Global trends in lifespan inequality: 1950-2015.

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Abstract

Using data from the UN World Population Prospects, we document global trends in lifespan inequality from 1950 until 2015. Our findings indicate that (i) there has been a sustained decline in overall lifespan inequality, (ii) adult lifespan variability has also declined, but some plateaus and trend reversals have been identified, (iii) lifespan inequality among the elderly has *increased* virtually everywhere, (iv) most of the world variability in age-at-death can be attributed *within*-country variability. Such changes have occurred against a backdrop of generalized longevity increases. Our analyses suggest that the world seems to be facing a new challenge: the emergence of diverging trends in longevity and age-at-death inequality among the elderly around the globe – particularly in high-income areas. As larger fractions of the world population survive to more advanced ages, it will be necessary that national and international health planners recognize the growing heterogeneity that characterizes older populations.

Keywords: lifespan inequality; global disparities; longevity; young, adult and elderly mortality

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Introduction

Living long and healthy lives is among the most highly valued and universal human goals, so the unparalleled longevity gains recorded all over the world during the last decades is a cause for celebration. While a huge body of scholarship has shed considerable light on the 'efficiency part' of the process (i.e. the global, regional and country trajectories in life expectancy over time are very well documented; see Riley 2001, 2005), much less is known about the 'equality part'. Since mortality can arguably be considered as the ultimate measure of health, lifespan inequalities should be seen as the most fundamental manifestations of health disparities. Indeed, the existence of very unequal length of life distributions might go beyond purely natural causes and could be indicative of an unfair state of affairs in which some population groups might be disadvantaged or discriminated against. For this reason, the study of lifespan variability has attracted a great deal of attention from demographers and other social scientists, particularly during the last decade or so (see, among many others, Edwards and Tuljapurkar 2005; Smits and Monden 2009; Engelman et al. 2010; Vaupel et al. 2011; Nau and Firebaugh 2012; Edwards 2013; Van Raalte and Caswell 2013; Gillespie et al. 2014; Van Raalte et al. 2014; Muszyńska and Janssen 2016; Sasson 2016; Seligman et al. 2016; Timonin et al. 2016).

Studies on lifespan disparities usually focus their attention on differences occurring either *between* or *within* countries. The former approach typically compares the average health performance among a cross-section of countries (most often by comparing the corresponding life expectancies) and aims at understanding why population health is better in some countries than in others (e.g. Anand and Ravallion 1993, Preston 1975, Moser et al. 2005). In contrast, the latter approach explores the lifespan differences that might exist among the individuals within a given country. Surprisingly, the study of *global* lifespan inequality (henceforth referred to as GLI) – that is: the study of variations in individuals' lifespan both within *and* between all world countries (henceforth WLI and BLI, respectively) – is largely underdeveloped; so far, it has only been analyzed in a couple of studies either using one or two cross-sections in time (see Smits and Monden 2009 and Edwards 2011). Despite its importance, our understanding of how the different types of inequalities are articulated into a coherent whole and how their relationship evolves as the demographic transition unfolds is still in its infancy – an issue we aim to address in this paper. For the first time, we document the joint evolution in within country, between country and global lifespan inequality during the period spanning from 1950 to 2015, and we investigate in detail the relationship between these trends and the advances in longevity that are sweeping the world.

There are many reasons to be interested in the study of *global* trends in length of life inequality. First, from a practical perspective we now have the possibility to do so. Not long ago, the set of life tables needed to conduct comparative analyses across and within world countries for long time periods was very difficult to access for researchers. Second, from an ethical perspective, if all human beings are entitled to equal rights, egalitarian concerns should apply equally at the national *and* global levels (e.g. should we tolerate individual's lifespan prospects to be determined by their country of birth?). Third, the

study of global inequalities allows us to see how the world has changed – often in fundamental ways – and to study the hotly debated consequences of economic globalization or other global phenomena affecting the living conditions of all human beings. Last but not least, exploring how age-at-death differentials jointly evolve within and between countries can throw considerable light on our understanding of human mortality processes and improve the quality of national and international public health policies.

An analysis of global lifespan inequality must necessarily take into consideration the unprecedented demographic transformations undergone by the world and its regions since the 1950s. On the one hand, the unfolding of the demographic and epidemiological transitions during more than six decades have dramatically changed world countries' population structures. While the prevalence of infant mortality was particularly high among most world countries in the mid-20th century, nowadays childhood and reproductive-age mortality have shrunk considerably, thus moving age-at-death distributions to more advanced ages. On the other hand, country-specific life expectancies and the corresponding population shares (which in turn are affected by differential population growth trajectories) strongly influence global trends in lifespan inequality. To gauge the specific effect that such structural changes have had on lifespan variability across and within countries we incorporate the following analytical strategies. First, we study lifespan variability not only across the entire age range, but also across adult *and* more advanced age ranges (for convenience, the last two ranges comprise the ages above 15 and above 65, respectively[[[Endnote#1]]]). As suggested in previous studies, there are good reasons to separate childhood, adult and elderly mortality (Edwards and Tuljapurkar 2005, Smits and Monden 2009, Engelman et al 2010, Edwards 2011). Second, we resort to well-known and newly developed inequality decomposition techniques that allow going beyond purely descriptive results and analyze what factors are the most important drivers of lifespan dispersion and its evolution over time. Inter alia, we run several counterfactual analyses to identify the influence that countries' relative population size, longevity and within country lifespan inequality have had on the dynamics of global lifespan inequality.

The empirical analysis relies on the latest version of United Nations' World Population Prospects (WPP) for the period from 1950 to 2015. The huge geographic coverage of the database (195 countries) allows performing global, regional and country-level analyses over time. Based on this data source, this paper aims to (i) document levels and trends in longevity and lifespan inequality for overall, adult and elderly mortality in the world and its regions; (ii) decompose global lifespan inequality in its within- and between-country components and assess what the corresponding contributions are; and (iii) examine the potential sources of lifespan inequality and evaluate whether poorer countries are following the footsteps of their richer counterparts or show diverging mortality trajectories.

Why is lifespan inequality important?

The relevance of studying differences in life expectancy across countries is unquestionable. But why should one be interested in measuring lifespan variability? The study of variations in age-at-death is important both for theoretical and practical reasons. As reviewed in the following section, such study can generate valuable insights for a proper understanding of the present and future dynamics in human mortality (e.g. the 'mortality compression' and 'shifting' hypotheses). In addition, the uncertainty associated with larger lifespan inequality, is likely to exert an influence on individuals' beliefs and behavior (Edwards 2013). From a practical perspective, even if differences in life expectancy across groups constitute the primary and most commonly reported form of lifespan inequality, they do not explain the whole story by failing to explain what is happening *within* groups. In this regard, larger lifespan inequality might be indicative of an increase in premature deaths, a disproportionate decrease in old-age mortality, or both things at the same time (Gillespie et al 2014). All these phenomena are a cause of legitimate ethical concern – particularly when the social patterning in mortality is attributable to preventable causes. Several recent studies indicate that looking at differences in group life expectancies alone (i.e. disregarding within group inequalities) can lead to the elaboration of unfair or misinformed policies (see Sasson (2016), Brønnum-Hansen (2017), Permanyer et al (2018)).

In 2000, the release of the World Health Report (WHO, 2000) sparked an intense debate among those who fostered a group-based approach (i.e. comparing average differences across pre-determined social groups, see Braveman et al 2000a,b) and those who took the individual as the basic unit of analysis (see Gakidou et al 2000). The former complained that the World Health Report 2000 decision of focusing on individuals would remove equity and human rights considerations from the agenda, while the latter indicated that focusing on between-group differences only one would lose sight of important within-group differences. Since both approaches are interesting in their own right (see chapters 3 and 4 in Eyal et al 2013) and none of them can claim superiority above the other, in this study we integrate them into a coherent whole by considering between-group differences as one component of total between-individual variation in a population.

Longevity and lifespan variation

Classical health transition theories suggest that longevity increases go in tandem with a transformation of the mortality distribution characterized by a concentration of deaths around the modal age at death, with both the mean and modal age at death increasing (Kannisto 2000, 2001). In this line, the so-called 'mortality compression' or 'rectangularization hypothesis' popularized by Fries (1980) postulates that as the epidemiological transition unfolds, the human survival curves gradually adopts a rectangular shape as life expectancy at birth increases and approaches an upper limit of the human lifespan. In the limit, the survival curve would become fully rectangular and all deaths would occur at the same age. While some studies suggest that the maximum

lifespan of humans is fixed and is unlikely to increase over time (Dong et al. 2016), most empirical evidence has shown no evidence of an upper bound to life expectancy, which continues to increase unabated (Oeppen and Vaupel 2002, Riley 2005).

The progressive rectangularization of the survival curve has been observed in several high-income countries (see Wilmoth and Horiuchi 1999, Shkolnikov, Andreev and Begun 2003). In the majority of cases, increasing longevity is associated with low lifespan disparities when one considers the entire range of ages at death (Vaupel et al. 2011). Yet, several studies have noted that restricting our attention to selected age ranges, the relationship between longevity and lifespan variability weakens, and even reverses. For the US, Myers and Manton (1984) found that while the relationship between life expectancy and lifespan inequality across the entire age range was negative, the relationship turned positive when the age at death distribution was bottom-truncated at the age of 60. Nusselder and Mackenbach (1996), Robine (2001) and Engelman et al. (2010) found similar patterns for other highly industrialized countries. In the same context, Edwards and Tuljapurkar (2005) found stagnating – rather than the expected declining – trends in lifespan variability when bottom truncating the lifespan distribution at the age of 10. While the selection of specific age ranges in the study of mortality compression has been criticized on grounds of arbitrariness (Robine 2001:187), several authors suggest that studying variability measures *conditional* upon survival to a certain age (i.e. exploring the so-called 'conditional' age-at-death distributions) is a promising avenue of research that can reveal unexpected patterns in adult mortality that are otherwise concealed by unconditional measures (Kannisto 2001, Engelman et al. 2010). As longevity increases and larger fractions of the population survive to more advanced ages, it becomes important to go beyond the analysis of mortality across the entire age range and focus our attention on some of its subsets. Rather than sticking to a particular age range, in this paper we document global trends in overall, adult and elderly lifespan variability.

The failure of the rectangularization hypothesis to explain recent trends in conditional lifespan variation measures gradually lead researchers to propose alternative scenarios of human mortality, like the so-called 'mortality translation' or 'shifting mortality model'. This alternative hypothesis suggests that central longevity indicators will continue to increase while the age-at-death distributions retain their shape as they shift towards more advanced ages (Bongaarts and Feeney 2003, Bongaarts 2005, Canudas-Romo 2008). So far, the compression and translation scenarios have been investigated in low-mortality settings, so it remains to be investigated how useful they are to describe trends in lifespan variability across and within world countries. While the mortality compression scenario might characterize the experience of some groups of countries during a certain period of time, the mortality translation could better describe other countries' experience during alternative time periods.

If the mortality compression hypothesis were true for the entire humanity (i.e. in the world as a whole), one should necessarily observe a global reduction in the differences in age at death – not only within countries but also between them. Alternatively, if the translation

hypothesis were the dominant explanation, one should observe a stagnation in lifespan inequality indicators in tandem with increasing longevity indicators. Yet, the current evidence to test such hypotheses at a global scale is sketchy and incomplete. In general, unconditional length of life inequality *within* countries has tended to decrease as longevity increases (Smits and Monden 2009, Vaupel et al 2011). Yet, Engelman et al (2010) report increases in lifespan variability among the elderly within a group of high-income countries. As regards between-country variation, some cross-national studies report worldwide convergence in life expectancy levels between the 1950s and the late 1980s (Goesling and Firebaugh 2004, Moser et al. 2005). Unfortunately, the spread of HIV/AIDS in Africa and the collapse of Communism contributed to reverse this favorable trend. Lastly, the evidence on global trends in lifespan inequality is particularly scarce[[[Endnote#2]]]. Using life tables from 180 countries, Edwards (2011) shows that the world inequality in length of life diminished between 1970 and 2000. In line with the previous two studies, his findings suggest that between-country inequality increased between the two points of time – a matter of concern for public health planners. One of the main aims of this paper is to fill this sketchy evidence by exploring the global trends in lifespan inequality for the world and its regions during the last 65 years. In our analysis, we will explore both unconditional and conditional age-at-death distributions.

Data

The main data source employed in this paper is the UN World Population Prospects' (WPP) abridged life tables, recording the number of deaths for age groups in 5-year intervals (with separate data for infants (age group 0-1) as well as an open-ended 100+ interval) for the 1950-2015 time span, again over 5-year periods. We aggregate our estimates for both sexes, but data is also available separately for females and males. The life tables information is complemented with countries' population size (also available from UN's WPP), which is needed to calculate the between-country component of global lifespan inequality.

In our analysis we use life tables from 195 countries over 13 5-year time periods (from 1950-55 until 2010-15), yielding a total of 2535 country-period observations. For descriptive purposes, we aggregate the data at different levels, employing the United Nations' regional classification of countries (in the Supplementary Material section we show the countries included in each of these regions). Due to the marked impact of the HIV-Aids epidemic on length-of-life distributions, we create a separate category for Sub-Saharan African countries which have had a HIV prevalence of more than 3%[[[Endnote#3]]].

While there is excellent data on mortality by age group for high-income countries, data are generally more sparse and less reliable for developing countries. Nevertheless, the UN population division has assembled a broad data set of country life tables and provides a detailed account of the data sources used in the construction of each countries' set of mortality estimates (see https://esa.un.org/unpd/wpp/DataSources/). Although the use of

model life tables is unavoidable for constructing complete data series for all developing countries, all missing country-year combinations are estimated via indirect methods based on real data. Therefore, while the accuracy of individual inequality estimates might not be perfect for every country in every year, we have strong reasons to believe that the broad picture that emerges from them is a faithful portrait of reality. As indicated along this paper, our empirical findings square well with those from other renowned studies, and the estimates we obtain from the UN WPP are highly correlated with the estimates derived from other reputable data sources, like the Human Mortality Database (HMD).

Methods

Measuring lifespan inequality

Currently, there is an unsettled debate on whether lifespan inequality should be measured using absolute or relative measures (sometimes also referred to as 'additive' and 'proportional' measures, respectively). While there is a long tradition in using relative inequality measures (partly driven by their massive use among economists because of their ability to compare income distributions expressed in different currencies), there is no theoretical reason why one should disregard the use of absolute ones when exploring differences in length of life. The choice between absolute and relative measures can be problematic when assessing trends because the corresponding results do not necessarily coincide – an issue that is partly attributable to the explicit dependence of relative measures to the values of the mean, which tend to change over time. Very often, relative measures might show declines because the mean has increased, while absolute measures might remain unaffected – a technical point that should be taken into consideration when assessing the validity of 'compression' and 'shifting' mortality models. Since the choice between both kinds of measures is purely normative (Atkinson 2013) and no clear consensus seems to be in place, in this paper we use both absolute and relative inequality measures.

In the last few years, several measures have been proposed to measure lifespan variability (see Wrycza et al. (2015) for an excellent review of the most widely used measures). We have selected specific inequality indices[[[Endnote#4]]] based on their popularity and their decomposability properties, which, as we show below, are very useful for the purposes of this paper. The first measure we consider is the Theil index, which is a relative measure defined as:

$$T_a = \frac{1}{l_a}\sum_{x=a}^{\omega} d_x \left(\frac{\alpha_x}{\mu_a}\right) log\left(\frac{\alpha_x}{\mu_a}\right) \qquad [1]$$

where a and ω are the youngest and oldest age intervals taken from the life table, l_a is the radix of the population, μ_a is the average age at death of the population, and d_x and α_x are the life table number of deaths and the average age at death in the age interval x to $x+5$, respectively[[[Endnote#5]]]. When $a = 0$ we are including the entire lifespan

distribution and when $a = 15$ we disregard mortality under 15 and focus on adult mortality only. Since both approaches have been used in the literature (see Smits and Monden 2009, Edwards 2011), we calculate inequality statistics both for the unconditional and conditional distributions. In addition, we also investigate lifespan inequality trends when $a = 65$, that is: length of life inequality among the population beyond the standard retirement age – an analysis that, so far, has only been conducted in a reduced group of high-income countries (see Engelman et al 2010).

Another of the inequality indices we will consider in the paper is the variance. Using the same notation as before it is defined as:

$$V_a = \frac{1}{l_a} \sum_{x=a}^{\omega} d_x (\alpha_x - \mu_a)^2 \qquad [2]$$

Unlike the Theil index, the variance is an absolute inequality measure. Again, we will report the values of this inequality measure for $a = 0, a = 15$ and $a = 65$. As a robustness check, in a Supplementary Material section we complement our analysis showing the results arising from other well-known inequality measures, like the Gini index or the coefficient of variation.

Inequality decompositions

The reason why we have chosen the inequality indices shown in equations [1], [2] is that they are amenable to interesting decompositions that can throw some light on the factors behind lifespan variability dynamics. The Theil index and the variance are known for their additive decomposability property. This means that global lifespan inequality (i.e. variations in age at death around the whole world) can be broken down in two clearly interpretable components: the inequality observed *within* countries and the one capturing the differences in average attainment *between* countries. More formally, additively decomposable inequality measures can be written as

$$I = I_B + I_W = I(\boldsymbol{\mu}_1, \dots, \boldsymbol{\mu}_n) + \sum_{c=1}^{n} s_c I_c \qquad [3]$$

where n is the number of countries, and $\boldsymbol{\mu}_c, s_c$ and I_c are the average length of life, the population share and the lifespan variability in country c, respectively. In the last equation, $I(\boldsymbol{\mu}_1, \dots, \boldsymbol{\mu}_n)$ represents the inequality that would be observed in a hypothetical distribution (sometimes referred to as 'smoothed distribution') where the age at death of each individual corresponds to the average age at death in the corresponding country (i.e. eliminating within-country variations). The second term is a population-weighted average of lifespan inequality within countries. The decomposition formula shown in [3] can be applied irrespective of the choice of the age range (i.e. both for conditional and unconditional lifespan distributions).

Lifespan variation counterfactuals

According to equation [3], global lifespan inequality is a function of three factors: (i) population shares (s_c), (ii) longevity (μ_c), and (iii) lifespan variability (I_c) in the different world countries. To simplify notation and explicitly indicate the dependency of lifespan inequality on these three factors, we will schematically rewrite equation [3] as

$$I_t = f(\{\boldsymbol{s}_t\}, \{\boldsymbol{\mu}_t\}, \{\boldsymbol{I}_t\}) \qquad [4]$$

where the bold letters indicate the country-wise vectors of population shares, longevity and within-country inequality, respectively, the subscript 't' now refers to the time period and f is a function (in the Supplementary Material section, we show the specific functional form that equation [4] adopts when applied to the cases of the Theil index and the variance). Given the transformations undergone by these three components around the world during the last decades, it is interesting to gauge their relative importance in assessing changes in overall lifespan inequality over time. To address this issue we use a set of counterfactual analyses. We ask what would have happened to total lifespan inequality in time period '2' if we held constant one of the three quantities that appear in the inequality index at its earlier (time period '1') value and allowed the other two to take their later (time period '2') value. In this way, we generate a counterfactual level of lifespan inequality in time period '2' and by comparing this with observed inequality in time period '2' we can assess the impact of change in the quantity we kept fixed at time '1' levels on inequality. In this way, we generate the following counterfactual inequalities:

$$C_1 = f(\{\boldsymbol{s}_1\}, \{\boldsymbol{\mu}_2\}, \{\boldsymbol{I}_2\}) \qquad [5]$$

$$C_2 = f(\{\boldsymbol{s}_2\}, \{\boldsymbol{\mu}_1\}, \{\boldsymbol{I}_2\}) \qquad [6]$$

$$C_3 = f(\{\boldsymbol{s}_2\}, \{\boldsymbol{\mu}_2\}, \{\boldsymbol{I}_1\}) \qquad [7]$$

Hence, C_1 indicates the level of lifespan inequality we would observe in time '2' if the population shares of each country had remained at its time '1' levels (i.e. in case there were no population growth). The second counterfactual measures the level of inequality we would observe in time '2' in case the longevity in each country had not changed over time. Lastly, C_3 measures the inequality we would observe in time '2' if within-country lifespan variation had remained at its time '1' levels. Comparing the values of the counterfactuals C_1, C_2, C_3 with the observed inequality levels (i.e. $I_1 = f(\{\boldsymbol{s}_1\}, \{\boldsymbol{\mu}_1\}, \{\boldsymbol{I}_1\})$ and $I_2 = f(\{\boldsymbol{s}_2\}, \{\boldsymbol{\mu}_2\}, \{\boldsymbol{I}_2\})$ we can estimate which of the three factors might have been more decisive in driving lifespan inequality changes over time. Clearly, the counterfactuals shown in equations [5] to [7] can be computed both for conditional and unconditional lifespan distributions.

Empirical Findings

Regional trends

In the different panels of Figure 1 we show the evolution of length of life distributions between 1950-55 and 2010-15 for the world as a whole and for its different regions. Two major changes have occurred when moving from the mid-20th century to the present date. First, all distributions have clearly shifted to the right, thus indicating a lengthening of lifespan across all regions and for the world as a whole. Second, the shape of the age-at-death distributions has changed dramatically during the last decades. Back in the 1950s, age-at-death distributions were twin-peaked, with a local/global maximum for the first age bracket and another local/global maximum at an adult age varying across regions. With the unfolding of the epidemiological and demographic transitions, infant mortality has decreased dramatically, thus gradually shifting the age at death distributions towards the right and increasingly concentrating deaths around their modal age. While these trends generally apply to all regions, we observe lots of heterogeneity across them. After World War II, the child mortality peak of the age-at-death distributions was higher than the adult mortality peak in all world regions except for the group of high-income countries – where child mortality levels were already very low in the 1950s. In the following decades, improvements in the age-at-death distributions can be observed across the board, but the pace of change has not been the same everywhere. In particular, we observe some stagnation around the 1990s for Central Asia and in the HIV-stricken countries of Sub-Saharan Africa.

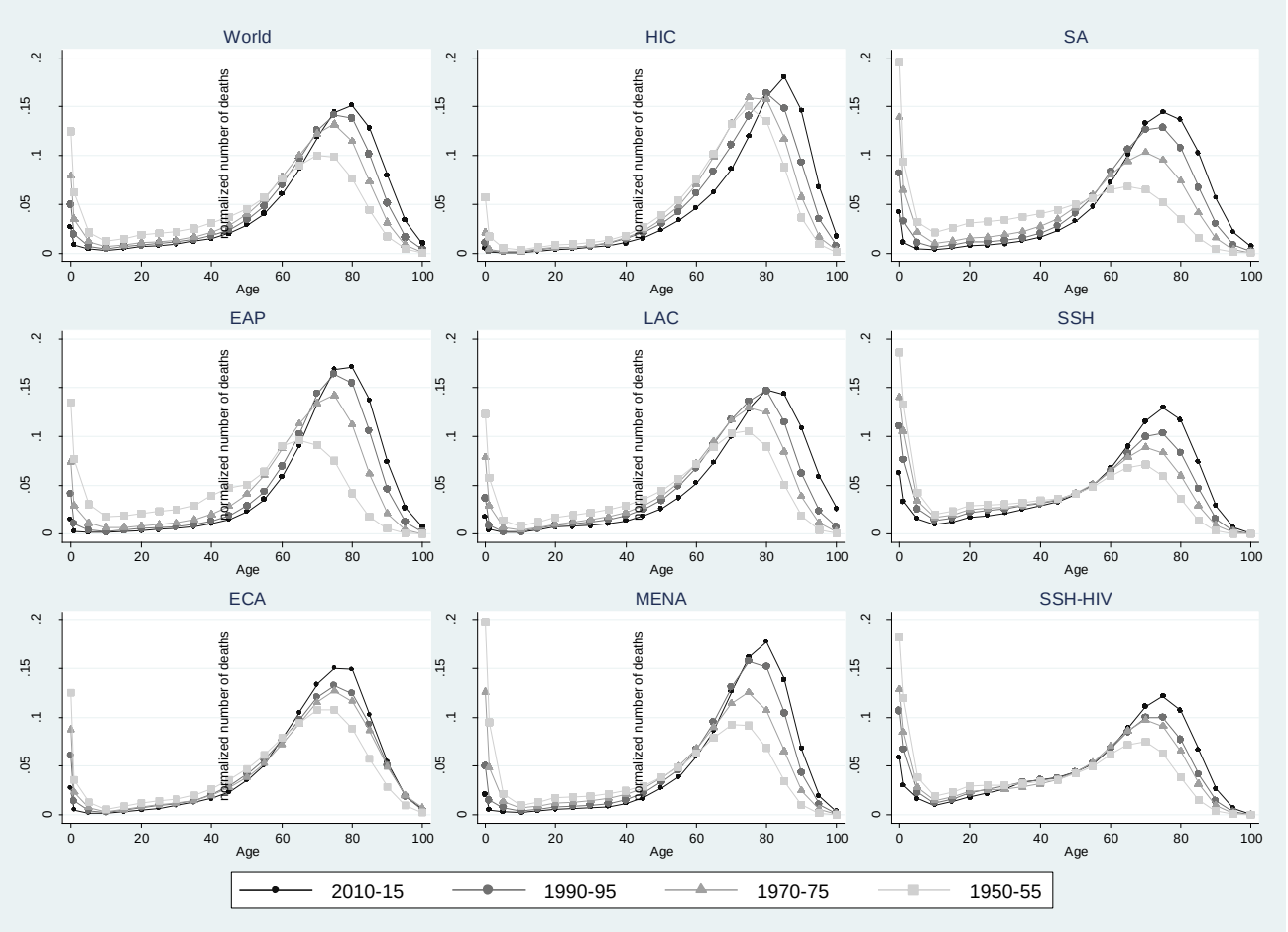

Figure 1. Density functions with age-at-death distributions in 1950-55, 1970-75, 1990-

95, 2010-15 in the world as a whole and its regions. Source: Authors' elaboration based on UN data.

In the light of the aforementioned transformations, what is the extent of longevity and lifespan inequality of the age-at-death distributions shown in Figure 1? The results, presented in Table 1, show several patterns that are worth pointing out. As regards unconditional lifespan distributions, global and regional life expectancies at birth have tended to increase monotonically all over the world (see the first group of columns in Table 1). The group of high-income countries has always had the highest longevity (regional e_0 of 65 in 1950-55 up to 78.6 in 2010-15). At the other extreme, Sub-Saharan Africa is the region with lowest life expectancy all over the period (except in 1950-55, when South Asia was the region with the lowest regional e_0). In tandem with these increases in longevity, we also observe monotonic declines in unconditional lifespan inequality at all moments and in all places (no matter what inequality measure we choose) – a finding that aligns well with conceptually related studies (Vaupel et al. 2011). Given the strong relationship between life expectancy at birth and unconditional lifespan inequality, it is not surprising to find the group of high-income countries and Sub-Saharan Africa as the regions with lowest and highest length of life inequality all over the studied period.

Shifting our attention to adult mortality (see the second group of columns in Table 1), we find relatively similar trends. Average length of life above age 15 (μ_{15}) tends to increase virtually in all places at all times, but not as fast as life expectancy at birth. Like in the previous case, the groups of high-income and Sub-Saharan African countries are the regions with highest and lowest levels of μ_{15}, respectively. Simultaneously, we observe generalized declines in adult lifespan variability – albeit at a much slower pace than the declines in overall lifespan inequality. There are some exceptions to this generally favorable trend in Central Asia and the high-income group around the 1990s (arguably as a consequence of the collapse of the Eastern bloc countries included in these regions), and in the HIV-stricken Sub-Saharan African countries. For the last group we observe some stagnation in the lifespan inequality declines around the 1990s and a slight inconsistency in the trends reported by the Theil index and the variance. The regional trends in overall and adult lifespan inequality reported in Table 1 cohere roughly with the findings reported by Edwards (2011:Figure 3).

Lastly, the trends in elderly mortality are notably different (see the third group of columns in Table 1). As expected, average length of life above 65 (μ_{65}) continues to increase in the world and most of its regions, but some regions increase faster than others. Interestingly, lifespan inequality among the elderly tends to *increase* over time for the world and all its regions (except in Central Asia): no matter what inequality indicator we use, we observe unequivocal increases in length of live variability in the older ages. Curiously, in contrast to the other lifespan inequality indicators shown in Table 1, the levels of lifespan inequality among the elderly across regions are relatively similar. In the 1950s, the group of high-income countries and Central Asia were the region with largest elder lifespan inequality, but in 2010 inequality was largest in Latin America and the

Caribbean. These findings – which cohere with the results of Engelman et al (2010) in the context of high-income countries – are extremely interesting for several reasons that will be discussed later in detail.

Region	Year	Pop. (mio.)	Full lifespan			Ages 15+			Ages 65+		
			e_0	Theil	Var	μ_{15}	Theil	Var	μ_{65}	Theil	Var
EAP	1950-55	732.7	44.6	0.298	854.0	59.4	0.049	308.4	74.6	0.0036	40.9
	1970-75	1137.1	60.6	0.141	672.4	68.6	0.027	228.5	77.1	0.0041	49.3
	1990-95	1659.3	68.8	0.077	473.4	73.0	0.021	199.7	78.9	0.0045	56.8
	2010-15	2005.0	74.2	0.038	299.3	75.8	0.018	186.2	80.6	0.0050	65.2
CA	1950-55	18.1	55.0	0.215	869.4	66.7	0.037	295.0	77.9	0.0051	62.6
	1970-75	34.4	62.4	0.149	753.7	70.9	0.030	268.5	79.5	0.0055	70.6
	1990-95	51.2	65.3	0.107	597.8	71.0	0.028	254.2	79.4	0.0053	67.8
	2010-15	63.9	70.0	0.057	388.4	72.6	0.023	217.3	79.4	0.0051	65.1
HIC	1950-55	854.0	65.0	0.105	576.3	70.6	0.027	235.3	78.4	0.0045	55.4
	1970-75	1046.1	71.1	0.049	350.9	73.2	0.022	212.8	79.6	0.0048	60.6
	1990-95	1184.9	74.3	0.036	305.1	75.5	0.022	226.4	81.5	0.0053	69.7
	2010-15	1275.7	78.6	0.026	256.7	79.2	0.019	214.8	84.1	0.0053	74.8
LAC	1950-55	168.7	52.0	0.243	900.1	64.8	0.043	323.4	77.3	0.0044	52.6
	1970-75	288.1	61.6	0.146	728.1	69.7	0.032	273.7	78.8	0.0048	60.6
	1990-95	448.5	68.8	0.078	500.3	72.5	0.029	265.5	80.3	0.0053	69.2
	2010-15	603.4	74.8	0.050	403.5	76.8	0.026	266.1	83.1	0.0061	84.4
MENA	1950-55	92.5	43.4	0.387	1058.1	63.5	0.046	327.5	76.5	0.0039	46.2
	1970-75	155.3	55.2	0.228	921.4	68.2	0.034	279.4	77.9	0.0043	52.7
	1990-95	261.2	66.7	0.097	559.7	72.1	0.025	226.6	79.0	0.0044	55.1
	2010-15	383.8	72.5	0.050	361.3	74.9	0.021	203.4	80.4	0.0046	59.5
SA	1950-55	477.0	37.2	0.411	880.3	55.4	0.065	367.7	75.0	0.0038	43.8
	1970-75	715.3	49.6	0.274	931.9	64.3	0.041	303.0	76.6	0.0044	52.0
	1990-95	1151.0	59.8	0.156	734.2	68.6	0.031	260.1	77.7	0.0047	57.2
	2010-15	1652.3	68.2	0.083	512.4	72.5	0.026	240.4	79.6	0.0054	68.4
SSH-HIV	1950-55	122.8	37.3	0.428	927.5	56.9	0.064	372.8	74.9	0.0034	39.0
	1970-75	193.5	46.2	0.301	928.7	61.4	0.053	354.2	76.1	0.0039	45.6
	1990-95	334.5	49.7	0.250	878.3	62.2	0.052	360.1	76.8	0.0041	49.2
	2010-15	558.1	58.1	0.149	708.5	65.3	0.046	348.1	78.0	0.0044	54.5
SSA	1950-55	58.6	35.8	0.453	922.5	56.4	0.065	373.7	74.8	0.0034	38.6
	1970-75	92.0	43.3	0.346	961.9	60.4	0.057	368.3	76.1	0.0039	45.3
	1990-95	161.8	49.5	0.266	926.8	63.3	0.051	359.7	77.1	0.0041	49.5
	2010-15	290.5	59.2	0.152	730.4	67.1	0.041	325.6	78.2	0.0044	54.2

Table 1. Regional indicators of longevity and lifespan inequality for unconditional and conditional age-at-death distributions. EAP=East Asia & Pacific, CA= Central Asia, HIC=High-income countries, LAC=Latin America & Caribbean, MENA=Middle East & North Africa, SA=South Asia, SSH-HIV=Sub-Saharan Africa High HIV, SSA=Other Sub-Saharan African countries. Source: Authors' elaboration based on UN data.

Within countries lifespan inequality (WLI)

In our previous analysis we have explored the regional trends in longevity and lifespan inequality. What can be said about the experience of individual countries? In Figure 2 we show a 3×2 scatterplot matrix comparing longevity levels (horizontal axes) against the corresponding lifespan inequality indicators (vertical axes) using data from all world countries between 1950-55 and 2010-15. The scatterplots in the first, second and third rows are based on unconditional, above 15 and above 65 age-at-death distributions, respectively. The scatterplots on the first and second columns measure lifespan inequality using the Theil index and the variance, respectively. In all cases, we superimpose the regional trends for comparative purposes. In general, the trends shown in Figure 2 go in line with the ones presented in Table 1. Like in previous studies (Smits and Monden 2009, Edwards 2011), we observe a strong negative correlation between life expectancy at birth and unconditional lifespan inequality (see first row in Figure 2). As the epidemiologic transition unfolds, longevity increases in tandem with decreases in lifespan inequality. Interestingly, all regions seem to follow a very similar path of demographic convergence, although we observe more cross-country heterogeneity when using absolute measures than relative ones.

Inspecting the relationship between longevity and *adult* mortality (i.e. disregarding under 15 mortality) a different picture arises (see second row in Figure 2). In this case, there is also a generally negative relationship between the two variables, but it is much weaker and the variability across countries and regions is substantially larger than before. Indeed, it is possible to identify several countries and regions where the inequality declines stall and are followed by extended plateaus (this is the case for High-income countries or Latin America and the Caribbean). Once again, there is more between-country and between-region variability using absolute inequality measures than using relative ones. Lastly, examining the relationship between countries' longevity and lifespan inequality among the elderly, we observe *diverging* trends across the board (see third row in Figure 2): as world countries' longevity increases, the variability in age-at-death distributions among the elderly increases as well. The validity of this interesting result does *not* depend on the choice of inequality measure.

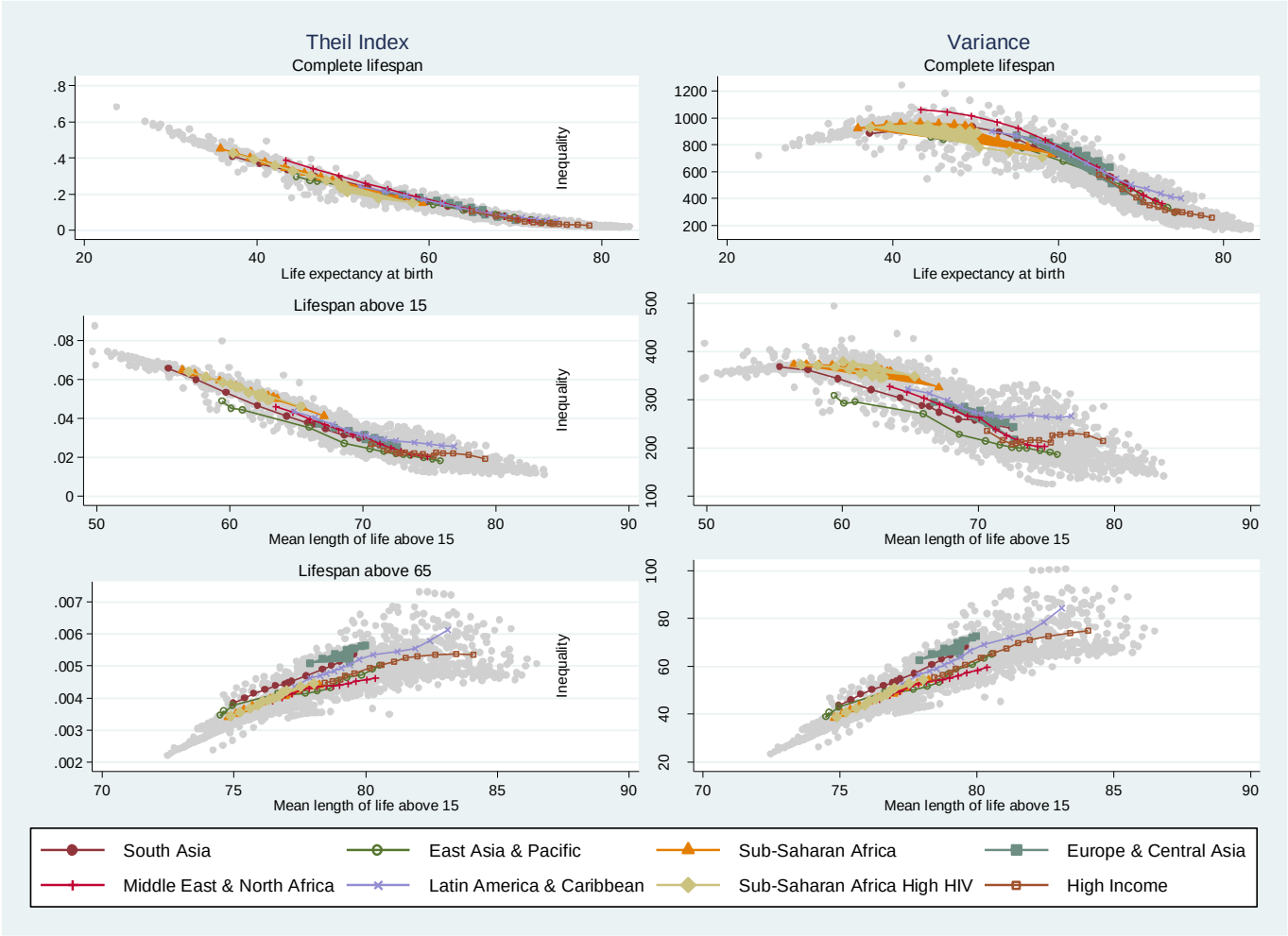

Figure 2: Scatterplots of longevity (horizontal axis) versus lifespan inequality (vertical axis) using the Theil index and the variance for overall, adult and elderly populations. Source: Authors' elaboration based on UN data.

Between country and global lifespan inequalities (BLI and GLI)

What can we say about the trends in global lifespan inequality? To what extent are these trends determined by length of life differences within and between countries? What are the contributions of the intra- and inter-country disparities to GLI? Figure 3 plots the trends in GLI and its within- and between-country components between 1950-55 and 2010-15 (the values upon which this Figure is based are shown in the Supplementary Material section). In the first row, we show the results corresponding to the entire age-at-death distributions, while the second and third rows show the results for the distributions bottom-truncated at 15 and 65, respectively. When considering unconditional age-at-death distributions, lifespan inequality has clearly declined over time – a result that does not depend on the choice of inequality measure. After six decades, GLI levels have shrunk dramatically from 0.26 to 0.06 for the Theil index and from 911.5 to 444.1 for the variance. Interestingly, most of the variation in lifespan across world citizens can be

attributed to differences occurring *within* countries. The contribution of the between-country component for the Theil index goes from 11% in 1950-55 to 7.6% in 2010-15 (for the variance, it declines from 16% to 10.7%).

The values of GLI for the adult population are declining as well, but much less than in the previous case. The Theil index (resp. the variance) declines from 0.046 to 0.025 (resp. from 333.2 to 244.7). In both cases, we observe a clear decline between 1950-55 and 1980-85 followed by a long inequality plateau. In the case of the variance, we even observe some slight increases at the turn of the millennium. These results suggest that the expected global compression in adult mortality has stagnated during the last 30-35 years approximately. Again, the contribution of the between-country component is relatively minor (around 6-12% for the Theil and 6-13% for the variance). Between-country inequality in adult mortality decreased between 1950-55 and 1970-75, increased between 1970-75 and 2000-05 and declined again from 2000-05 until 2010-15. As regards the levels of GLI for age-at-death distributions above 65, we observe the opposite trend. During the last six decades, lifespan inequality among the world elderly has *increased* from 0.0044 to 0.0055 for the Theil index and from 52.6 to 72 for the variance. Once again, these global differences can be mainly attributed to the disparities occurring within countries. The within-country component of global lifespan inequality among the elder has been increasing during the whole period, while the between-country component has declined between 1950-55 and 1970-75 and started increasing unabated from 1970-75 until 2010-15.

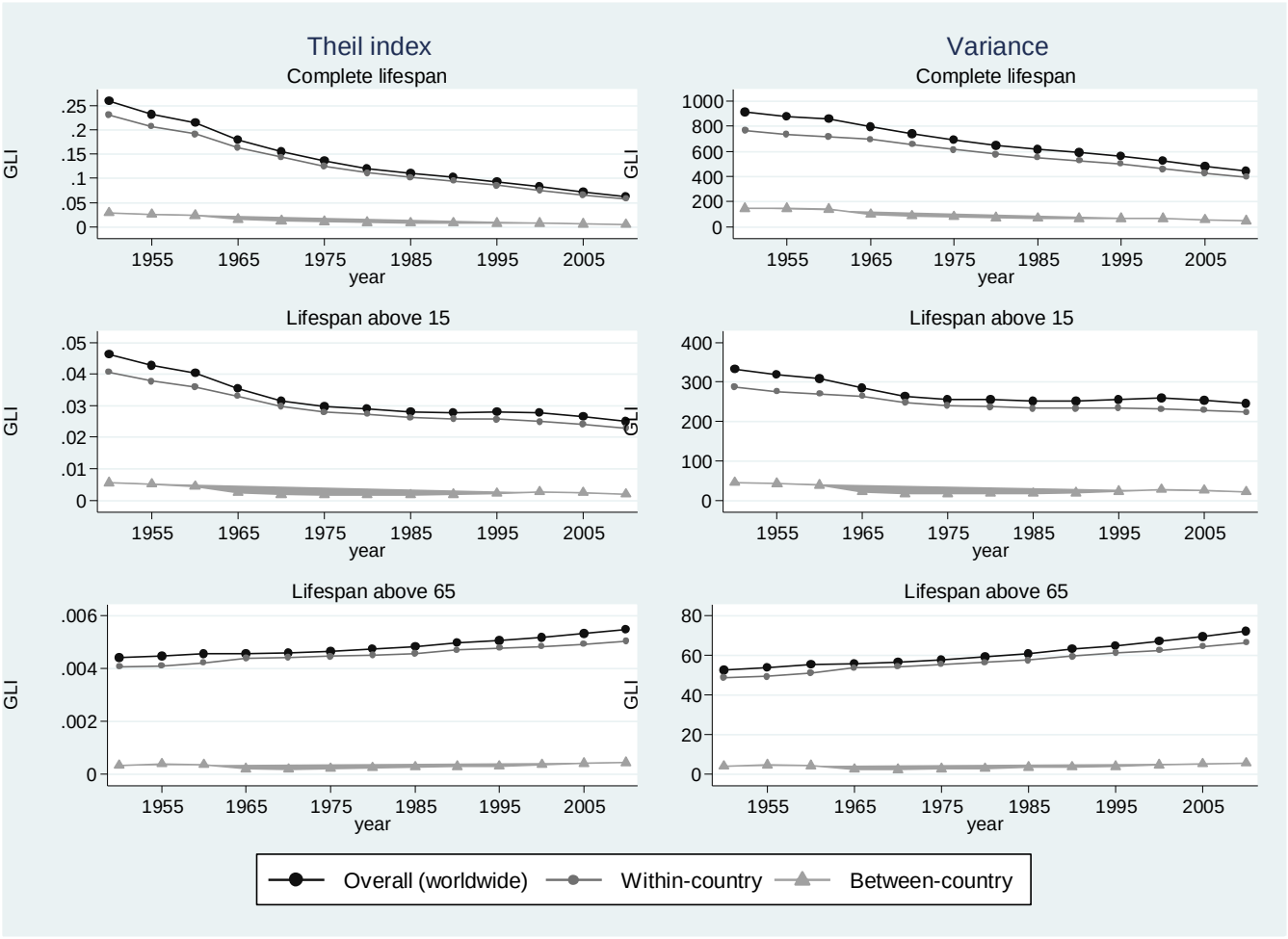

Figure 3. Global lifespan inequality between 1950-55 and 2010-15 using the Theil index and the variance (left and right columns, respectively) for overall, adult and elderly populations. Source: Authors' elaboration based on UN data.

Counterfactual analysis

During the last six decades, the world has undergone major socio-demographic transformations. Both the population size and the rate of increase of longevity have varied considerably across countries. In addition, the shape of lifespan distributions changed substantially over time. In this swiftly changing context, it is important to evaluate what of these explanatory factors have been more decisive in driving changes to GLI levels. For that purpose, we have run several counterfactual analyses. Using equations [4]-[7], we compare the real trends of GLI with the ones that would have been observed had some of its subcomponents (countries' population shares, longevity and lifespan variability) remained constant over time. Table 2 reports such counterfactual trends, both for the Theil index and the variance and for conditional and unconditional age-at-death distributions.

Considering the entire age range, we can conclude that within-country inequality is the strongest determinant of the observed declines in GLI (see counterfactual C_3). Had within-country inequality remained at its 1950-55 levels, GLI levels would have been much higher than the observed ones (i.e. from the "true" 0.0629 for the Theil in 2010-15

up to 0.3036, and from the "true" 444.1 for the variance in 2010-15 up to 868.9). At the other extreme, had population shares remained at their 1950-55 levels, global lifespan inequality would be slightly smaller as it is today (see counterfactual C_1). Hence, even if population growth *per se* has contributed to widen the global lifespan distribution, its effect has been quantitatively small. Somewhere in between, we observe that the effect of longevity on GLI depends on the choice of inequality measure. For the Theil index, changes in longevity have slightly deterred further declines in GLI (i.e. fixing longevity at its 1950-55 levels, GLI would have reached 0.049 rather than the observed 0.06), while the opposite effect is found for the variance (see counterfactual C_2). The counterfactual analyses applied to the age-at-death distributions bottom-truncated at the age of 15 are qualitatively very similar to the previous ones (see central rows in the two panels of Table 2). Lastly, the results for the distributions truncated at 65 suggest that neither population growth nor longevity changes have had an important effect in driving GLI trends. Once again, lifespan inequality trends within countries seems to be the major factor behind the observed GLI trends. Had within country inequality levels remained fixed at their 1950-55 levels, GLI levels among the elderly would have barely changed during the last sixty years.

Summing up, the empirical evidence presented here suggests that the *changes* in global lifespan inequality have been mainly driven by *changes* in within-country lifespan variability and, to a much lesser extent, by longevity trends across countries. Population growth has played a minor role in this process.

Panel A: Theil counterfactuals

Year	1950-55	1960-65	1970-75	1980-85	1990-95	2000-05	2010-15
$Theil$	0.2629	0.2183	0.1571	0.1216	0.1028	0.0827	0.0629
$C_1\ (constant\ population)$		0.2153	0.1504	0.1126	0.0922	0.0713	0.0520
$C_2\ (constant\ \mu)$		0.2126	0.1443	0.1071	0.0878	0.0684	0.0497
$C_3\ (constant\ T_w)$		0.2664	0.2693	0.2782	0.2881	0.2970	0.3036
$Theil\ (15+)$	0.0466	0.0407	0.0316	0.029	0.0277	0.0275	0.0249
$C_1\ (constant\ population)$		0.0403	0.0307	0.0277	0.0263	0.0254	0.0225
$C_2\ (constant\ \mu)$		0.0400	0.0305	0.0277	0.0264	0.0258	0.0227
$C_3\ (constant\ T_w)$		0.0464	0.0454	0.0467	0.0479	0.0497	0.0500
$Theil\ (65+)$	0.0044	0.0046	0.0046	0.0047	0.005	0.0052	0.0055
$C_1\ (constant\ population)$		0.0046	0.0047	0.0049	0.0051	0.0053	0.0056
$C_2\ (constant\ \mu)$		0.0046	0.0047	0.0049	0.0051	0.0052	0.0055
$C_3\ (constant\ T_w)$		0.0044	0.0041	0.0041	0.0041	0.0042	0.0042

Panel B: Variance counterfactuals

Year	1950-55	1960-65	1970-75	1980-85	1990-95	2000-05	2010-15
$Variance$	911.5	860.8	744.9	650.3	593.0	525.5	444.1
$C_1\ (constant\ population)$		856.3	727.8	621.3	555.0	478.1	392.9
$C_2\ (constant\ \mu)$		862.9	794.4	709.5	655.2	588.6	526.1
$C_3\ (constant\ V_w)$		912.7	870.1	867.5	872.4	879.6	868.9
$Variance\ (15+)$	333.2	309.6	264.4	254.6	251.5	257.9	244.7
$C_1\ (constant\ population)$		307.7	260.5	248.1	245.1	246.4	231.2

C_2 $(constant\ \mu)$		314.6	289.5	278.6	273.7	272.2	265.2
C_3 $(constant\ V_w)$		330.1	312.6	317.4	322.9	335.2	333.3
$Variance$ $(65+)$	52.6	55.2	56.5	59.1	63.0	67.0	72.0
C_1 $(constant\ population)$		55.5	57.9	61.7	66.1	69.9	74.9
C_2 $(constant\ \mu)$		54.8	58.8	61.0	64.2	67.3	71.2
C_3 $(constant\ V_w)$		52.8	48.6	48.4	48.6	49.2	50.1

Table 2. Counterfactual analyses for the Theil index (Panel A) and the variance (Panel B). Source: Authors' elaboration based on UN data.

Discussion and concluding remarks

In this paper, we document for the first time global trends in lifespan inequality from the 1950s to the present day. Our findings indicate that the extent of worldwide lifespan variability depends largely on the range of ages we are taking into account. When considering the entire age-at-death distributions, we observe a sustained decline in lifespan variability in the world and its regions between 1950-55 and 2010-15. Such concentration in the age-at-death distributions goes hand in hand with generalized increases in life expectancy at birth – a finding that squares well with related findings reported in previous studies (Smits and Monden 2009, Vaupel et al 2011, Edwards 2011). When the focus shifts to adult mortality (i.e. considering ages above 15), we also observe declines in global lifespan variability, but the evidence is not as compelling as before. While there are clear signs of sustained decline between 1950-55 and 1970-75, from the last year onwards we observe the emergence of inequality plateaus and even trend reversals not only in some specific regions like the Eastern European countries, the HIV-stricken countries of Sub-Saharan Africa and in Latin America and the Caribbean, but also in the world as a whole. These results are in line with the findings of Edwards and Tuljapurkar (2005) reporting adult lifespan inequality plateaus for a selected group of highly industrialized countries. Most of these adverse changes have taken place in spite of the generalized increases in longevity among the adult population. Lastly, focusing our attention on mortality trends among the elderly (i.e. ages above 65), we observe *increases* in lifespan inequality across *all* countries, regions, and in the world as a whole. Again, such changes have occurred against a backdrop of generalized mortality reductions among the elderly.

Decomposing global lifespan inequality levels in its within- and between-country components, we observe that most of the world variability in ages at death can be explained by differences occurring *within* countries. Depending on the inequality measure and the period we choose, the within-country component explains around 85% and 95% of the total variation (Smits and Monden 2009 and Edwards 2011 report analogous contributions within that range). This suggests that traditional narratives in global health disparities focusing on international variations in life expectancy (e.g. Goesling and Firebaugh 2004, Moser et al. 2005) neglect the major source of lifespan inequality: the one that takes place within countries. This is precisely the component that has experienced the most dramatic changes during the last six decades. Indeed, our counterfactual analyses

suggest that the observed *changes* in global lifespan inequality can be largely attributable to the changes in within-country lifespan distributions, while the contribution of increasing longevity and differential population growth have played a relatively minor role. While the between-country component is *relatively* small, it does not mean it is irrelevant. Even if between-country inequality in life expectancies at birth declined unabated from 1950-55 onwards, the cross-national inequality in the mean age at death among adults (i.e. deaths occurring beyond the age of 15) declined between 1950-55 and 1970-75, increased between 1970-75 and 2000-05, but resumed its downward trend until 2010-15. The description given in Edwards (2011) for the period between 1970 and 2000 fits well with our findings, which provide a longer and more nuanced view of the recent trends in international health inequality. Lastly, between-country inequality in the mean age at death among the elderly declined between 1950-55 and 1970-75 but started increasing from the last period until the present day – a matter for concern for international public health planners.

What do these findings tell us about the dynamics of human mortality? For a long time, researchers have debated which scenario best describes the future of mortality (particularly in low-mortality settings): adult mortality compression – where gains in life expectancy go in tandem with reductions in lifespan variation – or shifting mortality – where age-at-death distributions are translated to older ages while retaining their original shape (Canudas-Romo 2008). Inspecting the evolution of the different longevity and lifespan inequality indicators studied in this paper, one finds some support for the compression-rectangularization hypothesis popularized by Fries (1980). Indeed, unconditional lifespan inequality indicators tend to decrease with increasing longevity across all countries, regions and in the world as a whole. Yet, if life expectancy were really approaching a biological limit to human lifespan, one would expect the variations in age-at-death among the elderly to *decrease* with further increases in longevity – the opposite to what we actually observe across all countries, regions, and in the world as a whole. As suggested by Canudas-Romo (2008), it might well be the case that some countries initially follow the compression mortality model and gradually move towards the shifting mortality scenario.

The increase in lifespan variability among the elderly was previously investigated in a selected group of highly industrialized countries (Engelman et al 2010). According to the authors of that study, the systematic increases in longevity alter the health profile of survivors in fundamental ways: advances in medicine, socio-economic conditions and public health planning have facilitated that frailer individuals reach more advanced ages, thus increasing the heterogeneity in health profiles among the elderly. Interestingly, it turns out that such mechanisms might have been operating not only in high-income settings, but also across all world countries and regions (irrespective of their stage in the demographic or epidemiological transitions).

Sources of lifespan inequality

What factors might be driving these remarkable trends in lifespan inequality? As regards the determinants of international health inequalities (i.e. differences in longevity *between* countries), researchers have advanced several explanations. In an attempt to overcome the limitations of Omran's epidemiological transition theory (Omran 1971), Vallin and Meslé (2004, 2017) put forward the framework of 'divergence-convergence cycles'. According to these authors, health transitions can be seen as a succession of cycles composed of divergence periods (generated by revolutionary health innovations, like eradication of infectious diseases, or the cardiovascular revolution), followed by the convergence that ensues when laggard countries adapt and catch up with the forerunners. Indeed, the non-monotonic trends observed in adult and elderly lifespan inequality between countries (see middle and bottom panels in Figure 3) fit well with that description. Very often, the diffusion of knowledge and the adoption of new technologies are listed among the key drivers of international health convergence. Yet, the evolution of such cycles can be suddenly interrupted when socio-economic, political or other external shocks disrupt them for any reason. In this regard, the collapse of the Eastern Block and the spread of HIV/AIDS among Sub-Saharan African countries have been held responsible for the global increase in international health disparities around the 1990s (Goesling and Firebaugh 2004). Lastly, socio-economic differentials can be another key factor that might explain longevity variations across countries. In this line, the increasing cross-country disparities in elderly longevity might be partially explained by countries' unequal access to increasingly expensive technologies that further prolong the lifespan of elderly populations.

As shown before, most of global lifespan inequality changes have taken place *within* countries. The fundamental factor that has contributed to reduce countries' lifespan variability is the reduction in infant mortality. This decrease has been extensively documented elsewhere (e.g. Liu et al 2012, Liu et al 2015) and can be largely attributed to the use of cheap and widely available treatments, like the use of oral rehydration and antibiotics. Among adults and the elderly, within-country disparities in lifespan are often associated with the existence of socio-economic gradients. The positive association between socio-economic status (SES) and adult health and survival is well-established (Davey Smith et al., 1994; Ross and Wu, 1995). To illustrate, higher-educated individuals are, through their higher income, more able to afford food, clothing and accommodation, have jobs that entail fewer health risks, are more engaged in healthy life styles and better informed to use health services and new medical treatments (Hummer and Lariscy 2011, Pincus and Callahan, 1994). In this regard, a collection of recent studies suggests a clear patterning of longevity and lifespan variability in countries' SES groups along the following lines. On the one hand, researchers have often found diverging longevity trends across SES groups, with the socially advantaged ones benefiting more than the rest[[[Endnote#6]]] (see left panel in Figure 4). On the other hand, a handful of studies suggest that (i) there is a negative gradient between SES and lifespan inequality (i.e. lower socio-economic groups tend to have higher levels of lifespan inequality), and (ii) the gradient becomes steeper over time because of the decrease (resp. increase) in lifespan variability among high (resp. low) SES groups[[[Endnote#7]]] (see right panel in Figure

4). Overall, these findings suggest the emergence of divergent health dynamics across SES groups within national borders (at least in the context of high-income countries).

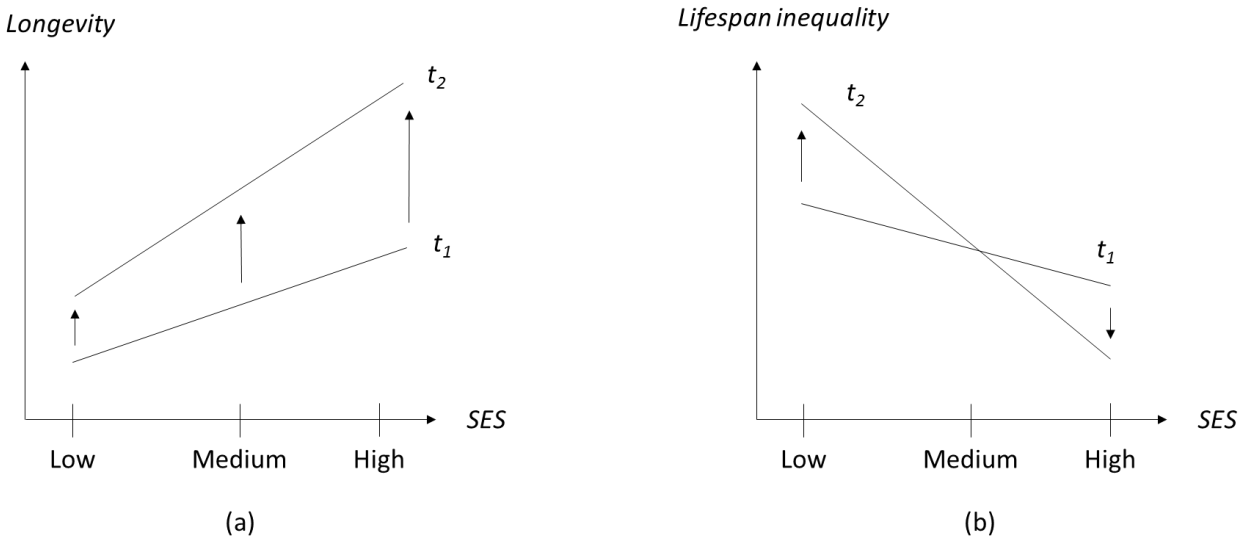

Figure 4. Within country changes in longevity and lifespan inequality across SES groups over time. Source: Authors' elaboration.

Since the levels and trends in global lifespan inequality are mostly attributable to the variations occurring within countries, one might wonder whether the SES health patterning depicted in Figure 4 applies as well for the world as a whole. In such global setting, low SES groups could naturally correspond to low-income countries and vice-versa. Therefore, one would like to know whether (i) poor countries benefit less than the rich ones from generalized longevity gains, and (ii) lifespan inequality increases in poorer countries and decreases in richer ones. These issues are investigated in Figures 5 and 6. Figure 5 plots countries' GDP per capita in 2010 against their longevity levels in 1950-55 *and* in 2010-15. In the upper panel, longevity is measured with life expectancy at birth, while in the middle and lower panels it is measured with the average length of live above 15 and 65 respectively. As can be seen, poorer countries have made larger improvements than richer ones in terms of life expectancy at birth (albeit starting at a lower level), so we observe convergence across countries (the slope of the best-fit line declines from 0.132 in 1950-55 to 0.083 in 2010-15, a statistically significant difference). When considering differences in adult mortality, the results are slightly different (see middle panel in Figure 5). Here, all countries increase their average length of adult life by approximately the same amount – irrespective of their economic level in 2010 – so we observe neither convergence nor divergence (the slope of the best-fit line goes from 0.18 in 1950-55 to 0.16 in 2010-15, a statistically insignificant difference). Lastly, the lower panel in Figure 5 shows that richer countries have increased their average length of life above 65 more than their poorest counterparts, that is: we observe international divergence in longevity gains among the older ages (the slope of the best-fit line increases from 0.38 in 1950-55 to 0.52 in 2010-15, a statistically significant difference). Hence,

whether or not poor countries benefit more than the rich ones from generalized longevity gains crucially depends on the part of the age-at-death distribution we are looking at.

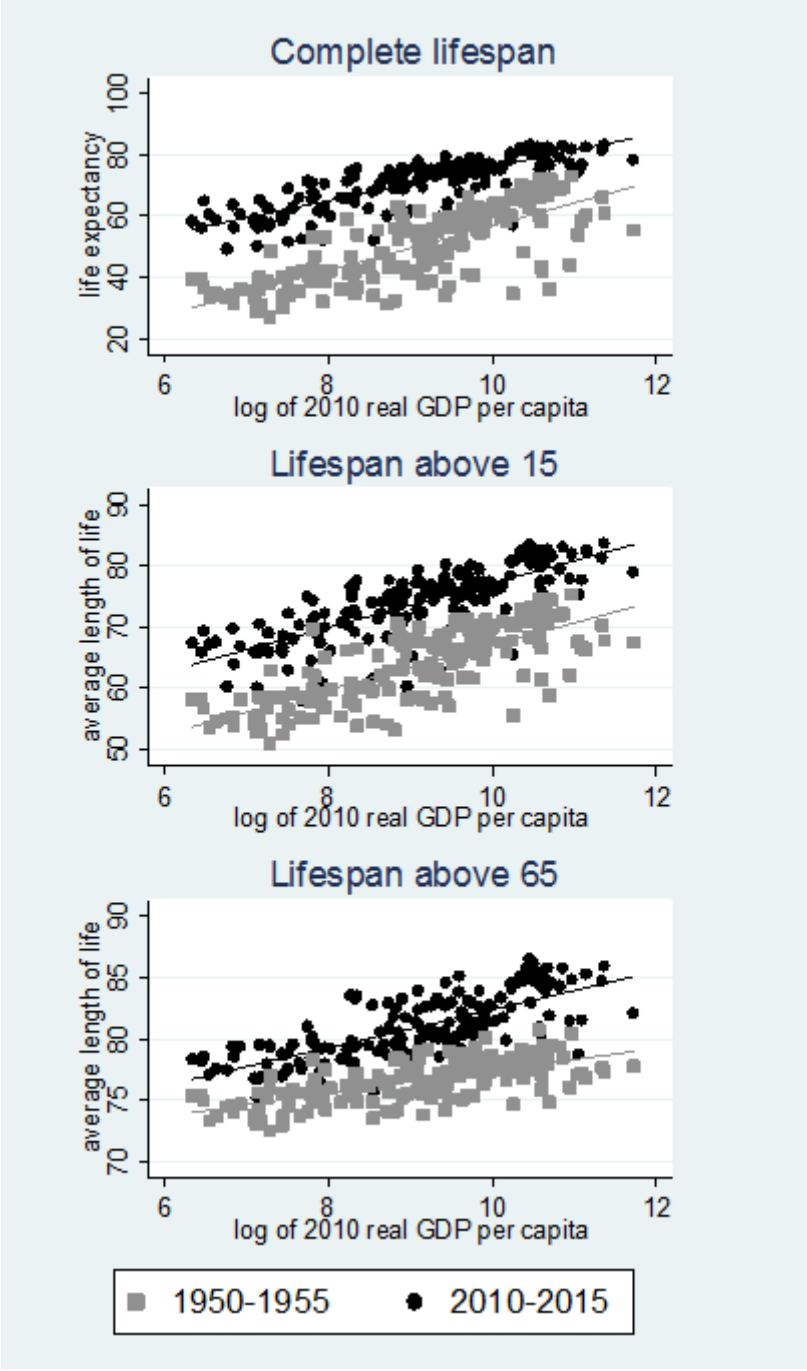

Figure 5. Scatterplot with countries' GDP per capita in 2010 vs life expectancy at birth (upper panel), average length of life above 15 (middle panel) and above 65 (upper panel) for the years 1950-55 and 2010-15. Source: Authors' elaboration based on UN data.

In Figure 6 we show several scatterplots comparing countries' GDP per capita levels in 2010 against several indicators of lifespan inequality in 1950-55 and in 2010-15 (Theil index and the variance applied to unconditional and conditional age-at-death distributions). While none of the scatterplots coincides *exactly* with the lifespan inequality

patterning suggested in the right panel of Figure 4, some of them have much in common. When using the variance for the unconditional and above 15 age-at-death distributions, we can see how the gradient goes in the expected direction *and* becomes steeper over time (i.e. lifespan inequality is lower *and* reduces quicker among high-income countries; see right-top and right-middle scatterplots). Yet, we do not reach the same conclusion when lifespan inequality is measured with the Theil index. In that case, lifespan inequality is lower among richer countries but decreases at a slower pace (see left-top and left-middle scatterplots) – a trend that is influenced by the increases in the mean of the distributions over time. Interestingly, the relationship between income level and lifespan inequality is *reversed* when focusing our attention on the ages above 65 (see bottom scatterplots in Figure 6). As opposed to what has been observed within countries' SES groups (i.e. Figure 4), it turns out that richer countries have *more* lifespan inequality among the elderly than poorer ones. According to the Theil index, countries' lifespan inequality levels among the elderly are converging, but we reach the opposite conclusion with the variance. Summing up, the scatterplots in Figure 6 suggest that when lifespan inequality is measured with the variance, richer countries converge faster when considering the full lifespan distribution but also diverge faster in elderly mortality. Alternatively, the use of relative measures like the Theil index almost invariably lead to the conclusion that poorer countries are catching up and approaching the patterns observed among their richer counterparts. Such discrepancy is reminiscent of the opposing trends that ensue when global income inequality is assessed with absolute or relative measures (see Niño-Zarazúa et al 2016).

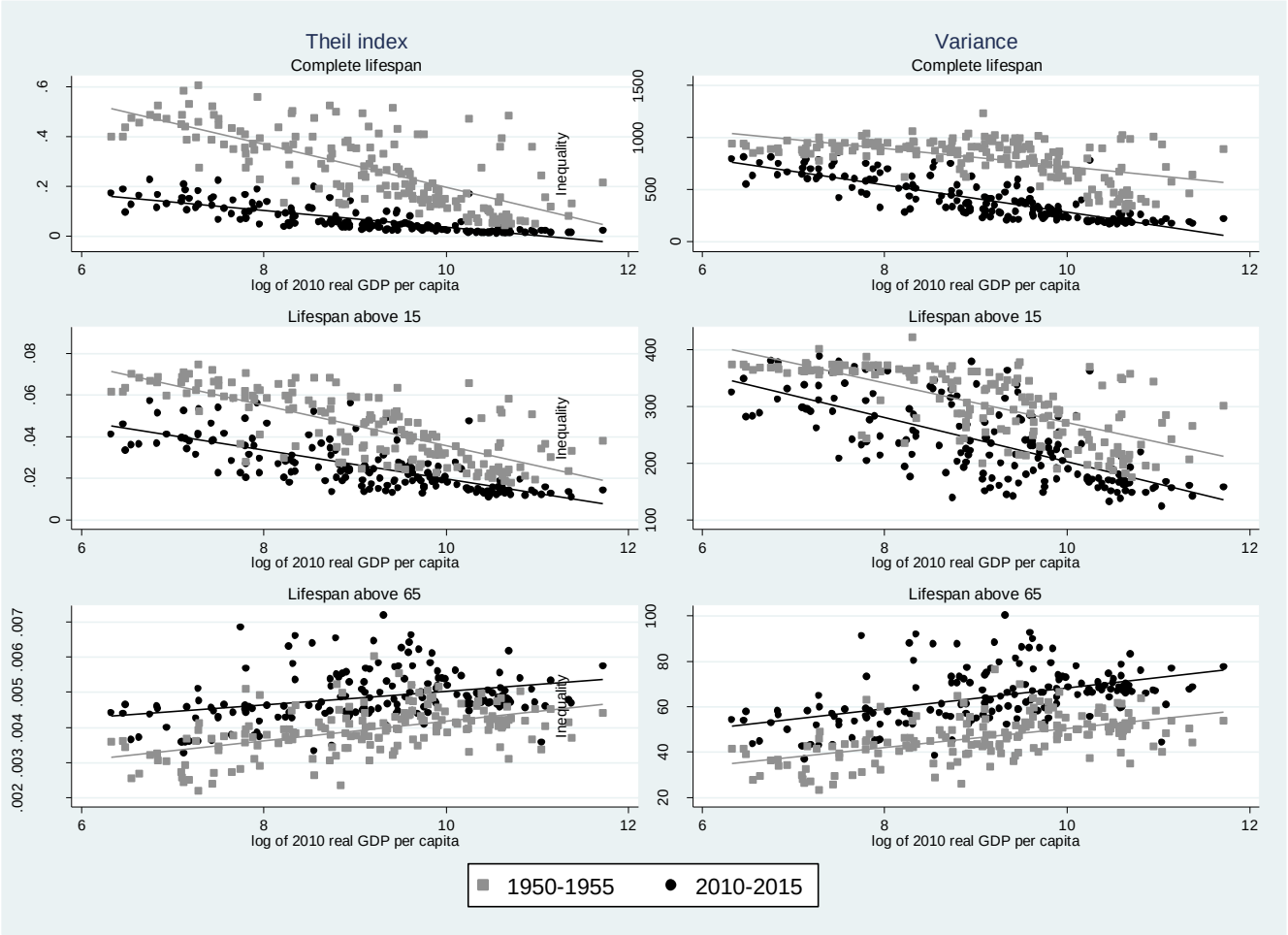

Figure 6. Scatterplot with countries' GDP per capita in 2010 (horizontal axis) versus lifespan inequality (vertical axis) using the Theil index and the variance for overall, adult and elderly populations. The 95% confidence intervals for the slope of the best-fit lines are the following: $(-22.5, -18)$ in 1950-55 and $(-7.4, -5.6)$ in 2010-15 for the top-left panel; $(-94.4, -71.3)$ in 1950-55 and $(-70.1, -54.1)$ in 2010-15 for the middle-left panel; (799.6,1300.2) in 1950-55 and (382.6,885.1) in 2010-15 for the bottom-left panel; $(-0.005, -0.003)$ in 1950-55 and $(-0.006, -0.005)$ in 2010-15 for the top-right panel; $(-0.015, -0.011)$ in 1950-55 and $(-0.017, -0.013)$ in 2010-15 for the middle-right panel; (0.039,0.067) in 1950-55 and (0.06,0.09) in 2010-15 for the bottom- right panel. Source: Authors' elaboration based on UN data.

The analysis presented in this paper have some limitations. First, all our findings are based on the worldwide life tables provided by the UN Population Division, some of which are based on estimated data. The indirect methods that are usually employed to estimate life tables based on incomplete information might over-smooth the corresponding age-at-death distributions – a potential source of downward bias for our lifespan inequality estimates. While we acknowledge that such bias might affect our estimates of lifespan inequality *levels* to a certain extent, we content that it is less likely that it affects lifespan inequality *trends*[[[Endnote#8]]], which are the main subject of interest in this paper. In

addition, comparing lifespan inequality levels for those countries simultaneously included in the UN database *and* in the Human Mortality Database shows an extremely high level of correlation (see Supplementary Material section). Second, the UN life tables are constructed up to age 100, while the HMD life tables include ages up to 110, an issue that might downwardly bias our lifespan inequality estimates. Once again, robustness checks presented in the Supplementary Material section show that this source of bias is negligibly small. Third, our counterfactual lifespan inequality analyses might look somewhat crude at first sight. Using ceteris-paribus-like arguments, they simply assume that some of the three components in our inequality measures can be kept fixed while allowing the others to change over time as they actually did, as if they were completely independent entities. Despite this limitation, such techniques are very useful to derive first-order approximations of complex phenomena that otherwise would be very difficult to model – a factor that explains their popularity in demographic studies (e.g. Goesling and Firebaugh 2004, Breen and Andersen, 2012, Permanyer et al 2013). Lastly, even if the UN data can be disaggregated by sex, we have only reported our findings for the entire population for the sake of brevity. Given the well-known longevity differentials among women and men, in future work it will be interesting to investigate their implications for lifespan inequality, particularly among the elderly.

Despite those limitations, the results presented in this paper confirm that the study of health inequalities should not be limited to the analysis of differences in life expectancy across countries. Since most lifespan variability takes place within countries, focusing on the trends of central longevity indicators alone one disregards the major source of variability, thus potentially arriving at overly simplistic conclusions. During the last decades, much progress has been made in increasing longevity while reducing age-at-death variability across the full lifespan and, to a lesser extent, across adult ages. Yet, we now appear to face a new challenge: the emergence of diverging trends in longevity and lifespan inequality among the elderly *around the globe*. While lifespan inequality is increasing among the elderly virtually across all world countries, longevity and heterogeneity in mortality among the old has increased faster in the richer regions of the globe. As larger fractions of the world population survive to more advanced ages, it will be necessary that national and international health planners recognize the growing heterogeneity that characterizes older populations.

Endnotes

Endnote#1: For the sake of completeness, we have also experimented with alternative age thresholds to define the 'adult' and 'elderly' groups. Yet, the substantive findings of the paper remain unaffected by the choice of alternative thresholds.

Endnote#2: The study by Smits and Monden (2009) measures global lifespan inequality around the year 2000, so it does not allow investigating trends over time.

Endnote#3: Data on HIV prevalence stem from the World Bank's World Development Indicators, which for HIV are based on estimates from UNAIDS. The cut-off at 3% corresponds to the top quintile of countries for which data on HIV prevalence is available, where prevalence is defined as the percent of the population between ages 15 and 45 infected with the virus. For countries without data, we assume that prevalence rates are below 3%.

Endnote#4: Like all previous studies on these matters, we use life table methods to analyze lifespan inequality. This means that we analyze the distribution of the d_x, rather than measuring inequality on observed death counts. This facilitates comparisons across populations with very different structures.

Endnote#5: When ages at death are reported in five-year intervals, we are inevitably missing part of the age-at-death variability. In this regard, it is important to highlight that (i) in countries where life tables are available for one-year intervals (e.g. those included in the HMD), the lifespan inequality estimates based on one-year and five-year intervals are very highly correlated (results not shown here but available upon request); and (ii) it is very unlikely that this affects the lifespan inequality trends over time.

Endnote#6: Steingrímsdóttir et al. (2012) and Deboosere et al. (2009) explored longevity differentials by educational attainment in, respectively, Norway (from 1961 to 2009) and Belgium (from 1991 to 2004). Analogously, Tarkiainen et al. (2012) and Bronnum-Hansen and Baadsgaard (2012) report differences in life expectancy for different income quantiles in, respectively, Finland (from 1988 to 2007) and Denmark (from 1986 to 2014). Other studies from the US have reported life expectancy differentials across education (Case and Deaton, 2015; Sasson, 2016) and income quantile groups (Chetty et al., 2016). While the studies carried out in European countries report increases in longevity across all social groups, this is not the case for the US (with the least-educated non-Hispanic white women experiencing longevity declines). When this happens, the two curves shown in the left panel of Figure 4 cross.

Endnote#7: Only a few recent papers investigate *changes* in lifespan variability across SES groups over time (Edwards and Tuljapurkar (2005) investigate the SES gradient in a single point in time). Sasson (2016) studies the lifespan inequality differences across education groups in the US between 1990 and 2010. Van Raalte et al. (2014) investigated trends in lifespan variability across occupational groups in Finland from 1971 to 2010 and Brønnum-Hansen (2017) across income quartiles in Denmark from 1986 to 2014. Lastly, Permanyer et al (2018) look at longevity and lifespan inequality differences across education groups in Spain between 1960 and 2015.

Endnote#8: Since the bias attributable to potential over-smoothing of life tables is expected to go in the same direction at all times (i.e. downwardly biasing our lifespan inequality estimates), it is to be expected that its potentially distorting influence is much weaker on lifespan inequality trends.

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Supplementary Material

Countries' regional classification (United Nations)

East Asia & Pacific:
Brunei Darussalam, Cambodia, China, Fiji, French Polynesia, Guam, Indonesia, Kiribati, Korea (North), Korea (South), Lao PDR, Macao, SAR China, Malaysia, Micronesia, Federated States of, Mongolia, Myanmar, New Caledonia, Papua New Guinea, Philippines, Samoa, Singapore, Solomon Islands, Thailand, Timor-Leste, Tonga, Vanuatu, Viet Nam.

Central Asia:
Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan.

High Income:
Albania, Australia, Austria, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Canada, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Latvia, Lithuania, Luxembourg, Macedonia, Republic of, Moldova, Montenegro, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine, United Kingdom, United States of America.

Latin America & Caribbean
Antigua and Barbuda, Argentina, Aruba, Bahamas, Barbados, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, French Guiana, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Mexico, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, Saint Lucia, Saint Vincent and Grenadines, Suriname, Trinidad and Tobago, Uruguay, Venezuela (Bolivarian Republic), Virgin Islands.

Middle East & North Africa
Algeria, Armenia, Azerbaijan, Bahrain, Egypt, Georgia, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Palestinian Territory, Qatar, Saudi Arabia, Syrian Arab Republic (Syria), Tunisia, Turkey, United Arab Emirates, Yemen.

South Asia:
Afghanistan, Bangladesh, Bhutan, India, Iran, Islamic Republic of, Maldives, Nepal, Pakistan, Sri Lanka.

Sub-Saharan Africa:
Angola, Benin, Cape Verde, Chad, Comoros, Congo (Brazzaville), Congo, (Kinshasa), Cote d'Ivoire, Djibouti, Eritrea, Gambia, Guinea, Madagascar, Mali, Mauritania, Mauritius, Mayotte, Niger, Reunion, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, United Republic of Tanzania.

Sub-Saharan Africa High HIV:
Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Equatorial Guinea, Ethiopia, Gabon, Ghana, Guinea-Bissau, Kenya, Lesotho, Liberia, Malawi, Mozambique, Namibia, Nigeria, Rwanda, South Africa, South Sudan, Swaziland, Togo, Uganda, Zambia, Zimbabwe.

Decomposition of Global Lifespan Inequality

The following table shows the levels and trends of global lifespan inequality and its decomposition in between-country and within-country inequality (Figure 3 is based upon these numbers).

Theil decomposition of GLI

Year	1950-55	1960-65	1970-75	1980-85	1990-95	2000-05	2010-15
$Theil$	0.2629	0.2183	0.1571	0.1216	0.1028	0.0827	0.0629
$Theil_w$	0.2341	0.1947	0.1449	0.1126	0.0950	0.0756	0.0581
$Theil_b$	0.0288	0.0236	0.0122	0.0090	0.0078	0.0072	0.0048
$\%Contr\ (btw.)$	10.9	10.8	7.7	7.4	7.6	8.6	7.6
$Theil\ (15+)$	0.0466	0.0407	0.0316	0.0290	0.0277	0.0275	0.0249
$Theil_w$	0.0410	0.0362	0.0298	0.0273	0.0259	0.0249	0.0229
$Theil_b$	0.0056	0.0045	0.0018	0.0018	0.0019	0.0026	0.0020
$\%Contr\ (btw.)$	12.0	11.0	5.7	6.1	6.7	9.5	8.0
$Theil\ (65+)$	0.0044	0.0046	0.0046	0.0047	0.0050	0.0052	0.0055
$Theil_w$	0.0041	0.0042	0.0044	0.0045	0.0047	0.0048	0.0051
$Theil_b$	0.0003	0.0004	0.0002	0.0002	0.0003	0.0003	0.0004
$\%Contr\ (btw.)$	7.6	7.8	3.8	4.7	5.5	6.6	7.6

Variance decomposition of GLI

Year	1950-55	1960-65	1970-75	1980-85	1990-95	2000-05	2010-15
$Variance$	911.5	860.8	744.9	650.3	593	525.5	444.1
Var_w	766.6	722.4	659.6	578.9	528	461	396.6
Var_b	144.9	138.4	85.3	71.4	65.0	64.5	47.5
$\%Contr\ (btw.)$	15.9	16.1	11.5	11.0	11.0	12.3	10.7
$Variance\ (15+)$	333.2	309.6	264.4	254.6	251.5	257.9	244.7
Var_w	288.4	271.1	247.4	237.2	232.7	230.7	222.9
Var_b	44.8	38.5	17.0	17.4	18.8	27.2	21.8
$\%Contr\ (btw.)$	13.4	12.4	6.4	6.8	7.5	10.5	8.9
$Variance\ (65+)$	52.6	55.2	56.5	59.1	63.0	67.0	72.0
Var_w	48.7	51.0	54.3	56.3	59.5	62.6	66.5
Var_b	4.0	4.3	2.2	2.8	3.5	4.4	5.5
$\%Contr\ (btw.)$	7.5	7.7	3.9	4.8	5.5	6.6	7.6

Table A1. Theil and variance decompositions of Global Lifespan Inequality over time for the full age-at-death distribution, the deaths above 15 and above 65. Source: Authors' elaboration based on UN data.

Computing the counterfactuals.

In order to compute the counterfactuals shown in equations [5], [6] and [7], we need to write the Theil index and the variance in an appropriate form that explicitly shows the dependency of these measures on the following three factors: (i) population shares (s_c), (ii) longevity (μ_c), and (iii) lifespan variability (I_c). We start with the Theil index. Assuming we have a list of n countries (indexed by c), it is well-known that the Theil index at time t can be written as

$$T_t = \sum_{c=1}^{n} s_{c,t} \frac{\mu_{c,t}}{\mu_t} ln\left(\frac{\mu_{c,t}}{\mu_t}\right) + \sum_{c=1}^{n} s_{c,t} \frac{\mu_{c,t}}{\mu_t} T_{c,t} \qquad [A1]$$

The first part in equation [A1] is the between-country component (which is obtained assuming all individuals in each country die at the same age, so there is no within- country variation) and the second one is the within- country component (which is a weighted sum of the within-country inequalities). Observing that global average age at death is equal to the population-weighted sum of country-specific average age at deaths, $\mu_t = \sum_{c=1}^{n} s_{c,t}\mu_{c,t}$ the additive decomposition of the Theil index (shown in [A1]) for time 't' can be rewritten as:

$$T_t = \sum_{c=1}^{n} s_{c,t} \frac{\mu_{c,t}}{\sum_{c=1}^{n} s_{c,t}\mu_{c,t}} ln\left(\frac{\mu_{c,t}}{\sum_{c=1}^{n} s_{c,t}\mu_{c,t}}\right) + \sum_{c=1}^{n} s_{c,t} \frac{\mu_{c,t}}{\sum_{c=1}^{n} s_{c,t}\mu_{c,t}} T_{c,t} \qquad [A2]$$

In equation [A2] we explicitly see how the Theil index in time 't' can be written as a function of countries' population shares ($s_{c,t}$), longevity ($\mu_{c,t}$), and lifespan variability ($T_{c,t}$).

As regards the variance, it is also well-known that it can be written as

$$V_t = \sum_{c=1}^{n} s_{c,t}\left(\mu_{c,t} - \mu_t\right)^2 + \sum_{c=1}^{n} s_{c,t} V_{c,t} \qquad [A3]$$

This is the additive decomposition of the variance. The first part in equation [A3] is the between-country component and the second one is the within- country component (which is a weighted sum of the within-country inequalities). After simple algebraic manipulations, the last equation can be written as

$$V_t = \sum_{c=1}^{n} s_{c,t}\mu_{c,t}^2 - \mu_t^2 + \sum_{c=1}^{n} s_{c,t} V_{c,t} \qquad [A4]$$

Once again, since $\mu_t = \sum_{c=1}^{n} s_{c,t}\mu_{c,t}$, we can finally rewrite the variance in time t as

$$V_t = \sum_{c=1}^{n} s_{c,t}\mu_{c,t}^2 - \left(\sum_{c=1}^{n} s_{c,t}\,\mu_{c,t}\right)^2 + \sum_{c=1}^{n} s_{c,t} V_{c,t} \qquad [A5]$$

This way, we have written the global variance as a function of the three ingredients we were looking for: the vector of country-specific population shares ($s_{c,t}$), variances ($V_{c,t}$) and longevity levels ($\mu_{c,t}$).

Robustness checks

To check the robustness of our empirical findings, we have performed different consistency tests. First, we have recalculated all our findings using well-known inequality measures other than the Theil index and the variance. Second, we have investigated whether or not the fact of working with life tables up to age 100 (rather than the value of 110 available in the HMD life tables) can downwardly bias our results.

1. Use of alternative inequality measures

Are our findings robust to the choice of alternative inequality measures? To check the robustness of our empirical findings, we will use other well-known inequality measures. One of them will be the family of Generalized Entropy measures GE(θ), which includes the Theil index as a particular case when $\theta = 1$. It is defined as

$$\mathrm{GE}(\theta) = \begin{cases} \frac{1}{l_a}\frac{1}{\theta(\theta-1)}\sum_{x=a}^{\omega} d_x\left[\left(\frac{\alpha_x}{\mu_a}\right)^{\theta} - 1\right] & if\ \ \theta \neq 0,1 \\ \frac{1}{l_a}\sum_{x=a}^{\omega} d_x log\left(\frac{\mu_a}{\alpha_x}\right) & if\ \ \theta = 0 \\ \frac{1}{l_a}\sum_{x=a}^{\omega} d_x\left(\frac{\alpha_x}{\mu_a}\right) log\left(\frac{\alpha_x}{\mu_a}\right) & if\ \ \theta = 1 \end{cases} \qquad [A6]$$

The choice of different values of θ give more emphasis to different parts of the distribution[2]. In Table A2, we show the regional trends in GE(θ) when θ*=0* and θ*=2*. In addition, Table A2 shows the regional trends in lifespan inequality when using the Gini index and the coefficient of variation, which are defined as follows:

$$G = \frac{1}{2l_a^2\mu_a}\sum_{x=a}^{\omega}\sum_{x=a}^{\omega} d_x d_y \left|\alpha_x - \alpha_y\right| \qquad [A7]$$

$$CV = \frac{\sqrt{V_a}}{\mu_a} \qquad [A8]$$

[2] Lower values of θ are associated with greater sensitivity to inequality at the lower tail of the distribution (i.e. among children and young individuals), and higher values of θ place more weight to inequality among the elderly. When $\theta = 0$ we obtain the so-called 'mean log deviation' (MLD) and when $\theta = 2$, GE(2) is ordinally equivalent to the squared coefficient of variation.

The results shown in Table A2 indicate that our findings are highly robust when using other inequality indices. Even if the inequality levels inevitably change when using alternative measures, the differences across regions and over time are preserved. No matter what inequality index we use, we observe generalized declines in age-at-death inequality for the complete lifespan, weaker declines (and even some trend reversals) when focusing on adult mortality, and generalized increases among the elderly.

2. Upper limit of the life table

To assess the robustness of our findings to the use of abridged life tables at age 100, we revisit our analysis with data from the Human Mortality Database (HMD) which contains life table up to age 110 for a limited numbers of (mostly high-income) countries. We find that, considering the full population of ages 0 to 110, the impact of lumping ages 100-110 together in a single category is very small: it amounts to less than 0.01 percent on average for all measures, with the smallest changes occurring for the Gini coefficients (which, as opposed to the other measures employed in the analysis, is not sensitive to the top-, but rather to the middle of the distribution). The largest percentage change observed across all measures, countries, and years is still only 0.5 percent and occurs for variance of the country with the highest life expectancy in the entire dataset, Japan, in the 2010-2015 time period. Naturally, if the population is restricted to older subpopulations, the impact of abridgment is larger, but still negligibly small: for the 65+ population, the changes on our inequality measures are all lower than .01 percent on average. Given that the countries in the HMD are among those with the highest life expectancies worldwide, the effects of abridging life tables at age 100 can be expected to be even smaller for less developed countries where only a very small part of the population survives above age 100 even in the more recent years. We therefore conclude that the use of abridged life tables has virtually no impact, neither qualitatively nor quantitatively, on the results obtained in this paper.

		Full lifespan				Ages 15+				Ages 65+			
Region	Year	GE(0)	GE(2)	Gini	CV	GE(0)	GE(2)	Gini	CV	GE(0)	GE(2)	Gini	CV
EAP	1950-55	0.7969	0.2154	0.3691	0.6564	0.0579	0.0437	0.1652	0.2955	0.0035	0.0036	0.0462	0.0850
	1970-75	0.4546	0.0926	0.2221	0.4303	0.0324	0.0241	0.1183	0.2195	0.0041	0.0041	0.0507	0.0908
	1990-95	0.2710	0.0507	0.1555	0.3185	0.0252	0.0187	0.1025	0.1934	0.0045	0.0045	0.0535	0.0952
	2010-15	0.1199	0.0275	0.1152	0.2344	0.0213	0.0162	0.0955	0.1802	0.0050	0.0050	0.0562	0.0999
ECA	1950-55	0.4900	0.0987	0.2310	0.4442	0.0357	0.0262	0.1233	0.2289	0.0044	0.0044	0.0527	0.0940
	1970-75	0.2197	0.0461	0.1526	0.3036	0.0294	0.0221	0.1132	0.2104	0.0046	0.0047	0.0542	0.0965
	1990-95	0.1726	0.0414	0.1483	0.2879	0.0317	0.0242	0.1199	0.2200	0.0049	0.0049	0.0560	0.0992
	2010-15	0.0972	0.0297	0.1269	0.2436	0.0285	0.0220	0.1137	0.2095	0.0053	0.0052	0.0578	0.1021
HIC	1950-55	0.3558	0.0718	0.1937	0.3790	0.0336	0.0248	0.1202	0.2228	0.0045	0.0046	0.0537	0.0955
	1970-75	0.1981	0.0426	0.1458	0.2918	0.0276	0.0207	0.1093	0.2036	0.0049	0.0049	0.0558	0.0990
	1990-95	0.1071	0.0282	0.1191	0.2373	0.0244	0.0184	0.1021	0.1916	0.0053	0.0053	0.0580	0.1025
	2010-15	0.0635	0.0200	0.1005	0.1999	0.0201	0.0152	0.0921	0.1746	0.0054	0.0052	0.0578	0.1025
LAC	1950-55	0.7201	0.1691	0.3210	0.5815	0.0520	0.0385	0.1534	0.2773	0.0043	0.0043	0.0519	0.0931
	1970-75	0.4844	0.0994	0.2333	0.4458	0.0372	0.0275	0.1272	0.2346	0.0046	0.0046	0.0540	0.0962
	1990-95	0.2633	0.0559	0.1711	0.3343	0.0353	0.0261	0.1233	0.2283	0.0051	0.0052	0.0572	0.1017
	2010-15	0.1492	0.0375	0.1398	0.2739	0.0323	0.0236	0.1165	0.2173	0.0061	0.0061	0.0625	0.1104
MENA	1950-55	1.1240	0.3043	0.4370	0.7802	0.0564	0.0415	0.1597	0.2880	0.0039	0.0039	0.0494	0.0888
	1970-75	0.7129	0.1570	0.3039	0.5604	0.0438	0.0318	0.1371	0.2521	0.0041	0.0042	0.0510	0.0911
	1990-95	0.3063	0.0600	0.1730	0.3464	0.0305	0.0222	0.1121	0.2109	0.0043	0.0044	0.0524	0.0933
	2010-15	0.1647	0.0341	0.1270	0.2613	0.0240	0.0177	0.0987	0.1879	0.0045	0.0045	0.0532	0.0944
SA	1950-55	1.0375	0.3185	0.4536	0.7982	0.0768	0.0607	0.1990	0.3485	0.0038	0.0039	0.0484	0.0884
	1970-75	0.7927	0.1913	0.3427	0.6185	0.0498	0.0369	0.1499	0.2715	0.0043	0.0045	0.0524	0.0943
	1990-95	0.4986	0.1051	0.2411	0.4585	0.0380	0.0278	0.1278	0.2359	0.0047	0.0048	0.0545	0.0975
	2010-15	0.2819	0.0567	0.1703	0.3367	0.0312	0.0233	0.1165	0.2160	0.0054	0.0055	0.0588	0.1047
SSH-HIV	1950-55	1.0868	0.3611	0.4796	0.8498	0.0765	0.0588	0.1948	0.3430	0.0033	0.0034	0.0455	0.0828
	1970-75	0.8855	0.2586	0.4067	0.7192	0.0680	0.0506	0.1784	0.3180	0.0038	0.0039	0.0489	0.0882
	1990-95	0.7151	0.1900	0.3448	0.6165	0.0614	0.0450	0.1668	0.3001	0.0041	0.0041	0.0508	0.0909
	2010-15	0.4383	0.1045	0.2455	0.4571	0.0502	0.0362	0.1471	0.2692	0.0044	0.0044	0.0527	0.0938
SSH	1950-55	1.0505	0.3336	0.4621	0.8168	0.0754	0.0575	0.1922	0.3392	0.0034	0.0035	0.0458	0.0834
	1970-75	0.7973	0.2172	0.3707	0.6591	0.0639	0.0470	0.1710	0.3067	0.0039	0.0039	0.0492	0.0887
	1990-95	0.6779	0.1781	0.3343	0.5968	0.0622	0.0466	0.1708	0.3052	0.0041	0.0042	0.0509	0.0913
	2010-15	0.4174	0.1050	0.2497	0.4583	0.0552	0.0408	0.1584	0.2857	0.0044	0.0045	0.0531	0.0946

Table A2. Lifespan inequality using different indicators across world regions between 1950-55 and 2010-15. Source: Authors' elaboration based on UN data.