rates then overall fertility rates likely fell as well; this effect could be compounded by reduced female bargaining power within marriage (discussed further below) that might result in higher female labor supply and therefore lower fertility rates. Outside of marriage, women may have felt increased pressure to have sexual relations before marriage, which given the lack of contraceptives in the Soviet Union likely led to an increase in out-of-wedlock births, female-headed households, unwanted pregnancies and abortions. A further prediction is that highly unbalanced sex ratios may lead to a lower quality of marital matches, in turn leading to higher divorce rates.

Beyond changing the relative bargaining position of men and women in the marriage market, changing sex ratios also affect the relative bargaining strengths of spouses within existing marriages. This point is made in Chiappori et. al. (2002), who argue that the sex ratio can be thought of as an external 'distribution factor' that affects spouses' bargaining positions

within marriage. In the highly unbalanced sex ratio environment of the Soviet Union, this implies that married men have better outside opportunities than women and a stronger bargaining position. The male behavioral response may well be to reduce labor supply and increase alcohol consumption; it is also possible that domestic abuse and spousal homicide would increase in this situation. With few outside options, women may rationally decide to remain in such relationships; there is ample anecdotal evidence and some statistical evidence that rates of domestic abuse are unusually high in Russia (Vannoy 1999). Finally, the weakened bargaining position of women within marriage may reduce the welfare of children, given the evidence that women devote a greater share of household resources to the well-being of children than men (Duflo 2000; Qian 2005).

Empirical research on the effect of unbalanced sex ratios on the well-being of men and women has been hampered by the problem that unbalanced sex ratios in many populations are not exogenous to existing social and economic conditions. For example, the unbalanced sex ratio between young African-American men and women is due to high incarceration and mortality rates of men, which in turn are related to high rates of poverty, low levels of educational attainment and other social and economic factors. Angrist (2002) avoids this problem by examining the effect of unbalanced sex ratios in the U.S. immigrant population, which was driven largely by exogenous changes in U.S. immigration policy. His results provide evidence of a positive relationship between sex ratios and the likelihood of marriage for women, and a negative relationship with female labor supply. The results also indicate that high sex ratios benefit children, as theory predicts.

Francis (2005) analyzes the effect of an exogenous change in the sex ratio of Taiwan due to the massive influx of mainland Chinese after the Communist victory in 1949. The evidence in

this paper also supports the idea of a strong positive effect of sex ratios on the well-being of women and children: higher sex ratios in Taiwan are associated with a higher bride price relative to the dowry, lower female labor force participation in the first year of marriage, a higher fraction of children who are female, and higher educational investments in children. Like these two papers, the empirical analysis in this paper examines the effect of a large, exogenous change in sex ratios, in this case due to the extremely high cost of World War II in terms of male lives in the Soviet Union. In contrast to other papers, this paper is one of the few to analyze the effects of very low sex ratios in a population on the outcomes of women and children.

IV. Empirical strategy, data and cross-region results

The empirical strategy uses the variation in sex ratios across regions and cohorts to identify the effects of changing sex ratios on various economic and social outcomes. At the national level the change in sex ratios across cohorts is taken to be exogenous to existing economic and social conditions at the time: as is well known, the German attack on the Soviet Union in June 1941 was a surprise to Soviet leaders as well as to the population as a whole.[9] There was virtually no emigration from the country or immigration into the country in the early postwar period, so national sex ratios would have been unaffected by these trends.

Much of the empirical analysis exploits regional differences in sex ratios, however, and it is possible that cross-regional migration occurred in the early postwar period that was correlated with both sex ratios and existing economic conditions in the regions. For example, the sex ratio for the 25-29 age group in Magadan in the Far East was 1.470 in 1959, reflecting the 'attraction'

[9]The German-Soviet Non-Aggression Pact was signed on August 23, 1939. On the unpreparedness of the Red Army for war in 1941, see Glantz (1998). Memoirs of Soviet citizens during the war also describe the surprise of the attack; see, for example, Leder (2001).

of the region (in the far northeastern corner of the RSFSR) to younger men due to the Kolyma gold fields; Magadan is also one of the notorious sites of forced labor camps (Rowland 1997). However, the sex ratio in the cohorts affected by the war is also unusually high in Magadan – 1.091 for the 35-39 age group – so that the difference in the two sex ratios is similar to that of regions which did not attract migrants (see Appendix Table 1). While data are limited the evidence also suggests that cross-regional migration rates were low, likely due to the scarcity of housing in the Soviet Union and the use of residence permits in many cities, and were uncorrelated with the regional population losses during the war. For example, the net urban migration rate for Russia was 24.3 per 1,000 population in 1950 and 16.6 in 1959; the net rural migration rate was even lower (Goskomstat of Russia 1998). The correlation between the change in population by region between 1939 and 1951 – a proxy for the physical and population losses suffered in each region – and the urban in-migration rate in 1960 is .08. In the cross-regional regressions (described below), which rely on variation in sex ratios by age cohort and region for identification, a control for the net urban migration rate is included to mitigate the effects of cross-regional migration on the estimates.

Two types of data for Russia are used in this analysis: regional data from the first postwar Soviet census conducted in 1959, and household survey data from Russia in the 1990s. The former data provide insight into the relationship between sex ratios and the marital status, fertility and other demographic outcomes of individuals in 1959; the Russian household survey data provide information into events over the course of women's lifetimes, such as total fertility and the number of abortions, and can also be used to investigate second-generation effects of changing sex ratios. The analysis also examines outcomes for women reported in the 1989 Soviet Census in Estonia, Latvia and Lithuania, the three Baltic countries which were forcibly

incorporated into the Soviet Union in 1940 and which suffered losses similar to those of Russia in World War II. The latter data are advantageous because of the large sample sizes available for analysis but are limited by the few questions asked of respondents regarding fertility and marital status. The next section discusses the 1959 regional data and results, followed by the Russian household survey results and 1989 Census results.

a. Regional data and results for 1959

The basic 1959 Census data, such as education levels and marital status of the population by region, were published in and collected from the census volume Tsentral'noe Statisticheskoe Upravlenie (1963). Detailed census data on the distribution of the population by region and five-year age group are unpublished and were collected from the GARF (*Gosurdarstvennyi Arkhiv Rossiiskoi Federatsii* (State Archive of the Russian Federation)) archive in Moscow. These data were combined with registration data on the number of births and out-of-wedlock births in each region by five-year age group, and registration data on the number of deaths in each region due to abortion by five-year age group, also collected from the Soviet archives in Moscow, to calculate birth- and abortion death-rates by five-year age group and region for 1959.[10] Descriptive statistics for the regional data are given in Table 2. As is evident from Table 2, the share of female-headed households in Russia was already high in 1959, at nearly 30 percent, and out-of-wedlock births accounted for 17 percent of all births. In contrast, out-of-wedlock births comprised 5.3 percent of all births in the United States in 1960 (*Statistical Abstract of the U.S.*, 1970).

[10]The two archives containing 1959 census data are the GARF archive and the RGAE archive (*Rossiiskii Gosudarstvennyi Arkhiv Ekonomiki* (Russian State Archive of the Economy)). The specific location of each data series used in the paper by *fond, opis* and *delo* is given in Appendix 1.

The regressions using the 1959 census data are primarily estimated as fixed effects regressions which 'stack' the data by age group and region in the following form:

$$Y_{aj} = \beta R_{aj} + X'_{aj}\delta + \lambda_a + \mu_j + \varepsilon_{aj}$$

where R_{aj} is the sex ratio for cohort *a* in region *j*, X' is a vector of control variables that vary by cohort and region, such as the birth rate by 5-year age group, λ_a is a set of cohort dummies by 5-year age group, μ_j is a full set of dummy variables for regions (*oblasts*) roughly equivalent to U.S. states, and Y_{aj} is various outcomes such as marital status that vary by cohort and region. For example, the regressions using the out-of-wedlock birth rate by five-year age group as the dependent variable relate the out-of-wedlock birth rate in 1959 for women aged 15-19, 20-24, 25-29, 30-34, 35-39, and 40-44 to the sex ratio in 1959 for those same age groups on the right-hand-side, along with controls for cohort- and region-specific levels of the percentage married and the birth rate in 1959. The sex ratio is calculated as the number of men divided by the number of women in each age cohort, where men are three years older than women. For example, the sex ratio facing women age 20 to 24 is calculated as the number of men age 23 to 27 divided by the number of women age 20 to 24. All regressions are weighted by the square root of the regional population in each group.

Figures 7 and 8 are scatter diagrams showing some of the basic relationships between regional sex ratios and demographic outcomes in 1959.[11] Figure 7 illustrates the strong positive relationship between sex ratios and the share of women married in the population; Figure 8 indicates that regions with lower sex ratios had much higher shares of female-headed households than regions with higher sex ratios, as would be expected based on theory.

[11]The numbers on the scatter diagrams in Figures 7 and 8 correspond to the oblasts listed in Appendix Table 1.

These simple cross-regional relationships exploit only the variation in sex ratios across regions and show the correlations in the data, but cannot be given a causal interpretation. A more convincing approach is to use the large, exogenous variation in sex ratios between cohorts created by the war in addition to the regional variation in sex ratios; the stacked regional regressions described above use this approach. The coefficient of interest, β, is identified from differences in outcomes between cohorts within the same region.

The principal threat to validity in the stacked regressions is omitted variables: in particular, in regions in which the male population was decimated, what else happened in these regions that might affect marriage markets? Clearly the regions with the largest population losses also suffered the greatest economic losses through the devastation that resulted from battles in the occupied territories. Economic losses may affect marriage markets; it is also possible that women were under more pressure to join the labor force in regions with larger population losses. The ethnic structure of the population in many regions would have been altered as well, primarily due to the destruction of the Jewish population. The full set of regional and cohort dummies in the regressions will absorb much of these effects, but as a specification check the regressions are also estimated omitting the oblast-level dummies (replaced with large-region dummies) and including controls for female employment, net migration rates, population density, average monthly wages, female education levels, and the size of the male population in each region. Data on regional economic losses do not exist, but since economic losses were likely highly correlated with the population losses, these regressions also include a control for the change in population in each region between 1939 and 1951.

The first set of regressions uses the share of women or men married as the dependent variable; results are shown in Table 3. For both men and women, a lower sex ratio is associated

with lower marriage rates; this effect is statistically significant for the population as a whole and for the urban population, but is statistically insignificant for the rural population. The coefficient on the sex ratio for women indicates that a 10 percent decrease in the sex ratio (for example, from 1.0 to 0.9) is predicted to decrease the share of women married by about 5 percentage points. Including variables for female employment, population loss, etc. leads to higher coefficient estimates and little insight into the factors other than the sex ratio which are related to marriage rates.

A second set of regressions tests the effect of the changing sex ratio on fertility and related outcomes. As shown in Table 4, fertility is higher for urban women in age cohorts with higher sex ratios, although this is not the case for rural women. The share of out-of-wedlock births is negatively related to the sex ratio for the population as a whole and for urban women, and the effect is economically and statistically significant. The coefficient on the sex ratio indicates that a 10 percent increase in the sex ratio is predicted to decrease the share of out-of-wedlock births by .33 percentage points, or about 2 percent of the out-of-wedlock birth rate in the sample. The third set of regressions in Table 4 regresses the death rate from abortions on the sex ratio and other regional controls. The death rate from abortions is calculated as the number of deaths due to abortions in each age group divided by the number of women in each age group; the number of women obtaining abortions (of any age) is unavailable by region for 1959.[12] The sign for all results is negative, as would be expected, but in most specifications the coefficients are statistically insignificant. It is puzzling that the regression results for almost all outcomes are statistically insignificant for rural areas. The most likely explanation is measurement error, as the

[12]Since a few cells have zero abortion deaths, this variable is constructed as log((abortion deaths + 1)/population).

vital registration system in the Soviet Union was less accurate and less complete in rural compared with urban areas in 1959.

V. Results using the Russian Longitudinal Monitoring Survey

An alternative approach to examining the effect of changing sex ratios on the population is to link the sex ratio at marriageable age for each individual to that individual's outcomes over their life course. This approach uses recent household survey data for Russia taken in the 1990s, the Russian Longitudinal Monitoring Survey (RLMS) to examine whether the sex ratio a woman faced at age 20 affected her subsequent fertility, child mortality and abortion experience, and whether the sex ratio affected the health outcomes of her children. The RLMS is a nationally representative panel survey taken between 1994 and 2004; analysis here uses the 1994-1998 data which contain information on births and abortions for each woman interviewed. All women aged 40 to 83 interviewed in 1994 are included in the analysis, as well as new female participants in the survey aged 40 to 83 in the 1995, 1996 and 1998 rounds.[13]

The key variable of interest is the sex ratio faced by each woman when she was approaching marriageable age, defined here in two ways: (1) as the number of men aged 23-27 divided by the number of women aged 21-25 when each woman was age 21; and (2) as the number of men aged 25-29 divided by the number of women aged 20-24 when each woman was age 20. The former definition takes account of the average spousal age gap in Russia, which is two to three years in the postwar period. This sex ratio is constructed using data on the Russian population distribution by single-year age group, which is only available beginning in 1959. For

[13]This age range was chosen to limit the sample to women who have largely completed their fertility and due to the lack of sex ratio data for women older than 83. In practice the results are robust to different sample definitions, such as all women aged 40 and over, women aged 35 to 75, and so on.

earlier years this sex ratio is constructed using data for the Soviet Union as a whole using population estimates from Andreev et. al. 1993. In practice the sex ratios of the USSR and the RSFSR are very close in magnitude for the years in which the two measures overlap, so splicing the two series together is unlikely to lead to misleading results. The alternative sex ratio is constructed using only data for the RSFSR and is calculated using the annual estimates of the age and sex structure of the RSFSR population by five-year age group contained in Andreev et. al. 1998. While it would be preferable to use regional sex ratios, these are only available in census years (1959, 1970, 1979), and no information is provided in the RLMS on the respondent's region of residence at age 20.

The regressions take the following form:

$$Y_i = \beta Ri + X'i\gamma_o + \delta_i + \varepsilon_i$$

where Y_i is the outcome of interest, R_i is the sex ratio for each woman at age 20 or 21, and X_i is a number of individual-level control variables. X_i includes a variable for the share of each woman's reproductive years (defined as age 16 to 45) during which abortion was legal; log(real per capita household income), a Russian/non-Russian ethnicity dummy variable; marital status at the time of the survey; highest education level obtained; and year-of-birth dummy variables (in two-year intervals). δ_i is a group of large-region dummy variables. The outcome variables include the total number of births reported by each woman, whether or not a woman has no children, and the total number of abortions reported by each woman.[14]

Summary statistics for the RLMS variables are given in Table 5, and the main regression

[14]While abortions are probably underreported in these data, the problem is likely of smaller magnitude than in countries in which the use of abortion as a means of fertility control is less widespread. For example, researchers conducting a validation survey of responses on abortion in Tallinn, Estonia in 1992 concluded that the completeness of reporting of abortions in surveys is high, likely because abortion is much less stigmatized in former Soviet countries than in many other countries (Anderson et. al., 1994).

results are reported in Table 6 (complete regression results for selected regressions are given in Appendix Table 3). For the total number of births, there is a positive relationship between this measure of fertility and the sex ratio, and a negative relationship between the probability of being childless and the sex ratio. Both of these signs are as predicted by theory, but the coefficients are not significant at conventional significance levels.

The expected sign for the number of abortions is negative: with a lower sex ratio and weaker prospects in the marriage market as well as a weaker intra-household bargaining position, women may be more likely to have unprotected sex resulting in unwanted pregnancies and more abortions. The results of the abortion regressions all indicate a strong, negative relationship between the number of reported abortions and the sex ratio. Because a woman's lifetime reported abortions is a nonnegative count variable, the Poisson regression is an appropriate specification to gauge the economic significance of this coefficient. This coefficient indicates that a 10 percent increase in the sex ratio is associated with a decrease in abortions by nearly 9 percent, or .28 abortions per woman.

This result for abortions is robust to a number of alternative specifications and changes in coding of the abortion variable. As reported in Table 7, using quantile regression to calculate the effect at the median – which would minimize the problem of 'heaping' and outliers in abortion reporting – leads to similar results. Restricting the age group to 35-75 has little effect on the results as well. While the number of missing answers to the abortion question is relatively small in the RLMS (313 observations out of 3,383 total), one might be concerned that these missing observations are nonrandom in a way that might affect the results. However, taking the two possible extreme treatments of these missing variables – coding all missing abortion observations as '0', or coding all as '3' (the median number of abortions) also has a negligible effect on the

results. Note that while it would be desirable to test the effect of the sex ratio on the marriage and divorce probabilities of women (and men) over their lifetimes, the RLMS only contains information on the current marital status of individuals so these relationships cannot be tested.

A final test of the effect of sex ratios on the population is whether there are second-generation effects. If sex ratios affect female bargaining power within the household and women are more likely to devote resources to their children's upbringing than are men, then children will be worse off in a low-sex ratio environment than in a high-sex ratio environment faced by their mothers. As a result, the low sex ratios caused by the war may have resulted in children having more health problems and poorer nutrition than they otherwise would have had. Because adult height is largely determined by age 2 or 3 and is significantly influenced by the diet and health conditions in the early childhood years, final attained adult height is a good proxy for children's health status in the early years of life (Bogin 1999). Table 8 uses the adult height for individuals aged 22 - 55 years as the dependent variable to test whether there are second-generation effects of sex ratios. Adult heights are related to the sex ratio defined as the number of men aged 25-29 divided by the number of women aged 20-24 in each individual's year of birth, as a proxy for the bargaining position of the individual's mother in the year the child was born. The expected sign on the coefficient is positive: higher sex ratios should increase female bargaining power and therefore the well-being of children. As shown in Table 8, the coefficient is positive and statistically significant at the 10 percent level for men, while it is negative and statistically insignificant for women. These results suggest that women with more bargaining power in their marriages did devote more resources to their children, and that male children were favored over female children.

A final set of results uses 1989 Census data for Estonia, Latvia and Lithuania to examine

the effect of changing sex ratios on Baltic women. As noted previously, the Baltic republics endured losses similar to those of Russia during World War II; this is evident in the strikingly similar sex ratios in the three populations from the 1959 Census (see Figure 9). The 1989 Census data for these three countries are available as part of the project "Dynamics of Population Aging in Economic Commission for Europe Countries," sponsored by the United Nations Economic Commission for Europe. Since this project focused on older persons, the micro data samples contain information only on (all) persons aged 50 and over in each country, along with the persons who reside with them. Due to the selective nature of this data, it is not possible to assess (for example) second-generation effects of unbalanced sex ratios, since individuals residing in multi-generation households are unlikely to be representative of the population as a whole. The number of questions asked of respondents is also limited, focusing on living conditions and household characteristics and omitting information on previous occupation and work history. Fertility questions were asked only on 'long form' questionnaires (and only of women); long forms were used in every fourth dwelling.

Descriptive statistics from these data sets are give in Table 9. The sample used here comprises individuals aged 50 to 75. Respondents older than age 75 are omitted because respondents become increasingly unrepresentative of the population with rising age, particularly for men: given that life expectancy in 1990 was 64.2 for men and 74.6 for women in Latvia, older men still alive in 1989 likely differed in significant ways from men who died at younger ages. A further disadvantage of these data is that information on the prewar age and sex distribution of the population is (currently) unavailable for either country; the first such data by year of birth are available only in the 1959 Census. Given the lack of alternatives, the sex ratio is defined using the 1959 Census data. Specifically, as in Figure 9 the sex ratio is defined as the

moving average over four years of the size of the male cohort divided by the size of the female cohort, where men are two years older than women. For example, for women born in 1925 (age 34 in 1959), the sex ratio is the number of men born between 1923 and 1926 divided by the number of women born between 1925 and 1929.

Results of these regressions are shown in Table 10. Like the results for Russia, higher sex ratios are associated with higher fertility rates for Estonia and Latvia; the coefficient is positive but statistically significant at only the 22 percent level for Lithuania. Low sex ratios are also strongly related to the probability of being childless for a woman in all three countries. In Estonia low sex ratios are related to a higher probability of child mortality, as might be expected, but this relationship does not hold for Latvia or Lithuania.

The one outcome for men that can be measured using the available data is educational attainment: if low sex ratios reduce competition among men for marriage partners, men may invest less in characteristics – such as education – that make them attractive to mates. The results for the three Baltic countries support this idea, indicating a positive and statistically significant relationship between the sex ratio and years of education for men. Finally, the same regression for women's educational attainment shows a positive and significant coefficient across all countries. While one might expect a negative coefficient for women (low sex ratios lead women to obtain more education since they may be unable to rely on a spouse for support), a positive coefficient seems plausible as well: in a high-sex ratio environment, a woman may be able to use her bargaining power within marriage to have her husband support her while she is in school. Overall the 1989 Census results provide mixed evidence on the effects of unbalanced sex ratios on incentives to invest in human capital, but reasonably clear results regarding the positive relationship between sex ratios and fertility.

VI. Conclusion

World War II exacted a devastating toll on the Soviet population. Tens of millions of people died, mostly men, leaving behind a population of women who survived but faced highly unfavorable conditions in the marriage market and within marriage. The results presented in this paper suggest that the effects of the war impacted these women's lives for decades, leading to higher rates of childlessness, more out-of-wedlock births, higher rates of female headship and higher rates of abortion than would have been the case absent the war. The evidence is suggestive that the unbalanced sex ratios had negative effects on the second generation as well, reducing the well-being of the (male) children of women in the cohorts most affected by the war. While it is impossible to test for other effects of the unbalanced sex ratios on the population given currently available data, it is likely that they affected male behavior as well and may explain in part some of the problems that have plagued Russian marriages for years, such as high rates of alcohol consumption, domestic abuse and divorce.

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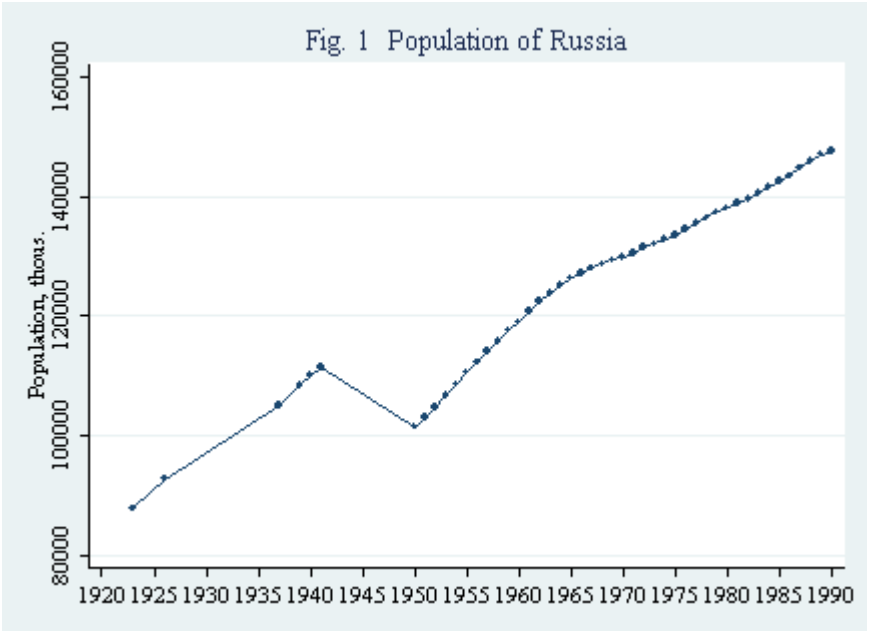


Fig. 1 Population of Russia
Population, thous.
80000
100000
120000
140000
160000
1920 1925 1930 1935 1940 1945 1950 1955 1960 1965 1970 1975 1980 1985 1990

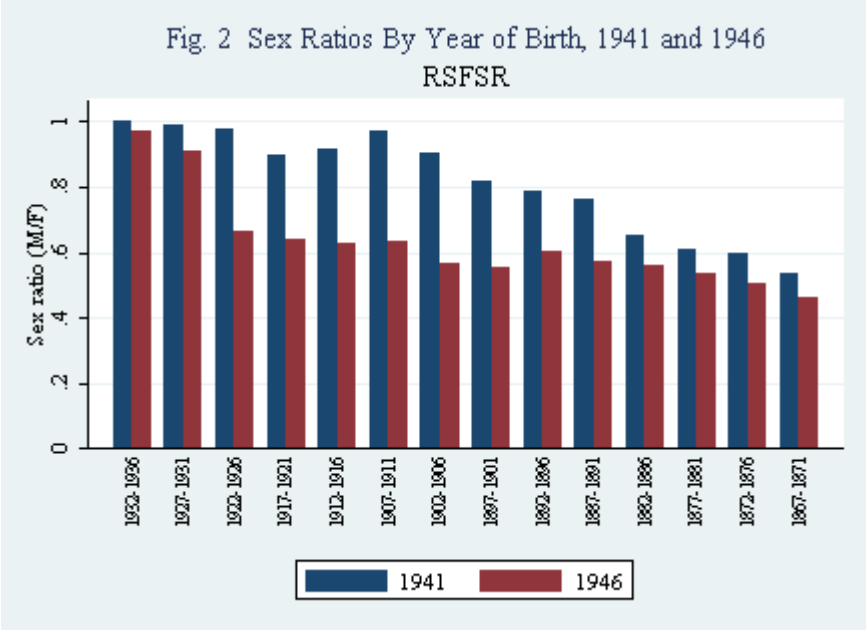


Fig. 2 Sex Ratios By Year of Birth, 1941 and 1946
RSFSR
Sex ratio (M/F)
0
.2
.4
.6
.8
1
1932-1936
1927-1931
1922-1926
1917-1921
1912-1916
1907-1911
1902-1906
1897-1901
1892-1896
1887-1891
1882-1886
1877-1881
1872-1876
1867-1871
1941
1946

Fig. 3 Sex ratios at age 20 by year of birth

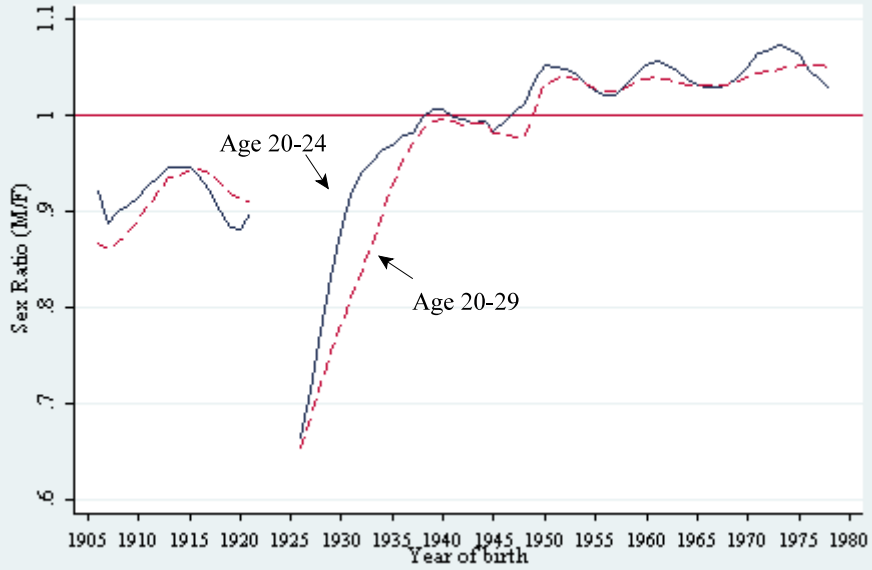


Fig. 4 Sex Ratios by Region, Ages 25-29 and 35-39, 1959

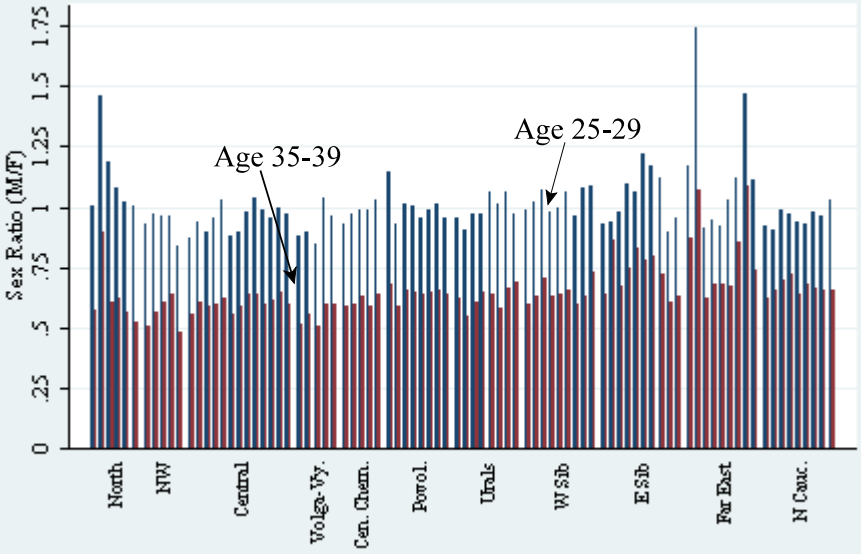


Fig. 5 Births Per 1000 Pop., Russia

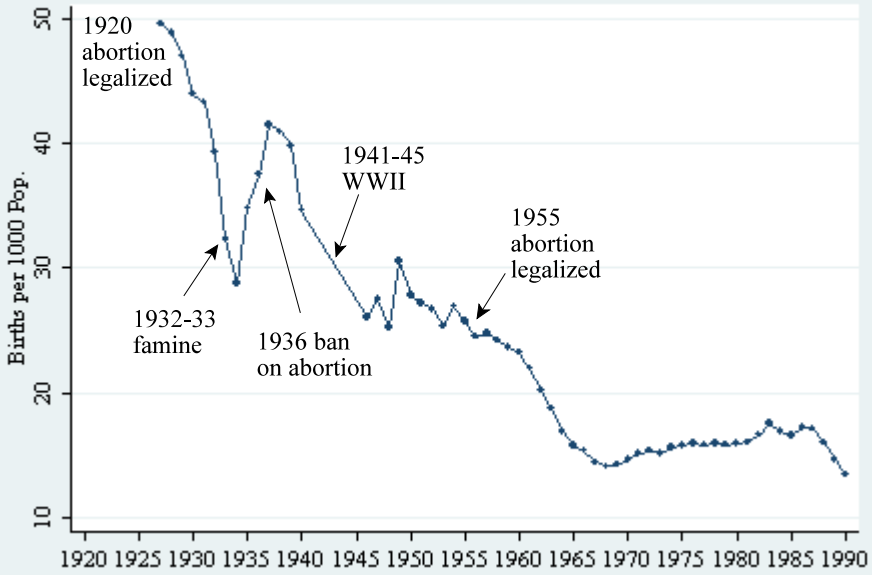
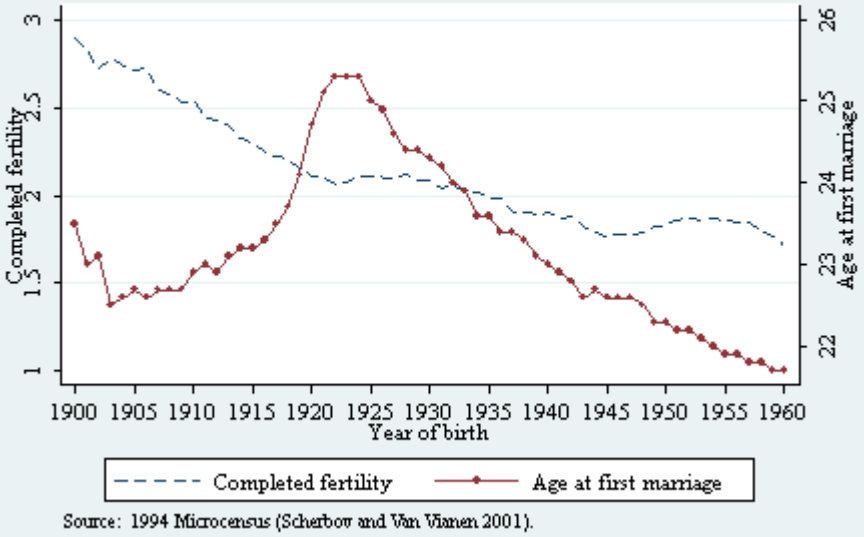


Fig. 6 Mean age at first marriage and completed fertility by year of birth, Russian women



Source: 1994 Microcensus (Scherbov and Van Vianen 2001).

Fig. 7 Correlation Between Sex Ratio and Marital Status, Women, 1959

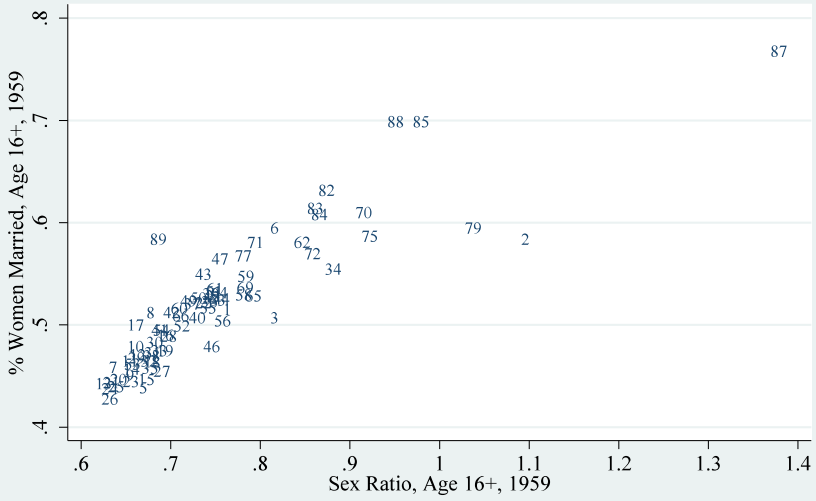
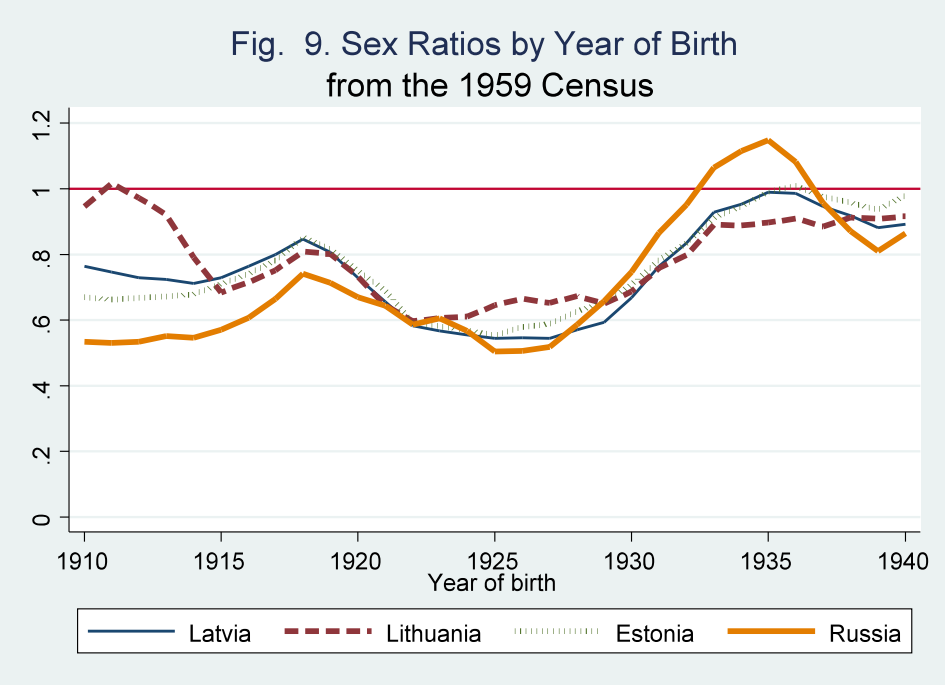


Fig. 8 Correlation Between Sex Ratio and Female-Headed Households, 1959



Note: The sex ratio is defined as a moving average over four years of the size of the male cohort divided by the size of the female cohort, where men are two years older than women.

Table 1. Key dates in Soviet history

1914 - 1917	First World War, ending in the 1917 Revolution and the fall of Russian Empire
1918 - 1922	Civil War and famine
1920	Abortion legalized; divorce made easily obtainable
1928	First Five Year Plan and beginning of industrialization drive
1932 - 1933	Collectivization of farming and great famine of 1932-33
1936	Abortion prohibited; divorce more difficult; modest benefits for mothers of large families
1936 - 1939	Stalin's purges
1941	June 22: Surprise invasion of the Soviet Union by Hitler
1944	Increase in child benefits for married and unmarried mothers; divorce extremely difficult
1948	Child benefits cut by half
1953	Stalin dies
1955	Abortion legalized
1974	Increase in child benefits
1991	Soviet Union ceases to exist

Table 2. Descriptive statistics, Russian regional data

		Mean	Standard dev.	N
1959 regional data:				
Sex ratios:	Age 15-54	.824	.110	73
	Age 16 and over	.750	.120	73
Emplt/Pop:	Men (16-59)	.625	.130	71
	Women (16-54)	.498	.137	72
Average monthly wage, rubles		82.6	26.6	72
% women age 10+ with education level:				
Higher		1.8	1.1	73
Incomplete higher		0.9	0.4	73
Specialized secondary		5.4	1.5	73
Secondary		5.2	1.8	73
Incomplete secondary		19.7	3.3	73
Primary		26.1	2.3	73
Net urban migration rate per 1,000 pop., 1960		20.9	13.2	72
Density (pop. per 1 square km)		30.1	38.7	73
1959 regional data by 5-year age groups:				
Sex ratios:				
Age 15-44		.860	.200	450
Age 15-49		.834	.234	450
Age 15-19		1.013	.075	73
Age 20-24		1.020	.141	73
Age 25-29		.994	.104	73
Age 30-34		.840	.081	73
Age 35-39		.643	.090	73
Age 30-39		.762	.081	73
Age 40-44		.645	.158	73
Age 40-49		.645	.186	73
Age 50-59		.564	.202	73
Proportion married, women				
All		.556	.225	455
Age 15-19		.084	.031	65
Age 20-24		.478	.071	65
Age 25-29		.748	.044	65
Age 30-34		.763	.040	65
Age 35-39		.705	.047	65
Age 40-44		.596	.062	65
Age 45-49		.517	.067	65

Table 2. Descriptive Statistics, continued

	Mean	Standard dev.	N
Proportion married, men			
All	.022	.008	455
Age 15-19	.274	.043	65
Age 20-24	.809	.046	65
Age 25-29	.924	.030	65
Age 30-34	.954	.023	65
Age 35-39	.963	.022	65
Age 40-44	.964	.022	65
Age 45-49			
Age-specific birth rate (births per 1000 women in each age group)			
Age 15-44	93.4	63.4	450
Age 15-19	29.4	12.2	73
Age 20-24	172.1	29.5	73
Age 25-29	157.5	32.8	73
Age 30-34	110.7	30.0	73
Age 35-39	67.8	25.3	73
Age 40-44	23.0	13.6	73
Share of births out-of-wedlock			
Age 15-44	.170	.071	438
Age 15-19	.223	.085	73
Age 20-24	.118	.049	73
Age 25-29	.127	.042	73
Age 30-34	.155	.042	73
Age 35-39	.193	.053	73
Age 40-44	.201	.074	73
Death rate from abortion (deaths per 100,000 women in each age group)			
Age 15-49	5.34	5.04	365
Age 15-19	1.59	2.51	73
Age 20-24	5.47	3.63	73
Age 25-29	8.88	5.96	73
Age 30-39	8.80	4.36	73
Age 40-49	1.93	1.89	73

Table 3. Stacked regional regressions 1959: Female and male marriage rates

	Proportion married, women, 15-49)			Proportion married, women, 15-49)			Proportion married, men, 15-49)		
	All pop.	**Urban**	**Rural**	**All pop.**	**Urban**	**Rural**	**All pop.**	**Urban**	**Rural**
Sex ratio	.053* (.027)	.059** (.024)	.032 (.022)	.096*** (.029)	.076*** (.019)	.108*** (.032)	.030* (.017)	.056** (.024)	.004 (.011)
% women employed	–	–	–	- .022 (.004)	-.004 (.003)	-.007 (.005)	–	–	–
Population loss 1939-1951	–	–	–	- .0003 (.0003)	.00002 (.0002)	.00001 (.0005)	–	–	–
Male population, thous.	–	–	–	.0001 (.0001)	-.00004 (.0001)	.0002 (.0002)	–	–	–
Net migration rate	–	–	–	.00004 (.0003)	-.0001 (.0002)	-.00007 (.0005)	–	–	–
Region (oblast) dummies	yes	yes	yes	no	no	no	yes	yes	yes
Cohort dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Large region dummies	no	no	no	yes	yes	yes	no	no	no
N	455	455	441	434	434	420	455	455	441
R2	.987	.992	.985	.982	.990	.976	.997	.998	.997

* Statistically significant at the 10% level; **5% level; ***1% level. Robust standard errors corrected for within-region clustering in parentheses. Regressions are weighted by the square root of the regional population in each age group. All regressions in the right-hand-side panel include controls for the average monthly wage in 1959, population per square km in 1959, and female education levels in 1959. Complete regression results for selected specifications are shown in Appendix Table 2 [*to be added*].

Table 4. Stacked regional regressions 1959: Age-specific birth rates, out-of-wedlock births, and death rate from abortion

Dep. variable:	Sex ratio Fixed effects	Sex ratio Lg. reg. + controls	N	R2
Log(age-specific birth rate, 15-44, all pop.)	.215 (.238)	.109 (.206)	390	.944
Urban population	.542*** (.163)	.438*** (.169)	390	.975
Rural population	.080 (.204)	.011 (.171)	378	.923
% births out-of-wedlock, 15-44, all pop.	-.059* (.034)	-.060** (.030)	366	.756
Urban population	-.033** (.016)	-.040*** (.014)	378	.832
Rural population	-.077 (.050)	-.066 (.043)	376	.676
Log(death rate from abortion, 15-49), all pop.	-.246 (.346)	-.442 (.348)	315	.758
Urban population	-.460 (.437)	-.461 (.404)	315	.689
Rural population	-.045 (.206)	-.549* (.292)	300	.693

Robust standard errors corrected for regional clustering in parentheses. Additional controls in FE regressions: % married and/or birth rate. Regressions weighted by the square root of the relevant regional population. All regressions in the "Lg. reg. + controls" column contain the controls listed in Table 3. N and R2 are for FE regressions.

Table 5. Descriptive statistics for RLMS data, women age 40 - 83
(Year of birth 1915 - 1958)

	Mean	Std. deviation
Average age:	56.5	10.9
Marital status:		
Single	.021	.142
Married	.582	.493
Divorced/Separated	.119	.324
Widowed	.275	.447
Marital status missing	.004	.003
Completed education:		
Primary or less	.135	.288
Incomplete secondary	.199	.307
Secondary	.260	.380
Vocational	.187	.252
Specialized secondary	.209	.303
Higher or incomplete higher	.144	.271
Log(real per capita monthly income, 1992? rubles)	7.26	1.54
Number of children:		
Mean	2.13	1.34
Share with no children	.031	.174
Ever had an abortion	.765	.424
Mean number of abortions	3.11	3.74
Sex ratios:		
Men 23-27/Women 21-25		
Average	.897	.218
Minimum	.576	
Maximum	1.47	
Men 25-29/Women 20-24		
Average	.857	.372
Minimum	.425	
Maximum	1.95	
Number of observations	3070	

Table 6. RLMS regressions, women age 40 - 83

DV:	Total births			No children			Number of abortions		
	OLS	OLS	Poisson	OLS	OLS	Probit	OLS	OLS	Poisson
Sex ratio, men 23-27/ women 21-25	.178 (.392)	–	.082 (.174)	-.048 (.071)	–	-.767 (.970)	-2.48* (1.28)	–	-.891** (.442)
Sex ratio, men 25-29/ women 20-24	–	.243 (.213)	–	–	-.018 (.043)	–	–	-2.14** (.949)	–
Ln(real per capita income, 1992 rb)	-.053 (.037)	-.053 (.037)	-.022 (.016)	-.003 (.004)	-.003 (.004)	-.017 (.067)	-.058 (.110)	-.059 (.111)	-.014 (.034)
% of years age 16-45 abortion legal	-.558 (1.78)	-.653 (1.77)	-.213 (.791)	.081 (.276)	.104 (.267)	1.33 (4.06)	1.76 (5.96)	3.00 (6.03)	.518 (1.79)
Total number of births	–	–	–	–	–	–	.371*** (.094)	.374*** (.094)	.110*** (.020)
Number of reported abortions	.043*** (.008)	.043*** (.008)	.018*** (.003)	-.004*** (.001)	-.004*** (.001)	-.163*** (.034)	–	–	–
Had a child who died	1.34*** (.119)	1.34*** (.120)	.497*** (.033)	-.042*** (.006)	-.042*** (.006)	na	–	–	–
Married	.413** (.189)	.411** (.189)	.222* (.115)	-.092* (.047)	-.092* (.047)	-.700*** (.252)	1.60*** (.364)	1.61*** (.357)	.737*** (.217)
Divorced	.073 (.203)	.072 (.203)	.042 (.122)	-.081 (.049)	-.081 (.049)	-.526* (.285)	1.70*** (.399)	1.70*** (.389)	.761*** (.219)
Widowed	.380* (.201)	381* (.201)	203* (.119)	-.089* (.047)	-.089* (.047)	-.673** (.258)	1.40*** (.325)	1.39*** (.316)	.675*** (.198)
N	3070	3070	3070	3070	3070	3070	3070	3070	3070
R2	.241	.241	na	.036	.036	na	.080	.081	na

Robust SEs corrected for clustering by region in parentheses. Other controls: dummy variables for year-of-birth (in two-year intervals), year of survey; completed education; Russian/non-Russian; missing household income or marital status; large region. Omitted education variable is primary or less education. Omitted marital status variable is single.

Table 7. Robustness checks: RLMS abortion regressions

Dep. variable:	Sex ratio: men 23-27/ women 21-25 at age 21	Sex ratio: men 25-29/ women 20-24 at age 20	N	R2
Quantile regression (median)^	-1.80** (.865)	–	3070	.042
Quantile regression (median)^	–	-1.66*** (.628)	3070	.042
Number of abortions, women age 35-75	-2.41* (1.30)	–	3535	.076
Number of abortions, women age 35-75	–	-2.19** (.939)	3535	.077
Number of abortions, missing abortion coded as 0	-2.41** (1.20)	–	3383	.097
Number of abortions, missing abortion coded as 0	–	2.19** (.878)	3383	.098
Number of abortions, missing abortion coded as 3	-2.21* (1.16)	–	3383	.069
Number of abortions, missing abortion coded as 3	–	-2.00** (.889)	3383	.070

^Standard errors are bootstrapped based on 1000 repetitions. Other controls are as in Table 6.

Table 8. Second-generation effects

Dep. variable:	Sex ratio coef. (men 25-29/ women 20-24 in year of birth)	N	R2
Adult height, men age 22 - 55	1.54* (.912)	5,022	.091
Adult height, women age 22 - 55	-1.20 (.856)	5,435	.078

* Statistically significant at the 10% level; **5% level; ***1% level. Robust standard errors corrected for regional clustering in parentheses. Other controls: abortion legal in year of birth; Russian/non-Russian ethnicity; large-region dummy variables; year-of-birth dummy variables (in two-year age groups); year of survey dummy variables.

Table 9. Descriptive statistics for 1989 Baltic Census data, Ages 50 - 75

	Estonia:		Latvia:		Lithuania:	
	Men	Women	Men	Women	Men	Women
Proportion by gender:	.406	.594	.400	.600	.413	.587
Average age:	59.4	60.9	59.3	60.9	59.4	60.5
Marital status:						
Single	.052	.077	.040	.065	.036	.075
Married	.803	.517	.805	.516	.861	.576
Divorced/Separated	.084	.116	.092	.123	.050	.070
Widowed	.059	.289	.059	.293	.051	.278
Marital status missing	.001	.002	.004	.003	.001	.002
Completed education:						
Primary or less	.372	.398	.276	.335	.521	.607
Incomplete secondary	.237	.221	.305	.276	.193	.149
Secondary	.110	.137	.148	.162	.083	.082
Specialized secondary	.154	.150	.137	.126	.103	.093
Incomplete higher	.012	.011	.014	.014	.009	.009
Higher	.116	.085	.121	.087	.092	.061
Number of children:						
0	na	.178	na	.191	na	.167
1		.303		.322		.211
2		.351		.334		.334
3+		.169		.153		.288
Ethnicity:						
Estonian/Latvian/Lith.	.643	.637	.534	.532	.802	.795
Russian	.261	.285	.307	.328	.085	.092
Other	.096	.078	.158	.140	.113	.114
Sex ratio[1]:						
Average, pop. 50 - 75	.742		.730		.741	
Minimum	.524		.511		.556	
Maximum sex ratio:	1.005		1.000		.936	
Number of observations:						
All sample	145,647	213,190	249,646	374,195	350,332	497,644
Sample w/fertility questions	na	53,411	na	93,196	na	123,188

[1]The sex ratio is a moving average of men/women, where men are 3 years older than women and the age groups are summed by 5-year groupings (for example, (men age 23+24+25+26+27)/(women age 20+21+22+23+24).

Table 10. Regressions using the 1989 Census for Estonia, Latvia and Lithuania
(individuals age 50-75; year of birth 1913 - 1939)

Dep. variable:	Number of children (women)			No children (women)			Had a child who died (women)		
	Estonia	Latvia	Lithuania	Estonia	Latvia	Lithuania	Estonia	Latvia	Lithuania
Sex ratio	.381** (.190)	.441*** (.144)	.211 (.171)	-1.22*** (.474)	-.776** (.355)	-.618* (.330)	-.938* (.509)	.049 (.416)	.003 (.290)
Abortion legal at age 20	.147** (.063)	.014 (.039)	.054** (.023)	-.696*** (.159)	-.603*** (.094)	-.747*** (.045)	-1.02** (.172)	-1.23*** (.116)	-1.27*** (.043)
Number of children	–	–	–	–	–	–	.120*** (.010)	.114*** (.008)	.138*** (.005)
Marital status controls	yes	yes	yes	yes	yes	yes	yes	yes	yes
Education level controls	yes	yes	yes	yes	yes	yes	yes	yes	yes
County controls	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year of birth controls	yes	yes	yes	yes	yes	yes	yes	yes	yes
N	53,411	93,196	123,188	53,491	93,196	123,188	53,411	93,196	123,188
R^2	.112	.117	.151	.135	.142	.209	.063	.071	.086
Mean of DV	1.62	1.55	2.01	.178	.191	.167	.131	.114	.161

* Statistically significant at the 10% level; **5% level; ***1% level. Robust standard errors in parentheses. The "childless" and "child died" regressions are logit regressions. Regressions also include a control for nationality (Estonian/Latvian/Lithuanian, Russian, or other). Year of birth dummy variables are in two-year intervals.

Table 10 (continued). Regressions using the 1989 Census for Estonia, Latvia and Lithuania
(individuals age 50-75; year of birth 1913 - 1939)

Dep. variable:	Years of education (men)			Years of education (women)		
	Estonia	Latvia	Lithuania	Estonia	Latvia	Lithuania
Sex ratio	1 .70***	1.32***	2.11***	2.30***	2.24***	2.00***
	(.403)	(.278)	(.248)	(.641)	(.469)	(.378)
Abortion legal	1 .79***	1.72***	3.47***	3.74***	3.47***	4.54***
	(.131)	(.078)	(.030)	(.211)	(.123)	(.046)
Number of children	na	na	na	-.322***	-.277***	-.252***
				(.013)	(.010)	(.007)
Marital status controls	yes	yes	yes	yes	yes	yes
Education level controls	no	no	no	no	no	no
County controls	yes	yes	yes	yes	yes	yes
Year of birth controls	yes	yes	yes	yes	yes	yes
N	1 45,647	2 49,608	3 50,322	53,410	93,181	1 23,181
R^2	.121	.137	.215	.177	.183	.262
Mean of DV	7.57	8.01	6.28	7.26	7.44	5.52

* Statistically significant at the 10% level; **5% level; ***1% level. Robust standard errors in parentheses. Regressions also include a control for nationality (Estonian/Latvian/Lithuanian, Russian, or other). Year of birth dummies are in two-year intervals.

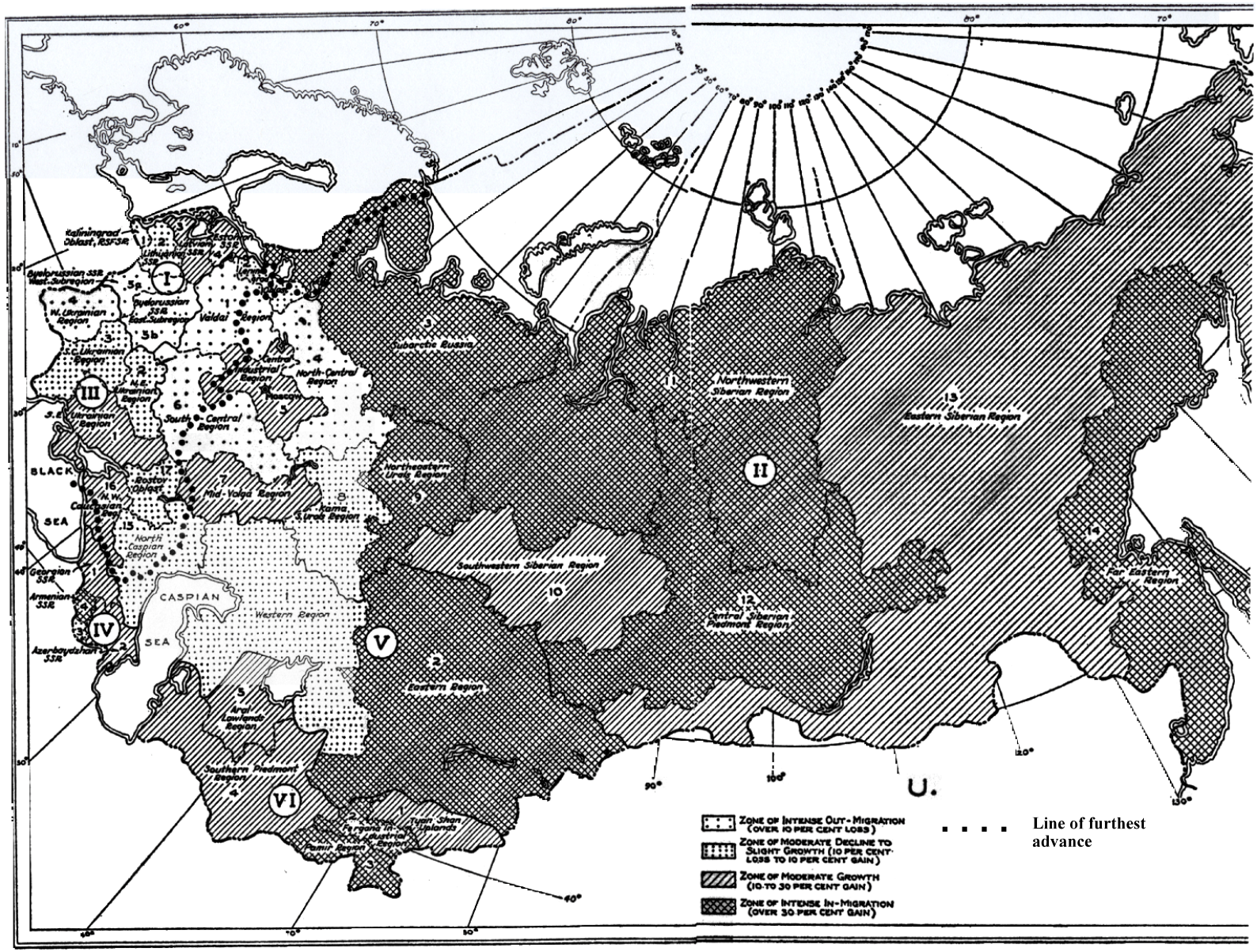
Appendix Table 1. Population and Sex Ratios by Region

Region No:	Region	Population, thous. 1939	1951	Change	1959 Sex Ratio: 25-29	35-39	Diff.
North:							
1	Republic of Karelia	469	482	13	1.009	.579	.430
2	Republic of Komi	319	459	140	1.460	.900	.559
3	Arkhangelskaya oblast	1109	1014	-95	1.191	.610	.581
5	Vologodskaya oblast	1599	1228	-371	1.024	.569	.455
6	Murmanskaya oblast	291	337	46	1.008	.521	.487
Northwest:							
7	St. Petersburg (Leningrad)	3385	2899	-486	.934	.511	.423
8	Leningradskaya oblast	1294	1000	-294	.975	.569	.406
9	Novgorodskaya oblast	1152	737	-415	.968	.610	.359
10	Pskovskaya oblast	1550	1043	-506	.961	.638	.323
Central:							
11	Bryanskaya oblast	1802	1527	-275	.872	.560	.312
12	Vladimirskaya oblast	1340	1330	-10	.935	.606	.329
13	Ivanovskaya oblast	1388	1278	-110	.895	.592	.303
14	Kaluzhskaya oblast	1178	891	-287	.954	.596	.359
15	Kostromskaya oblast	1075	923	-152	1.026	.623	.404
16	City of Moscow	4542	5347	805	.883	.561	.322
17	Moskovskaya oblast	4255	4131	-124	.895	.591	.303
18	Orlovskaya oblast	1286	926	-360	.983	.638	.344
19	Ryanzanskaya oblast	1925	1437	-488	1.036	.641	.394
20	Smolenskaya oblast	1984	1220	-764	.991	.598	.393
21	Tverskaya oblast	2489	1891	-598	.960	.618	.342
22	Tulskaya oblast	1729	1734	5	1.000	.651	.348
23	Yaroslavskaya oblast	1602	1364	-238	.971	.600	.371
Volga-Vyatskii:							
24	Mari-el Republic	581	575	-6	.881	.512	.369
25	Rep. of Mordovia	1185	983	-202	.898	.559	.339
26	Chuvashskaya Rep.	1078	1026	-52	.846	.509	.337
27	Kirovskaya oblast	2334	1916	-418	1.035	.597	.439
28	Nizhegorodskaya oblast	3520	3337	-183	.968	.595	.373
Central Chernozem:							
29	Belgorodskaya oblast	1440	1327	-113	.932	.592	.339
30	Voronezhskaya oblast	2709	2196	-513	.971	.603	.368
31	Kurskaya oblast	1773	1418	-355	.985	.635	.351
32	Lipetskaya oblast	1353	1174	-179	.990	.594	.396
33	Tambovskaya oblast	1878	1521	-357	1.026	.641	.385
Povolzhsky:							
34	Rep. of Kalmykiya	179	123	-56	1.149	.679	.470
35	Rep. of Tatarstan	2914	2686	-228	.927	.589	.338
36	Astrakhanskaya oblast	683	567	-116	1.010	.661	.349
37	Volgogradskaya oblast	1775	1444	-331	1.002	.650	.352
38	Penzenskaya oblast	1651	1453	-198	.954	.641	.313
39	Samarskaya oblast	1646	1809	163	.988	.646	.342

Appendix Table 1, continued

Region No:	Region	Population, thous. 1939	1951	Change	1959 Sex Ratio: 25-29	35-39	Diff.
40	Saratovskaya oblast	2273	1957	-316	1.014	.657	.357
41	Ulyanovskaya oblast	1183	1108	-75	.956	.643	.313
North Caucuses:							
42	Rep. of Adygeya	247	na	na	.926	.626	.300
43	Rep. of Dagestan	1023	836	-187	.901	.659	.242
44	Kabardino-Balk. Rep.	350	344	-6	.985	.698	.287
45	Karachaevo-Cherk. Rep.	246	na	na	.974	.723	.251
46	North Ossetia	408	383	-25	.938	.641	.297
47	Chechnya-Ingushetia	727	459	-268	.929	.683	.256
49	Krasnodarskii Krai	3172	3338	166	.977	.663	.314
50	Stavropolskii Krai	1759	1540	-219	.969	.656	.313
51	Rostovskaya oblast	2893	2756	-137	1.032	.659	.373
Urals:							
52	Rep. of Bashkortostan	3158	2773	-385	.958	.626	.332
53	Udmurtskaya Rep.	1223	1181	-42	.908	.550	.358
54	Kurganskaya oblast	976	886	-90	.970	.608	.361
55	Orenburgskaya oblast	1672	1642	-30	.970	.646	.324
56	Permskaya oblast	2086	2493	407	1.063	.644	.419
58	Sverdlovskaya oblast	2610	3268	658	1.061	.667	.394
59	Chelyabinskaya oblast	1727	2313	586	.970	.694	.276
West Siberia:							
60	Altai Republic	162	na	na	.989	.596	.393
61	Altaiskii Krai	2388	2409	21	1.019	.630	.390
62	Kemerovskaya oblast	1654	2181	527	1.071	.708	.363
63	Novosibirskaya oblast	1862	2060	198	.983	.635	.348
64	Omskaya oblast	1390	1427	37	.999	.642	.357
65	Tomskaya oblast	643	671	28	1.063	.661	.402
66	Tyumenskaya oblast	991	1000	9	.968	.603	.364
East Siberia:							
69	Rep. of Buryatia	546	569	23	.930	.637	.293
70	Tuva Republic	na	130	na	.938	.867	.071
71	Rep. of Khakasiya	275	na	na	.983	.677	.306
72	Krasnoyarskii Krai	1960	2121	161	1.097	.746	.352
75	Irkutskaya oblast	1303	1428	125	1.171	.797	.374
77	Chitinskaya oblast	963	819	-144	.900	.608	.293
Far East:							
79	Sakha Republic	414	377	-37	1.169	.874	.295
82	Primorskii Krai	888	1036	148	.917	.625	.291
83	Khabarovskii Krai	657	791	134	.946	.683	.262
84	Amurskaya oblast	634	618	-16	.925	.685	.240
85	Kamchatskaya oblast	109	122	13	1.032	.678	.354
87	Magadanskaya oblast	173	166	-7	1.470	1.091	.379
88	Sakhalinskaya oblast	100	535	435	1.112	.743	.369
89	Kaliningradskaya oblast	na	455	na	.842	.480	.362

Appendix Figure 1. Line of Furthest German Advance in World War II



Appendix Table 3. RLMS regressions, women age 40 - 83

DV:	Total births		No children		Number of abortions	
	OLS	Poisson	OLS	Probit	OLS	Poisson
Sex ratio, men 23-27/ women 21-25	.178 (.391)	.082 (.174)	-.048 (.071)	-.767 (.970)	-2.48* (1.28)	-.891** (.442)
Ln(real per capita income, 1992 rb)	-.053 (.037)	-.022 (.016)	-.003 (.004)	-.017 (.067)	-.058 (.110)	-.014 (.034)
Income missing indicator	-.238 (.245)	-.213 (.791)	-.009 (.024)	.034 (.388)	-.251 (.660)	-.056 (.202)
% of years age 16-45 abortion legal	-.558 (1.78)	-.297 (.089)	.081 (.276)	1.33 (4.06)	1.76 (5.96)	.518 (1.79)
Number of total births	–	–	–	–		
Number of reported abortions	.043*** (.008)	.018*** (.003)	-.004*** (.001)	-.163*** (.034)	–	–
Had a child who died	1.34*** (.119)	.497*** (.033)	-.042*** (.006)	na	–	–
Married	.413** (.189)	.222* (.115)	-.092* (.047)	-.700*** (.252)	1.60*** (.364)	.737*** (.217)
Divorced	.073 (.203)	.042 (.122)	-.081 (.049)	-.526* (.285)	1.70*** (.399)	.761*** (.219)
Widowed	.380* (.201)	203* (.119)	-.089* (.047)	-.673** (.258)	1.40*** (.325)	.675*** (.198)
Missing marital status indicator	.267 (.368)	.137 (.196)	-.128*** (.047)	na	.878 (1.06)	.501 (.434)
Russian	-.332** (.154)	-.141** (.060)	.004 (.008)	.099 (.143)	.490 (.310)	.158 (.103)
Incomplete secondary ed.	-.103 (.064)	-.032 (.027)	-.012 (.008)	-.225* (.128)	.509*** (.157)	.157*** (.050)
Secondary ed.	-.229*** (.067)	-.093*** (.031)	.007 (.012)	.110 (.188)	.209 (.146)	.065 (.050)
Vocational ed.	-.137** (.055)	-.063** (.026)	.005 (.007)	.118 (.100)	.142 (.179)	.047 (.054)
Specialized secondary ed.	-.275*** (.057)	-.136*** (.027)	.010 (.008)	.158 (.108)	-.146 (.151)	-.041 (.048)

Higher education	-.226*** (.071)	-.122*** (.036)	-.007 (.101)	-.141 (.138)	-.742*** (.149)	-.266*** (.058)
Large region dummy variables	yes	yes	yes	yes	yes	yes
Year of birth dummy variables	yes	yes	yes	yes	yes	yes
Year of survey dummy variables	yes	yes	yes	yes	yes	yes
War dummy	yes	yes	yes	yes	yes	yes
N	3070	3070	3070	3070	3070	3070
R2	.241	na	.036	na	.080	na

Robust standard errors corrected for clustering by PSU (region) in parentheses. Year-of-birth dummy variables are in two-year intervals. Large regions are North, Central, Volga, North Caucuses, Urals, West Siberia, East Siberia, Moscow/St. Petersburg. Omitted education variable is primary or less education. Omitted marital status variable is single.

Appendix 1: Data sources

Archival data:

Age and sex distribution of the population by RSFSR oblast, 1959: GARF F. A-374, op. 40, d. 1, 2, 3, 4.

Births (total and out-of-wedlock) by age of mother and RSFSR oblast, 1959: GARF F. A-374, op. 31, d. 4923.

Female employment and total employment by RSFSR oblast, 1959: GARF F. A-374, op. 31, d. 2944.

Deaths from abortion by age and RSFSR oblast, 1959: RGAE F. 1562, op. 27. d. 834, 835, 836.

Wages, average monthly, by RSFSR oblast, 1959: GARF, F. A-374, op. 31, d. 2779

Other data:

Doctors per capita: Tsentral'noye statisticheskoe upravleniye, *Narodnoye khozyaistvo RSFSR*

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

Marital status by RSFSR oblast, men and women, 1959:

Net migration rate 1960: *Naselenie Rossii za 100 let*