Mortality Inequality

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rough draft, do not quote

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Economists and other social scientists have long been interested in measures of income inequality. Most such measures are based on individual or household income at a moment in time. However, as a measure of the distribution of welfare, the typical income inequality measure leaves out an important dimension: the length of time over which an income or consumption stream is enjoyed. (See Becker, Philipson and Soares, 2004). Clearly two individuals with the same annual income or consumption but differing in longevity do not have the same total welfare. This paper is about differences in longevity.

The paper seeks to describe the evolution of longevity differences across individuals. This modest goal is motivated by the comparative neglect of the longevity component in the analysis of inequality. Specifically, think of an individual born today. He or she will have a lifetime welfare or utility related to total lifetime consumption (Y), which can be expressed

$$Y = CX \tag{1}$$

where C is some appropriately discounted measure of the individual's annual consumption and X is the number of years the individual lives. Using lower case to denote natural logs, (1) would be

$$y = c + x \tag{2}$$

The variance (V) or standard deviation (S) of the log of income across individuals in a society is a common measure of income inequality. The analogous measure of lifetime inequality as described by (2) would be

$$V(y) = V(c) + V(x) + 2r(c,x)S(c)S(x) \tag{3}$$

where r(c,x) is the correlation coefficient between c and x across individuals.

The first term of this familiar formula for the sum of two random variables describes the distribution of per capita consumption. Most of the income inequality literature concentrates on something like this V(c) term. Another literature on health inequality essentially focuses on some version of the correlation coefficient in the third term. The correlation between income and longevity within and between countries is positive, but most of this may reflect differences between the very poorest countries or people and the rest. (Preston, 1975; Cutler, Deaton and Lleras-Muney,2006). This paper will focus on the mainly neglected middle term. This term measures the inequality of lifetimes, the kind of inequality that arises when one individual born today dies shortly thereafter while another lives to a ripe old age.[1]

It is hard to know why the V(x) term, or its square root S(x), has been neglected relative to the other two terms in (3) in discussions of inequality. (Henceforth I will mainly focus on estimates of S(.) rather than V(.)) The two kinds of inequality are not different in any fundamental way. Both are affected by or related to a similar list of background characteristics like gender, race or parental attributes. Both are affected by a production process whose endogenous correlates such as education, occupation, location and so forth are similar.

Historically, mortality inequality has contributed substantially to total inequality. To provide some context for that assertion it is helpful to start with some sense for the magnitude of the more familiar consumption inequality term, S(c). For that purpose I take

[1] The variance of log age provides a convenient description of mortality inequality in the context of the simple variance decomposition in equation (1). However, it is problematic as a stand-alone measure . The distribution of mortality inequality is skewed left with a significant mass in the first year of life. Hence the variance of age at death is sensitive to the infant mortality rate. This sensitivity is exaggerated by the log transformation. For this reason I show important results both inclusive and exclusive of infant mortality.

the standard deviation of the log of household income as a proxy for S(c). Figure 1 shows some rough estimates of this proxy for the US and Sweden[2].

For the US, perhaps the least egalitarian of the rich countries, this proxy has ranged between .75 and .9 over most of the 20th century. For Sweden, the prototypical advanced welfare state, the much more limited data lies .15 or .2 below the US figures. Both countries are characterized by increasing income inequality over the last quarter century or so. The crudeness of the proxy needs to be emphasized. For mechanical reasons it understates the true inequality.[3] For substantive reasons it probably overstates the inequality we want to measure – average consumption over a lifetime.[4] We can, however, get a sense of magnitudes from Figure1: think of S(c) as having an upper bound around 1 in the developed world, as having no clear trend in the US but probably declining in other rich countries toward a lower bound of around .5 or more.

By comparison, as will be clear shortly, S(x), the standard deviation of longevity, has taken on values even greater than 1 over much of the history available to us, and values over .5 have been common until comparatively recent times, when much smaller values emerged. Thus much of the social inequality in our history has been at least as much due to mortality inequality as to income inequality. And we shall see that the narrowing of social inequality over the last century owes more to declines in S(x) rather than S(c).

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[2] The roughness is due to the kind of data we have available to portray long time series of the proxy. These are income distributions or even fragments thereof.

[3] All households in a decile or quintile are assigned the same income. Thus within-group dispersion is suppressed.

[4] The proxy contains transitory income elements that we might like to exclude, and it probably does not adequately capture life-cycle effects: current-income-poor older households who are dissaving.

The paper mainly summarizes mortality data of a kind that may be less familiar to economists than demographers. Accordingly, I begin by outlining the kind of data that I will use, where they come from and what measures I will extract from them. This is followed by several sections describing various aspects of the data.

The history of mortality inequality that I will review occurred in the context of substantial increases in average life expectancy. Accordingly, before I review the history of mortality inequality I will summarize the more familiar facts about longevity, and I will discuss the conceptual and empirical connection between the two. This will be followed by a description of the trends in mortality inequality over two long periods, one beginning around 1750 and the other beginning around 1900. The choice of these periods is driven by data availability. One remarkable feature of these data is the extraordinarily low levels to which overall mortality inequality has been driven in the developed world. Relatively little of today's social inequality is coming from the lottery of life. That fact motivates description of the history two important sub-categories of mortality inequality: gender and place.

Today if you were born female you can expect to live around 10 percent longer than a male born on your birthday. I will document the considerable historical variability in this female premium. This is followed by a more detailed analysis of geographic inequality in the United States. Historically, as emphasized by Becker et al (2004), where you are born matters to your expected longevity. Some of this geographic inequality is income-related, because there are also geographic differences in average incomes. The penultimate section of the paper reviews the history of mortality differences across US states and counties. Here there is more focus on the recent history (since 1970), when geographic income differences have tended to widen. I investigate whether geographic mortality differences have reinforced or offset these income differences.

I will mainly, but not entirely, ignore the well-studied correlation between health and wealth in the third term in equation (1).

I. Mortality Data: Concepts and Sources

Most of the data used in this paper come from life tables. A life table is simply a function in which the y-variable is the number of survivors and x is their age. The number of survivors is set to an arbitrary value (usually 100,000) at age 0 (birth) and the table follows the 100,000 births to their deaths. Thus suppose 5,000 of the 100,000 die before their first birthday and another 1000 before their second. The life table would show:

age	0	1	2	…
survivors	100,000	95,000	94,000	…

The bottom row gets steadily smaller with age until it approaches zero at around 100 years. The first difference of the life table is mortality and, in percentages the mortality rate. Thus , the mortality rate at age 0- infant mortality - is 5 per cent; the mortality rate at age 1 is 1.05 per cent (1,000deaths /95,000 alive at the start of the year), etc. Sometimes we have only mortality rates, and we have to infer life tables. Often the mortality rates cover a range of ages – for example, we might be told only that the rate is 3.05 percent for age 0 to 2 for the population described by the above table[5] - and we have

[5] Since 1 minus this rate compounded for 2 years reduces 100,000 to 94,000

to infer intermediate values. These details and how I handled them are discussed in the appendix.

The most commonly used kind of life table, and the one I use exclusively, is the period life table which comes from mortality records in a particular year or group of years. This answers the question: how many survivors would there be at age k if 100,000 individuals born today have the mortality rates that we observe today for people at various ages up to k?[6] This would be an unbiased estimate of actual experience only if there was no medical progress. If we can expect continued progress, then today's life table values understate the expected number of survivors at each age from a group of 100,000 born today. The reader needs to keep in mind the conservative counterfactual implicit in data derived from period life tables.

I extract two kinds of information from life tables, corresponding to the first two moments of the distribution of the age of death. One is expected longevity, and the other – the focus of the paper – is the standard deviation of (log) longevity. Expected longevity is simply a weighted average of ages where the weights are mortality at each age. Thus in the illustrative table above, 5000 live one year or less, 1000 live 2, and the remaining 94,000 live to ages from 3 on up to 110 or so. The total life years lived by this hypothetical group of 100,000 described by any life table is the sum of all mortality weighted ages up to, say, 110, and this sum divided by 100,000 is expected longevity.

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[6] A cohort life table tracks a given birth cohort over time., and answers the question: of 100,000 people born in year t-K how many actually survived in years t-K+i (where i ranges from 0 to around 100)? This has the advantage of describing actual experience, without any need to make assumptions about technology. But it has the fatal disadvantage of cutting off much interesting history. For example, a reasonably complete history of cohort life tables would today get us only up to the birth cohorts of the first part of the 20th century, because non-trivial numbers of those born later still survive.

The inequality measure is just the mortality weighted standard deviation around this expected value (or, more accurately, around the expected value of the log of age.[7])

These mean and variance estimates have been sensitive to the level and change of infant mortality and over much of the history I shall describe. Mortality rates usually trace at a U-shape when plotted against age, with the left branch declining sharply from birth through the first few years of childhood. This pattern still holds, but the level of infant mortality has declined substantially. For the typical developed country of today, something like 15 per cent of all children died before their first birthday up to a century ago. This figure is now under 1 percent. Thus something like a sixth of the increase in longevity is due to reduced infant mortality. The impact on inequality measures is even greater, because of their sensitivity to extreme values. I deal with this sensitivity by supplementing overall measures with those excluding mortality below age 5.

The life tables I use or construct come from a variety of sources., as described more fully in the appendix.. Many are from two public use data bases, one at the University of California (Berkeley) and the other at the Max Planck Institute.[8] These were supplemented by searches of the demographic literature and national vital statistics print and electronic sources. Some of the literature tries to estimate life tables from sketchy available data, and I did not attempt to exercise quality control. Nor did I include every country for which some data are available. I used two main selection criteria: length and importance. Because the paper has a historical focus, I included any country

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[7] For this purpose I assume that mortality, including infant mortality, takes place at the end of the year. This makes the minimum value of log age=0, and avoids the problem that log of age 0 is undefined. However, in fact, most infant mortality occurs closer to the date of birth than the end of the first year

[8] http://www.mortality.org/ and http://www.lifetable.de/ respectively.

where the data begin 1850 or before and excluded any where the data begin after 1900.[9] For countries where the data begin between 1850 and 1900 I included large countries or less developed countries (where historical data are often especially scarce). The resulting sample of 23 countries is nevertheless heavily tilted toward today's developed economies, and especially toward Scandinavia where the data reach back into the 18th century. About half the sample has data from 1850 or before, and I begin with this half because of the insight it may offer about the role of modern medicine.

II. Mortality Inequality Since the 18th Century

Figure 2 summarizes the mean and standard deviation of longevity from birth for the 10 countries where the data go back at least to the mid 19th century. Figure 3 has the same data for the population that survives to age 5 – i.e., it excludes infant mortality and the historically perilous first few years of life. The sample is fairly homogeneous in that it is drawn completely from northern Europe plus the US.

Panel A in both figures repeats the familiar history of the ongoing growth of life expectancy. There is little or no progress before 1850, but continual growth thereafter. These panels also show a narrowing dispersion of life expectancy over time within the sample, though this is most clear in Figure 2. This narrowing dispersion of life expectancy across countries is the aspect of inequality emphasized by Becker, Philipson and Soares (2004). They emphasized the narrowing difference between rich and poor countries, but the figures show that this narrowing has been pervasive.

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[9] For the last 50 or so years, the UN *Demographic Yearbook* has mortality rates and life table estimates for many more countries than are in my sample.

Panel B in the same figures summarize the evolution of within-country inequality, which is the focus of this paper. Inequality is measured by the standard deviation of the log of longevity, which is an approximation of the square root of the V(x) term in equation (3). Here, as with mean longevity, there is long-run progress following another long period of stagnation. And, again similar to the mean, the inequality measure seems to converge toward a common value as we get closer to the present. Two aspects of this history - the magnitude and timing of the decline in inequality – deserve elaboration.

The magnitude of the decline in mortality inequality is remarkable when compared to the evolution of income inequality. In the mid 18th century and for a long time thereafter (and probably before) the inequality measure hovers over 1.5 in Figure 2. Today it averages below .4. This decline of 100+ log points is at least twice the range of the similarly scaled consumption inequality proxies in Figure_. Thus, in terms of the decomposition in equation (1), the decline of mortality inequality has been a far more important contributor to the historical decline in social inequality than any narrowing of income inequality.

The history in panel A of Figure 2 is dominated by the decline in infant mortality. However, even if we exclude infant mortality entirely, as in panel A of figure 3, the decline in mortality inequality remains remarkable. Here the long run decline is on the order of 40 log points, which might be comparable to the decline in income inequality over the same period in one of today's advanced welfare states.

While there has been a considerable reduction in mortality inequality, this process seems to have started well after the onset of increasing life expectancy. This is clearest in Figure 3. Here life expectancy begins to increase noticeably around 1850 while inequality does not begin its steep descent until the 19th century is nearly over. In Figure 3 there is some progress before 1900, but it accelerates as that date approaches. The impression that progress in inequality lagged progress in longevity is sharpened in Table xxx. Here the century from 1850 to 1950 is divided into two 50 year periods, and the underlying progress in the two 50 year periods is compared. Around a third of the total progress in longevity had been completed by 1900, but only a sixth to a quarter of the total decline in inequality had been completed over this initial 50 year period.

This lag between the onset of medical progress and the decline in mortality inequality is important because it shows that the connection between the two is not as straightforward as a casual glance at Figure 2 or 3 might suggest. Progress, as it has played out so far, unleashed two opposing forces on inequality. They can be illustrated in the following stylized model that captures the essence of these forces: Suppose all individuals die either at some early age (A_1) or they survive to die in old age at age A_2. Then the mean life expectancy is

$$X = (1-p)A_1 + pA_2 \tag{4}$$

where p is the proportion who survive to old age. The variance of log X here is

$$V(x) = p(1-p)D^2 \tag{5}$$

where

$$D = (a_2 - a_1) \tag{6}$$

where the lower case again denotes logs. In this stylized model inequality depends on how many survive to old age and the difference in the ages at which death occurs. It is useful to write out how (5) changes over time

$$\frac{dV(x)}{dt} = 2p(1-p)\frac{dD}{dt} + D^2(1-2p)\frac{dp}{dt} \tag{7}$$

In principle, progress could consist simply of more people surviving to old age ($\frac{dp}{dt} > 0$). In that case, the first term in (7) would be zero and we would be left with what I will call a "Kuznets curve" for mortality. As with Kuznets' original application to income inequality, the connection between medical progress and inequality is non-monotonic. Inequality increases with progress at a decreasing rate as long as the fraction, p, who survive to old age is less than half. As death in old age becomes common, the second term on the right hand side of (7) becomes negative and progress becomes the handmaiden of equality.

In practice medical progress has also affected the age at which people die in ways that offset the first branch of the Kuznets curve. Specifically, the gap between the age of those who die "early" and those who survive to old age has declined steadily. Thus the first term in (7), which measures that decline, has been negative over most of the history. Table XX, which is taken from English life tables, illustrates some of the key developments in the relevant variables over the last 150 years or so. It draws the line between old and young at 80. Progress is evident throughout this period, but it mainly exempts the old. Instead, progress consists of more people surviving to old age and increased life spans for those who do not. Only in the last 50 years has there been any measurable increase in longevity of the aged. Even so, the aged today can expect to live only three years more than in the era of the dark satanic mills. The two major changes since that time are the vast increases in the numbers of old people and in the life expectancy of those who do not make it to old age.

While the cut off at 80 is somewhat arbitrary, the data in the table help to organize the historical connection between medical progress and inequality. For much of the period, the proportion of old people has been small enough to keep us on the upward sloping branch of the mortality Kuznets curve – i.e the second term on the right hand side of (7) has been positive, though gradually diminishing. The first term has been negative over most of the history as infant mortality and other sources of premature death have been reduced, while geriatric longevity remained the same. Over the first 40 or so years after 1850 the Kuznets effect and the narrowing gap between pre and post geriatric lifetimes offset each other. Some time around the turn of the 20th century the mortality Kuznets effect became sufficiently small for the net effect of medical progress to become decisively egalitarian. This interplay between the Kuznets effect and an increase in longevity toward an apparent ceiling in old age will be important in interpreting the more recent history of mortality inequality in less developed countries.

That history is included in Figures_ through _ . These describe a sample of 13 countries where the data begin sometime in the latter half of the 19th century. This sample is considerably more heterogeneous than the previous one. It includes some countries that have been near the top of the world income distribution all along (e.g., Australia), some that rose considerably (Japan) and some that remain well down (India). For comparison the heavy line in each figure is the average of the 10 country sample discussed earlier.

To reduce clutter and gain some further insight the 13 countries are divided into two quasi-geographic groups. One group of 8 includes European countries plus Australia and New Zealand. All of these, with the possible exception of Russia, are near the top of the world income distribution today (though not necessarily throughout the depicted period). The other 5 countries are in Asia and Latin America, and of these only Japan would qualify as a rich country today.

The broad patterns in these two diverse groups are:

- Long run progress is evident in both the mean and inequality of longevity for both groups. The singular case is Russia, where progress stopped, slowed or even reversed, depending on the measure, some time in the 1950s.
- Convergence in mean life expectancy, as discussed in Becker at al (2004) is also evident, but the degree of convergence is sensitive to economic growth. The convergence is obvious in countries that were poor and became rich (Southern Europe, Japan), less so in countries that remain poor today (Brazil, India).
- By contrast, the degree of inequality has not converged in any straightforward way. For the initially poor countries, the Kuznets effect visibly retards progress until well into the 20th century, long after the progress had begun in the developed world. For Southern Europe and Japan, for example, the inequality at birth measure is nearly the same around 1940 as it was in the developed world a century earlier. For Brazil and India, decisive progress in this measure does not begin until much later. On the whole there is more variety in inequality at birth in the middle of the period than at the beginning or end, and greater rich country-poor country differences today than 100 years ago
- Some of the convergence in the mean and divergence in inequality is driven by the development of infant mortality. If we take out infant mortality (Figures 6 and 7), the common pattern is one of considerable variety in both the levels and improvement of both measures until c.1940, and then a gradual convergence

Taken together, the long run trends summarized in Figures 1 through 7 reveal an important role for mortality inequality in overall social inequality. In some countries, like the United States, where income inequality has apparently declined little over the last century, the link between mortality equality and social equality may have been decisive. Today's poor countries have considerably more mortality inequality than rich countries, but their recent experience suggests that this gap will be steadily eliminated thereby ameliorating the social inequality in these countries.

III. Gender and Geography

Inequality, in mortality as well as in the command over resources at a moment in time, has a group dimension. The odds of success depend on, among other things, where you are born and your sex and race. For example, a girl born in a rich country today can expect to live around 5 to 10 percent longer than a boy born the same day. Here I summarize what we know about the historical evolution of this and related facts. I also try to describe the trend of geographic disparities within one country (the United States). Here I emphasize the last quarter century or so, when overall income inequality has increased, in an attempt to assess whether geographic mortality disparities have complemented or offset the income inequality trends.

A. Male-Female Mortality Differences since 1750

Females are paid less than males per hour, but they live longer. Indeed, they have been the hardier gender from the beginning of our data. Panel A. Figure 8 shows the history of the mean ratio of female to male life expectancy across the long-period-sample of ten countries. Since 1750 the female advantage in life expectancy has averaged around 7 per cent and fluctuated in a range between 2 and 10 per cent. These fluctuations trace clear cycles.[10] The last cycle spans the great medical advances of the last 2/3 of the 20th century. The peak around 1980 coincides roughly with the emergence of advances in treatment of heart disease, which has an especially high incidence among males in late middle age. There is a hint of a slow decline in the female advantage over the century or so preceding the discovery of antibiotics (say 1840-1940), but that sub-trend is not significant statistically. Overall, the female advantage is the same today as it was in 1750 and the same as it has averaged since then.

This long-run stability of the average masks considerable differences across countries at any moment and over time. Panel B of Figure 8 shows the cross-country standard deviation around the mean values plotted in panel A. There is a clear (and statistically significant) decline in this standard deviation around 1900, but the standard deviation is never trivial. For example, even the lower values after 1900 (around .02 or so) suggest a range across these uniformly rich countries in any year which is roughly as wide as the historical band since 1750. Figure 9 illustrates the variety in time series behavior as well as the cross-country variety. Here I show the post WWII history for the four largest countries in this sample. They all show some evidence of the inverted U-shape that characterizes the female advantage in this period. But the pattern differs greatly among the four. In every year the range across these countries is around .04, or half the historical range of the sample average. The peak of the inverted U occurs around 1970 in the US and England and more than 20 years later in Germany. The rank

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[10] The significant first order serial correlation is around .5

correlation between the countries at the beginning and end of the period is negative.[11] The question of why such variety survives similar levels of development and presumably similar access to the frontier of medical technology merits study.

The overall temporal stability of the female mortality advantage masks some significant cross-currents. In Figure 10 I break the female advantage into three components based on age: first in early childhood, then in the broad window from early childhood to late mddle age and finally in the years beyond 50. Higher and rising values signify greater female advantage. The first two panels show the male to female probabilities of death from birth to age 5 and then from age 5 to 50. Prior to the twentieth century the probabilities of death over these two intervals were roughly the same – on the order of .3 or .4. Today both probabilities are well below .1. The last panel shows the female to male ratio of the extra years lived for those who survive to 50, a number which has ranged from around 15 to 30 years over the sample period.

Females have had the better mortality experience in all life stages since the mid 18th century.[12]And until recently medical progress tended to widen that female advantage at every stage from birth to old age. The advantage in early childhood begins growing in the late 19th century. Then around 50 years later, there is a marked acceleration of the female advantage across all life stages. This growth stops in the last two or three decades, and it is decisively reversed for the population that reaches age 50.[13] That decisive

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[11] But not significant in this small sample.

[12] That is, all the ratios in all panels exceed 1 for all years. A few ratios dip below 1 for individual countries, but this is extremely rare. For example, every one of the country-years that are averaged in panel A exceed 1.

[13] The reversal reflects advances in treatment of heart disease, where male morbidity at 50 is considerably greater than female morbidity. However, as shown in panels A and B of figure 10, the trend toward a widening female advantage ended at all life stages at roughly the same time. This suggests that more is at work here than reduced heart mortality, which is essentially non-existent below age 40.

reversal at older ages is driving the inverted U traced by the female advantage in overall life expectancy traces over most of the last century.[14]

The larger sample of countries available over the last century mainly confirms the patterns evident in figures 8 through 10. That is, even for countries that are or have been well below the top of the world income distribution, there is a female advantage in life expectancy at birth that averages on the order of 5 to 10 per cent, and that flattens or reverses in the last quarter century.[15]

While I can safely spare the reader most details about fermale-male differences in lower income countries, no discussion of this source of inequality can ignore the experience of the former Soviet Union. We have already seen how singular this experience has been in the aggregate, with declining life expectancy and stagnating inequality (Figure 6). Every age and gender shows symptoms of this deterioration, but male-female differences are an especially important part of this story.

Figure 11 summarizes some salient facts. Here data for Russia[16] are shown relative to corresponding data for eighteen OECD countries. Panel A. is a summary of relative life expectancy at birth. It shows improvement for both males and females over

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[14] Because mortality by age 50 became very rare the dramatic growth in the female mortality advantage did not translate into similarly dramatic growth in the overall lifetime advantage. Even if a male today has twice the mortality risk as a female every year from from birth to age 50 his cumulative risk is on the order of 5 per cent. Reducing that risk by half or even to zero would have little effect on overall male life expectancy. The future of gender differences in life expectancy will depend almost entirely on developments in old age mortality, such as the advances in heart disease treatment that underlie the reversal of the female advantage in recent years.

[15] India is a prominent exception. Female and male life expectancy over the twentieth century are the same on average, and the time pattern is broadly opposite to much of the rest of the world. Female relastive life expectancy falls 6 percentage points from 1900 to 1940, then reverses around 1970, when the opposite pattern first becomes evident in the developed world.

[16] Our data are for the territory of the Soviet Union from 1897-1987. So it includes the Tsar's empire up to 1917. After 1987 we have some data for some of the constituents for some years, including one year of overlap (1990) between the Russian Federation and the Commonwealth of Independent States (the immediate successor to the Soviet Union). For present purposes the differences in any relevant datum between these two entities were trivial. Accordingly I used Russian Federation data after 1990.

all of the first part of the 20th century with an acceleration following the Bolshevik Revolution. By the mid 1950s Russian life expectancy had come to nearly equal that of the typical advanced country. Then the improvement stops and a relative deterioration sets in that accelerates after the collapse of the Soviet Union, particularly for males.

Perhaps the most notable aspect of this widening gulf between the sexes is the experience of mature adults, some of which is summarized in panel B of Figure 11. For some Russian age-sex groups any deterioration in mortality has been relative but not absolute. For example, infant and early childhood mortality has continued to improve absolutely and substantially in Russia, as it has in the rest of the world. However, for adult Russian males the recent deterioration has been absolute and substantial. Figure 11 shows the experience of 50 year olds, and its significant feature is the very sharp relative decline in male mortality experience in the 1990s. The underlying data show that life expectancy at 50 stopped improving for both sexes from the mid 1950s to the end of the Soviet Union. That already peculiar pattern continues for females up to the present. However, male life expectancy at 50 declined on the order of 3 to 4 years over the decade of the 1990s. A decline of this magnitude is essentially unprecedented in all the data we have since 1750.[17] A 50 year old Russian male today can expect fewer years of life than his counterpart at the coronation of the last Tsar. Younger Russian males have not been spared. They are better off today than a century ago, but not by much. And their mortality experience ha has also deteriorated considerably in the last half century.[18]

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[17] There are considerably larger declines for males during wars, which have been taken out of our data. In addition, very short period substantial declines in life expectancy sometimes occurred during famines. The unique aspect of the Russian adult male decline is that it does not appear to be temporary. It is risky to place great weight on year-to-year changes in these data, but they do show a halt of the decline in adult male and female mortality in the last few years. (The last available year at this writing is 2005.)

[18] The probability that a 5 year old Russian boy will die by age 50 has doubled since 1957, compared to a roughly 20 per cent increase for a 5 year old girl. Most of that increase occurred in the 1990s. (Of course,

The recent Russian experience on gender differences is unique and extreme. But it highlights the lack of any clear trend over time in these differences. Since overall inequality has declined, the contribution from the gender component has grown, but it remains tiny.[19]

both these probabilities have decreased substantially in the rest of the world). The current 5 to 50 mortality rate for males exceeds 1/4; it was over 1/3 in the 1890s.

[19] To illustrate, consider the contemporary values for the standard deviation of log life in the whole population as shown in figures 2 or 3. These are on the order of 20 to 40 log points depending on the definition. Mean gender differences on the order of 7 log points contribute less than 1 log point to these standard deviations.

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