Appendix

For Online Publication

This appendix contains 4 parts. Section A presents the comparative statics and the Figures resulting from simulating the model which are referred to in Section III in the paper. Section B introduces the data and provides summary statistics. Section C shows how different filters work, and why we choose the setting in the paper. Section D presents various empirical analyses described in the paper.

A. Theory appendix

A1. mortality rates and economic conditions: comparative statics

Using the expressions in Section III, we can compute the mortality rate at any given age. To illustrate the effects of economic conditions we consider the mortality rate age 2 and how it varies with changes in conditions at age 2 and age 1.

In the first period the (infant) mortality rate MR_1 is given by

$$\begin{aligned} MR_1 = P(H_1 \quad &\leq \quad \underline{H}|g_1) = P\left(H_0 + I(Y_1, B_1) - \delta + \varepsilon_1 \leq \underline{H}|g_1\right) \\ &= P(\varepsilon_1 \leq \varphi_1) = F(\varphi_1) \end{aligned}$$

where $\varphi_1 = \underline{H} - I(Y_1, B_1) + \delta - H_0$ captures the threshold for dying in period 1 in terms of the random shock. Consider now the probability of dying at age $t = 2$. This is given by the probability that the stock falls below $\underline{H}$ at age 2, conditional on having survived to age 2, which can be expressed as:

$$\begin{aligned} MR_2 &= E(D_2 = 1 | D_1 = 0) \\ &= P(H_2 < \underline{H} | H_1 > \underline{H}, g_1, g_2) \\ &= \frac{P(H_2 < \underline{H}, H_1 > \underline{H} | g_1, g_2)}{P(H_1 > \underline{H} | g_1, g_2)} \\ &= \frac{P(\varepsilon_2 < \varphi_2 - \varepsilon_1, \varepsilon_1 > \varphi_1)}{1 - F(\varphi_1)} \\ &= \frac{K(\varphi_2, \varphi_1)}{1 - F(\varphi_1)} \end{aligned} \tag{1}$$

where $\varphi_2 = \underline{H} - I(Y_1, B_1) - I(Y_2, B_2) + \delta + \delta * 2^{\alpha} - H_0$, and $K(\varphi_2, \varphi_1) = \int_{\varepsilon_1 = \varphi_1}^{\infty} \int_{\varepsilon_2 = -\infty}^{\varphi_2 - \varepsilon_1}$ $f(\varepsilon_1) f(\varepsilon_2) d\varepsilon_1 d\varepsilon_2$.

Short-term effects. Under assumptions (1)-(3) in Section 3.1 of the text, we can now express the effect of an unexpected improvement in current economic conditions g_2 on the logarithm of mortality at age 2 as

$$\frac{\partial lnMR_2}{\partial g_2} = \frac{-1}{K(\varphi_2, \varphi_1)} \underbrace{\frac{\partial K}{\partial \varphi_2}}_{>0} \left[\underbrace{I_y \frac{\partial Y_2}{\partial g_2}}_{>0} + \underbrace{I_B \frac{\partial B_2}{\partial g_2}}_{<0} \right] \tag{2}$$

The term outside the parentheses captures the responsiveness of the probability of dying to changes in H and is negative (higher health results in lower mortality). The term inside the parentheses captures the effect of changes in economic conditions on health, and it has an ambigous sign. It depends on how conditions affect both inputs and on how inputs affect health. Because (by assumption) the two inputs have opposite effects (signs) on health, the overall sign of the short term effect of improved conditions is ambigous and determined by the relative magnitudes of the two effects. If overall investment goes up, mortality falls.

Long term effects. Consider now the effect of economic conditions earlier in life, specifically the effect of economic conditions one period earlier, $\frac{\partial lnMR_2}{\partial g_1}$. This effect is given by:

$$\begin{aligned}\frac{\partial lnMR_2}{\partial g_1} \quad &= - \quad \frac{1}{K(\varphi_2,\varphi_1)}\frac{\partial K}{\partial \varphi_2}\left[I_y\frac{\partial Y_2}{\partial g_1}+I_B\frac{\partial B_2}{\partial g_1}+I_y\frac{\partial Y_1}{\partial g_1}+I_B\frac{\partial B_1}{\partial g_1}\right] \\ &- \quad \left[\frac{1}{K(\varphi_2,\varphi_1)}\frac{\partial K}{\partial \varphi_1}+\frac{F'(\varphi_1)}{1-F(\varphi_1)}\right]\left[I_y\frac{\partial Y_1}{\partial g_1}+I_B\frac{\partial B_1}{\partial g_1}\right]\end{aligned}$$

The first term shows that good economic conditions in the past affect current mortality because they affect the level of current health. This is composed of two parts. First, economic conditions in the past affect prior investments $\left[I_y\frac{\partial Y_1}{\partial g_1}+I_B\frac{\partial B_1}{\partial g_1}\right]$ and this changes the initial stock in period 2, h_1. Second, past conditions affect the level of current investment $\left[I_y\frac{\partial Y_2}{\partial g_1}+I_B\frac{\partial B_2}{\partial g_1}\right]$. The overall sign of the term in parenthesis is ambiguous and depends on the relative magnitudes of the two effects over time. The second term corresponds to a selection effect and it also has an ambiguous sign because $\frac{\partial K}{\partial \varphi_1} < 0$ but $F'(\varphi_1) > 0$. Thus the overall effect of changing conditions on the long term is also ambiguous.

Culling versus scarring. Selection effects in this model are small because shocks have permanent "scarring" effects on the health stock of the population, and thus on mortality. We can also consider temporary shocks to mortality that do not affect the stock of health, which might just then by thought of as "culling". One way to characterize these shocks is to model them as idiosyncratic shocks to the dying threshold, so that $\underline{H}_t = \underline{H}(g_t) = \underline{H} + \eta(g_t)$. If we assumed no scarring effects but only temporary culling effects then we can express the effects of shock in the short term as

$$\frac{\partial lnMR_2}{\partial g_2} = \frac{1}{K(\varphi_2,\varphi_1)}\underbrace{\frac{\partial K}{\partial \varphi_2}}_{>0}\frac{\partial \eta(g_2)}{\partial g_2} \tag{3}$$

if good economic conditions raise the threshold ($\eta'(g_t) > 0$), then more people will die. The fraction dying depends on the mass close to the threshold.

The long term effect of this temporary shock to the threshold will be given by

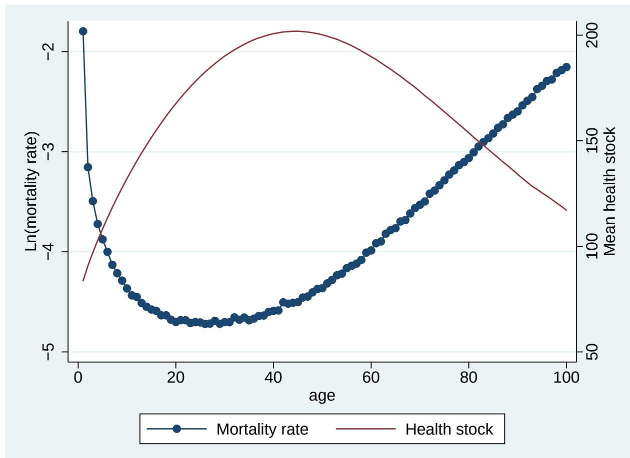
$$\frac{\partial lnMR_2}{\partial g_1} = -\left[\frac{1}{K(\varphi_2,\varphi_1)}\frac{\partial K}{\partial \varphi_1} + \frac{F'(\varphi_1)}{1-F(\varphi_1)}\right]\frac{\partial \eta(g_1)}{\partial g_1}$$

in which case the long term effects are given exclusively by selection effects.

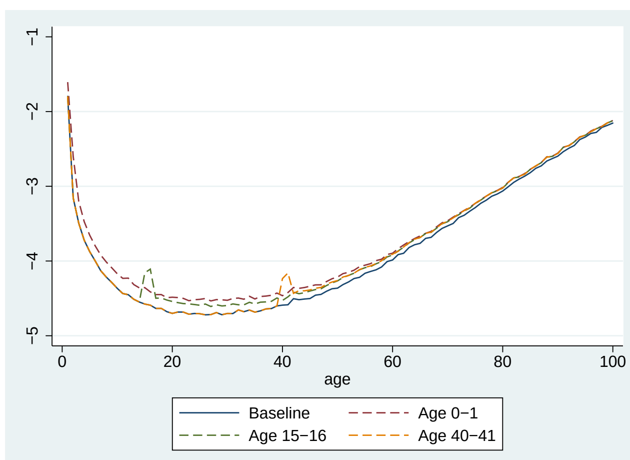
To understand the implications of the model, we simulate mortality rates under different assumptions. We assume the initial health stock H_0 is normally distributed with mean 68 and standard deviation of 34. The threshold for death H is 36. Shocks ε_t are drawn every period from a $N(0,16)$. The rate of depreciation is $\delta = 0.04$, and the aging rate is $\alpha = 1.3$. Last the level of investment is constant at 4.5. These values result in mortality rates matching the profile of males in Belgium in 1860, with an infant mortality of about 17 percent and life expectancy around 38. For details see Lleras-Muney and Moreau (2016).

Figure A1(a) shows the evolution of the health stock and mortality rates with age. Figure A1(b) shows the impact of mortality shocks at three different ages: 1, 15, and 40. We model the shock as a temporary decrease in the investment level from 4.5 to -0.5 that last for two years, and then investment reverts back to 4.5. In each case, mortality remains higher after the shock than in the no-shock baseline, throughout the range of ages.

Figure A1: Evolution of health stock with age



(a) Evolution of mortality rates and health



(b) Effect of negative shocks at different ages

Note: We assume the initial health stock H_0 is normally distributed with mean 68 and standard deviation of 34. The threshold for death H is 36. Shocks ε_t are drawn every period from a $N(0,16)$. The rate of depreciation is $\delta = 0.04$, and the aging rate is $\alpha = 1.3$. Last the level of investment is constant at 4.5. These values result in mortality rates matching the profile of males in Belgium in 1860, with an infant mortality of about 17 percent and life expectancy around 38.

B. Data appendix

B1. Macro level data

Human Mortality Database (HMD) Mortality data are taken from the Human Mortality Database (HMD).[1] To understand the effects of economic conditions over the life time, we need populations with significant time series representation. Table B1 lists the 32 countries with mortality information available prior to 1970 that we study. We exclude Chile (1992-), Germany (1990-), Israel (1983-), Slovenia (1983-), and Taiwan (1970-) because the data covers very few years. The countries in our sample are mostly European countries, and a few other developed countries (Australia, Canada, the US, New Zealand and Japan). Six of the countries are Eastern European (Belarus, Estonia, Latvia, Lithuania, Russia, and Ukraine) and others are formerly Soviet Union (Bulgaria, Czech Republic, Hungary, Poland, and the Slovak Republic); our results are not sensitive to including or excluding these countries, as we show below. For some countries such as Belgium, Denmark, France, and Sweden, we can follow the mortality of all ages since about 1850. But not all countries collected high quality data so early. For example, Australia, Canada, the United Kingdom, and the United States started around 1930. The last country enters the sample in 1960. The average number of years observed is 97 years.

Agriculture Shares of GDP Data on agriculture shares are compiled data from multiple national and international sources and reported by the International Historical Statistics.[2] The data only cover 23 countries in our database. We attempted

[1]See http://www.mortality.org/ for more details.
[2]http://www.eui.eu/Research/Library/ResearchGuides/Economics/Statistics/DataPortal/IHS.aspx

to examine the industrial and service share of the economy as well, but these are not measured as consistently across time or over countries. For example, the industrial sector covers construction for European countries but not for the North America countries. For another, the commerce sector excludes financial for European countries and other services, but covers finance in North America. Thus, we confine our analysis to agriculture.

Figure B1 shows the share of agriculture changing since 1800. Among the countries with available data, the average agriculture share declines from around 40 percent in 1800-1850 to 2 percent in the 2000s.

Unemployment Rate Unemployment rates are not available for all countries and all years. For example, many countries in the former Soviet Union only have unemployment data for the 1990s. The unemployment rate used in this paper are from World Development Index (WDI), Layard et al. (2005), OECD website and Mitchell (1998). Our previous paper Cutler et al. (2015) provides the details.

PM 2.5 data The PM 2.5 data are from Atmospheric Composition Analysis Group (See http://fizz.phys.dal.ca/~atmos/martin/). The researchers estimate ground-level fine particulate matter (PM2.5) by combining Aerosol Optical Depth (AOD) retrievals from the NASA MODIS, MISR, and SeaWIFS instruments with the GEOS-Chem chemical transport model, and subsequently calibrated to global ground-based observations of PM2.5 using Geographically Weighted Regression (GWR) (Van Donkelaar et al., 2016). The data are available since 2000.

Figure B2a show the pro- cyclicality of PM 2.5. Higher GDP fluctuations are associated with higher values of PM2.5.

CO_2 emissions The CO_2 data come from the World Development Indicator (WDI). Carbon dioxide emissions result from the burning of fossil fuels and the manufacture of cement. CO2 emissions are estimated using data on consumption of solid, liquid, and gas fuels and gas flarings (Bank, 2015).

The U.S. Department of Energy's Carbon Dioxide Information Analysis Center (CDIAC) calculates annual anthropogenic emissions from data on fossil fuel consumption (from the United Nations Statistics Division's World Energy Data Set) and world cement manufacturing (from the U.S. Department of Interior's Geological Survey, USGS 2011). Although estimates of global carbon dioxide emissions are probably accurate within 10 percent (as calculated from global average fuel chemistry and use), country estimates may have larger error bounds. Trends estimated from a consistent time series tend to be more accurate than individual values.

Figure B2b show the strong correlation between CO_2 and $PM_{2.5}$ emissions. For the country-year cells with valid measures for both, we regress each on country and year fixed effects, and plot the residuals of $PM_{2.5}$ against those of CO_2. There is a strong positive correlation between the two residuals ($\rho = 0.24$; $p = 0.001$).

Figure B3a shows the trend in average per capita CO_2 emissions across the countries in the sample. Emissions rose rapidly in the 1960s and slowed in the 1970s. After 1980, CO_2 emissions are generally flat, perhaps as a result of environmental regulations (e.g., the Clean Air Act of 1970 in the United States), which would have affected both CO_2 and $PM_{2.5}$. Similar to PM2.5, CO_2 is also strongly procyclical, consistent with Khan et al. (2016). This is shown visually in the top left panel of Figure B4a for CO_2. To form residual CO2 emissions, we regress per capita emissions on country and year dummy variables, and a quadratic time trend for each country.

Other mediators Other mediators in this study including working hours, labor force participation, and transportation. The data are all from OECD website. The alcohol consumption and smoking consumption data are from WHO website.

Figure B3b shows that labor force participation (LFP) of women is increasing over time, while that for men is decreasing. An analogous analysis for women's LFP finds a strong pro-cyclicality, as shown in Figure B3b. Figure B3c shows that hours worked per worker are generally fairly constant over time, fluctuating in a range of about 4 percent. We use the same methodology to detrend work hours and do not find a significant correlation between working hours and GDP fluctuations. Figure B3d transportation miles have increased over time, and the vehicle kilometers present a strong pro-cyclicality in Figure B4d.

We also examine the patterns for health behaviors, including alcohol and tobacco consumption. Panel e in Figure B3 does not show a obvious time trend in alcohol consumption (i.e., the alcohol consumption is measured in liters of pure alcohol per capita), but panel f shows that the tobacco consumption (grammes per capita) has been declining since the 1980s. Panels e and f in Figure B4 shows that both alcohol and tobacco consumption significantly pro-cyclical.

Figure B5 shows the pro-cyclicality of the mediators by government expenditure level. For mediators like CO_2, labor force participation, vehicles miles driven, and tobacco, we find the pro-cyclicality is very similar between high and low government expenditure countries. However, for working hours and alcohol consumption, we find a stronger pro-cyclicality in low-government expenditure countries. The difference is significant (P-value = 0.05) for alcohol consumption but not statistically significant for working hours. We also find that the counter-cyclicality for alcohol is mostly driven by the eastern European countries such as Russia, the pro-cyclicality is similar when we drop Russia, which is classified as a high expenditure country according to our definition.

Consumption Consumption data are from Barro-Ursua Macroeconomic Data (See Barro's website: http://scholar.harvard.edu/barro/publications/barro-ursua-macroeconomic-data for details). It is measured in country-year level. Panels a and b in Figure B6 show the show the pro-cyclicality of consumption in high and low government expenditure countries. The slope is larger in lower expenditure countries. The difference in pro-cyclicality between high and low government expenditure countries is significant (coef = .057 in .032 in high and low government expenditure countries respectively; p-value for difference = 0.04).

B2. Micro level data

European Community Household Panel (ECHP) The ECHP is a panel survey started in 1994, which follows households until 2001. Households are interviewed annually over the seven year span. The ECHP samples people in 14 countries for which we have mortality data. Most of the countries are high government spending countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, and Italy), but there are some low spending countries as well (Ireland, Luxembourg, the Netherlands, Portugal, Spain, and the UK). To focus on early life conditions, we consider people aged 30 and older who live in the country they were born (95.8 percent of the total sample). In total, there are about 750,000 observations for about 150,000 unique individuals, corresponding to 31 countries and covering cohorts born

1911 to 1972. Panel A of Table B2 report the summary statistics for the ECHP sample.

The primary measure of health we employ is self-reported health status, scored on a basis from very good (1) to very bad (5).[3] The average person rates their health a 2.4 on the 1-5 scale. The next outcome is the log of total personal income. We also include variables for satisfaction with work and main activity; financial situation; and leisure time. In each case, the scale is from 1 to 6, with higher levels corresponding to greater satisfaction. The averages are 3.7 for financial satisfaction and 4.6 for leisure time satisfaction.

Our fourth set of variables is for health behaviors. We measure current smoking status and a dummy for obesity (BMI$\geq$30). All of these variables are based on self-reports. Across the cohorts and years, 33 percent of people are current smokers and 13 percent are obese.

Finally, we include measures for social integration: the frequency with which people talk with others and meet with friends. Each of these variables is expressed on a 1 to 5 scale, from never (=1) to on most days (=5). The median person reports talking with others and meeting with friends once or twice a week.

Eurobarometer (EB) The EB is the longest running regular cross-national and cross-temporal opinion poll program in Europe. Starting in 1997 and up to 2012, 31 countries in Europe conducted biannual face-to-face interviews. We use the EB data because we have no mental health or alcohol in the ECHP. But the EB contains

[3]Since the survey is a panel, we can also measure mortality, but the samples are not large enough for accurate estimates at the country-cohort level. Nevertheless, though noisy, our qualitative results are very similar to those we report for self reported health, and for those presented earlier using the HMD.

a smaller number of observations so for other outcomes we present results from the ECHP. We restrict analyses to individuals aged over 30.

As part of the SF-36 Health Survey-instrument the EB asks the occurrence of current mental health problems, and the answers vary from 1 for "Never" to 5 "Almost everyday". These nine questions are about the frequency of feeling full of life, feeling tense, felling down in dumps, feeling calm, having a lot of energy, felling downhearted, feeling worn out, feeling happy, and feeling tired. We use the principle component factor (PCF) model of the answers to the nine questions to construct an overall mental health index. Higher score means being mentally healthier. The EB also contains questions on alcohol–we construct a consistent measure across surveys and look at an indicator for whether the individual drinks every day.

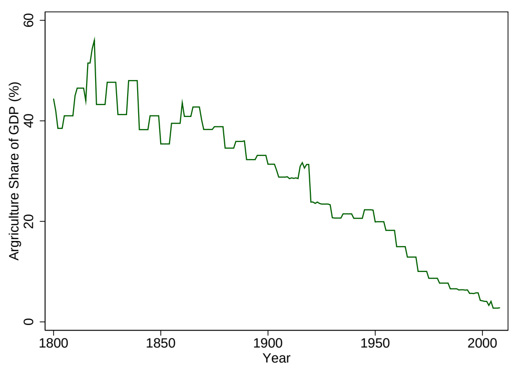
Panel B of Table B2 report the summary statistics for the EB sample. The mental health is standardized with mean value of zero. The standard deviation for the mental health score is 2.16. There are 11 percent of individuals who drink every day.

Survey of Health, Ageing and Retirement in Europe (SHARE) The Survey of Health, Ageing and Retirement in Europe (SHARE) is a multidisciplinary and cross-national panel database of micro data on health, socio-economic status and social and family networks of approximately 123,000 individuals (more than 293,000 interviews) from 20 European countries (+Israel) aged 50 or older (See http://www.share-project.org/ for details)

We use the SHARE data because it contains measures of cognition. The cognition measures we use include verbal fluency, numeracy, and delayed word recall. For verbal fluency tests, the respondents were asked to name members of animals within a limited time span of one minute. The score is the sum of acceptable animals that range from 0 to 100. The numeracy test asks the individual to subtract 7 from the prior number, beginning with 100 for five trials. Correct subtractions are based on the prior number given, so that even if one subtraction is incorrect subsequent trials are evaluated on the given (perhaps wrong) answer. Valid scores are 0-5. Delayed word recall tests memorization ability. It is the count of the number of words from the 10 word immediate recall list that were recalled correctly after a delay spent answering other survey questions. The measure ranges from 0 to 20.

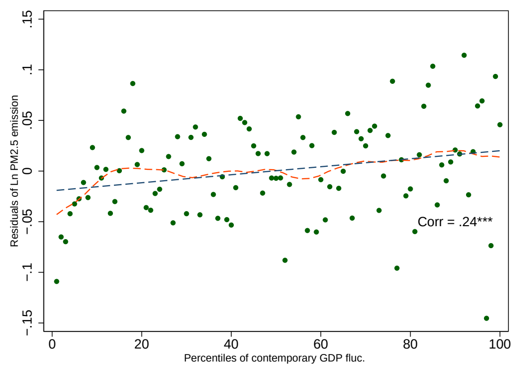
Panel C of Table B2 report the summary statistics for the SHARE. The mean score for verbal fluency, numeracy, and word recall are 20, 3.3 and 8.8, respectively.

Figure B1: Agriculture share over time

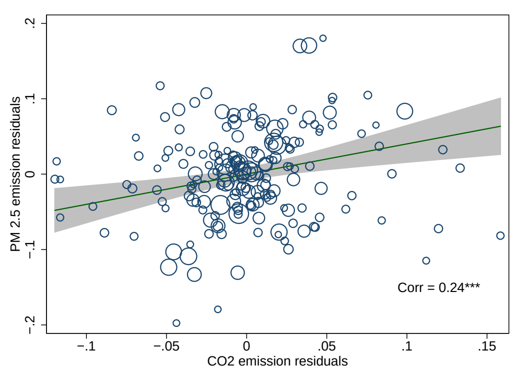


Note: We collect the data from International Historical Statistics (IHS). IHS provides the shares of GDP in about every 5-10 years for each country. The mean value of agriculture share of the 23 countries is plotted.

Figure B2: Pro-cyclicality and correlation with CO_2 of $PM_{2.5}$



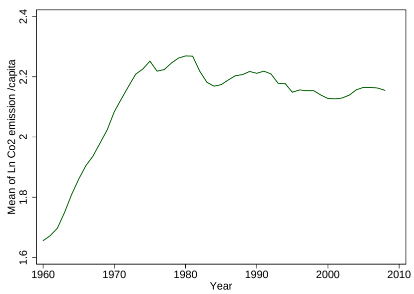
(a) Pro-cyclicality of PM 2.5



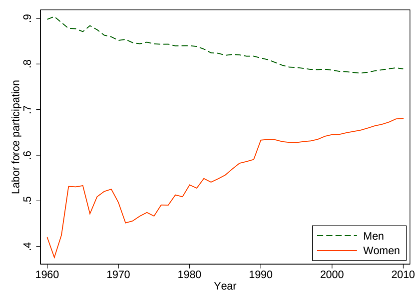
(b) Correlation of PM 2.5 with CO_2

Note: The PM 2.5 data are from Atmospheric Composition Analysis Group. To form residual $PM_{2.5}$ and CO_2 emissions, we use the data from the 23 countries in 2000-2008 and regress per capita emissions in logarithm on country and year dummy variables.

Figure B3: Time Trends for Mediators

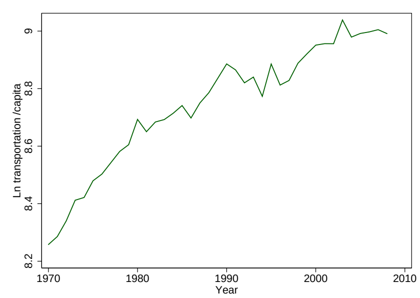


(a) CO_2

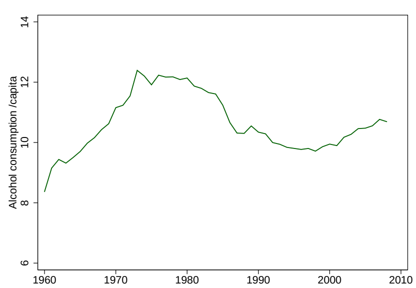


(b) Women and Men LFP

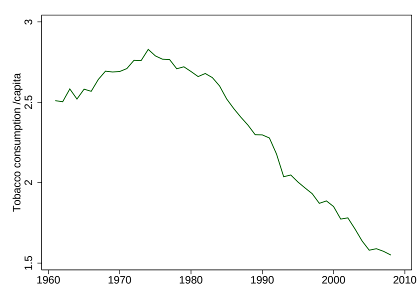
(c) Working Hours



(d) Vehicle Miles Driven



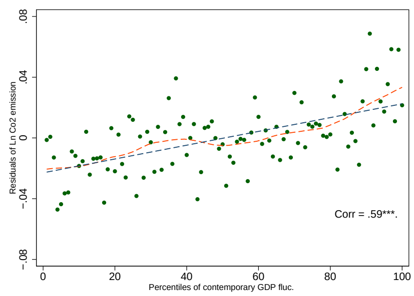
(e) Alcohol consumption



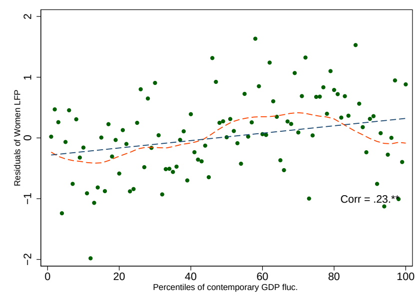
(f) Tobacco consumption

Note: Data source of CO2 emission is World Development Indicators. Working hours and vehicle miles driven are from OECD website. Alcohol and tobacco consumption are from the WHO website. The mean values of all available countries are plotted against the years.

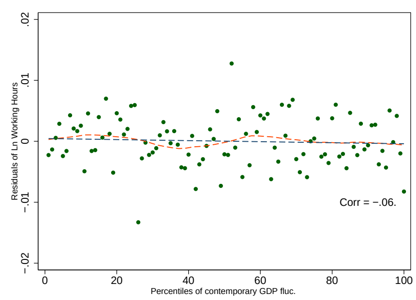
Figure B4: Pro-cyclicality of Pollution, Work Hours, Motor Vehicle, and Health Behaviors



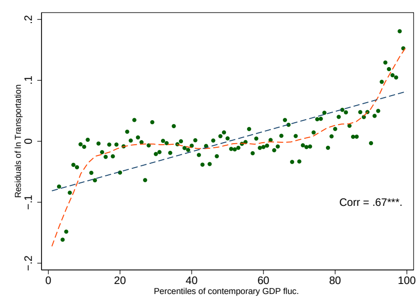
(a) CO_2



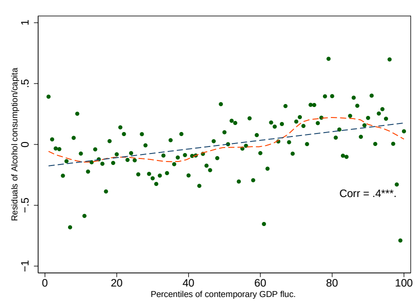
(b) Women LFP



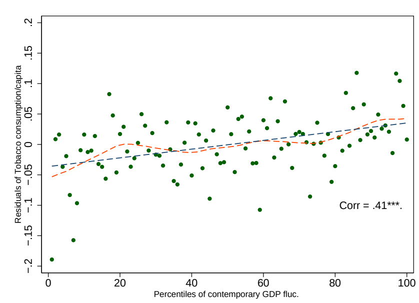
(c) Working Hours



(d) Vehicle Miles Driven



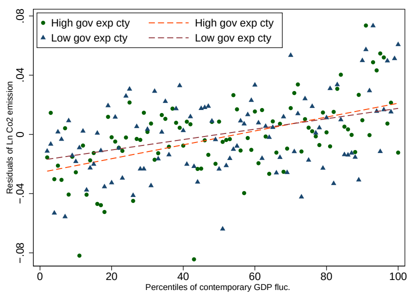
(e) Alcohol consumption



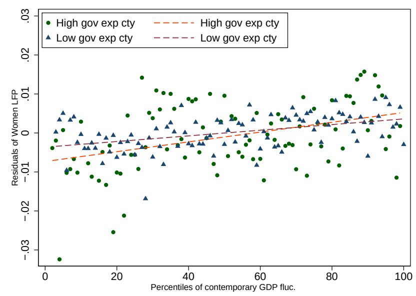
(f) Tobacco consumption

Note: Data source of CO2 emission is World Development Indicators. Working hours and vehicle miles driven are from OECD website. Alcohol and tobacco consumption data are from WHO. To obtain the residuals of the mediators, we use the data from all the available countries in all the years, and then regress each mediator on country and year dummy variables, as well as country specific linear and quadratic trends in time. Then we plot the mean value of the residuals over the bins of the GDP residuals.

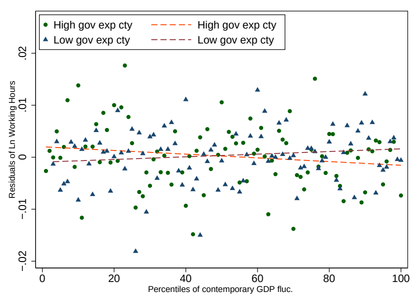
Figure B5: Pro-cyclicality of Mediators, in High and Low government expenditure countries



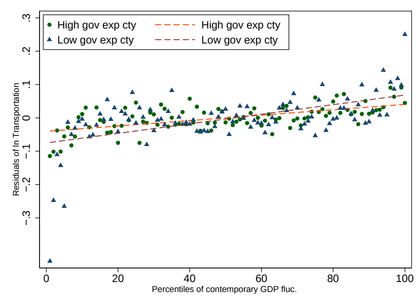
(a) CO_2



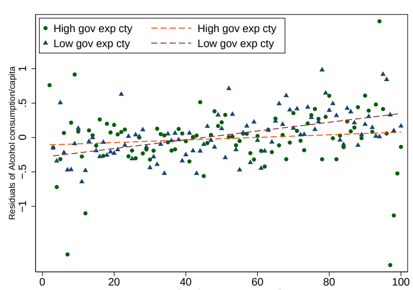
(b) Women LFP



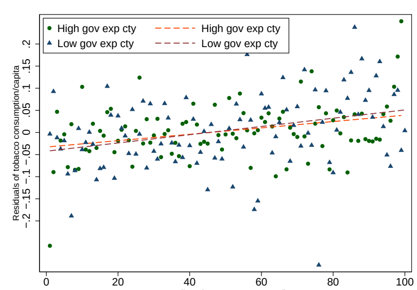
(c) Working Hours



(d) Vehicle Miles Driven



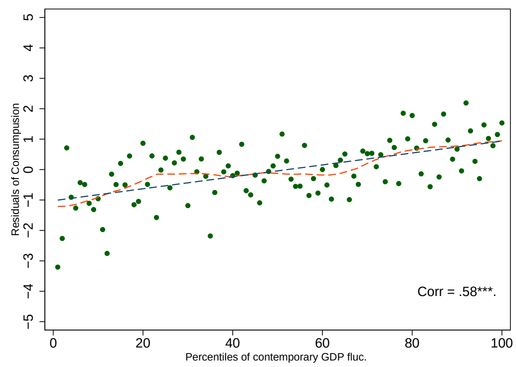
(e) Alcohol consumption



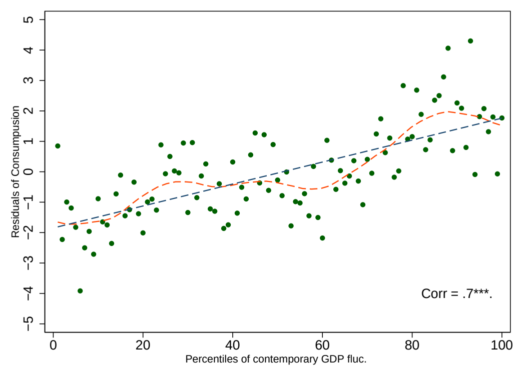
(f) Tobacco consumption

Note: Data source of CO2 emission is World Development Indicators. Working hours and vehicle miles driven are from OECD website. Alcohol and tobacco consumption are from the WHO website. The methodology is the same as that in Figure B4.

Figure B6: Consumption and GDP fluc. in high gov expenditure and low gov expenditure countries



(a) Consumption - GDP (High G countries)



(b) Consumption - GDP (Low G countries)

Note: Consumption data are from Barro-Ursua Macroeconomic data. It is measured in country-year level. The methodology is the same as that in Figure B4. Panels a and b show the pro-cyclicality for consumption in high government expenditure (high G) countries and low government expenditure (low G) countries, respectively.

Table B1: Countries in Human Mortality Database

Country	Earliest Year	Latest year	Gov. exp as share of GDP in 2000	Birth cohorts in sample
Sweden	1800	2011	**55.1%**	1800-1962
France	1816	2012	**51.6%**	1800-1962
Denmark	1835	2011	**53.7%**	1800-1962
Iceland	1838	2010	41.9%	1800-1962
Belgium	1841	2012	**49.1%**	1800-1962
Norway	1846	2009	**42.3%**	1800-1962
Netherlands	1850	2009	**44.2%**	1800-1962
Italy	1872	2009	**46.2%**	1800-1962
Switzerland	1876	2011	35.1%	1800-1962
Finland	1878	2009	**48.3%**	1800-1962
Spain	1908	2009	39.1%	1818-1962
Australia	1921	2009	35.5%	1831-1962
Canada	1921	2009	41.1%	1831-1962
United Kingdom	1922	2011	39.1%	1832-1962
United States	1933	2010	33.9%	1843-1962
Portugal	1940	2012	41.1%	1850-1962
Austria	1947	2010	**52.1%**	1857-1962
Bulgaria	1947	2010	---	1857-1962
Japan	1947	2012	39.1%	1857-1962
New Zealand	1948	2008	38.3%	1858-1962
Czech Rep.	1950	2011	41.8%	1860-1962
Hungary	1950	2009	**46.8%**	1860-1962
Ireland	1950	2009	31.3%	1860-1962
Slovak Republic	1950	2009	**52.1%**	1860-1962
Poland	1958	2009	41.1%	1868-1962
Belarus	1959	2012	---	1869-1962
Estonia	1959	2011	36.1%	1869-1962
Latvia	1959	2011	---	1869-1962
Lithuania	1959	2011	---	1869-1962
Russia	1959	2010	**42.3%**	1869-1962
Ukraine	1959	2009	---	1869-1962
Luxembourg	1960	2009	37.6%	1870-1962

Note: Data are from the HMD. The values in **bold** in the last column denote countries with government spending as a share of GDP that is above the median. Government spending data is not available or less relevant for Eastern European countries.

Table B2: Summary Statistics for ECHP, EB and SHARE Data

Variable	Observations	Mean	Std.
Panel A: ECHP data (Age 30+)			
ln(Total Individual Income)	529,376	11.37	2.17
Health			
Self-reported health status	746,712	2.41	0.97
(1= very good; 5 = very bad)			
Satisfaction (1= not satisfied; 6=very satisfied)			
Life satisfaction	637,846	4.18	1.34
Financial satisfaction	670,227	3.62	1.36
Leisure time satisfaction	637,386	4.19	1.40
Health behaviors			
Current smoker (yes = 1)	241,128	0.33	0.46
Obese (yes = 1)	212,102	0.13	0.33
Social relationships			
Freq. of the activity (1=Never; 5=On most days)			
Talking with others	658,761	4.18	1.01
Meeting friends	729,166	4.01	0.93
Panel B: Eurobarometer data (Age 30+)			
Mental health (PCA score)	45,650	0.00	2.16
Current drinker (yes = 1)	17,831	0.11	0.31
Panel C: SHARE data (Age 50+)			
Self-reported health status	185,236	3.14	1.09
(1= very good; 5 = very bad)			
Cognition			
PCA score	117,670	0.00	1.38
Verbal fluency (0-100)	180,560	19.7	7.63
Numeracy (1-5)	120,316	3.34	1.14
Words recall (0-20)	181,080	8.82	3.71

Note: The data in Panel A are from the European Community Household Panel, 1994-2001. The sample is people aged over 30 with the exception of individual income, which is for people aged 30-64. Birth cohorts 1910 and earlier ones are dropped because of top coding. The data in Panel B are from Eurobarometer. The data in Panel C are from SHARE.

C. Filters for GDP and Mortality

A central issue in our analysis is measuring trend GDP. The most common method to form trend GDP is using a Hodrick and Prescott (1997) filter. This method locally smooths GDP to form trend. A parameter can be adjusted to determine how much smoothing occurs. We use various filters to smooth the ln(GDP /capita).

Panels a and b in Figure C1 shows how they work for the United States. The left column shows the actual ln(GDP /capita) and the smoothed value derived from different smoothing filters over time; the right column shows the corresponding residuals. As the smoothing parameter increases, the filtered GDP line become more smoothed (Panel a), leaving larger variation in the residuals (Panel b). Panels c and d show the results if we use polynomial smoothing. Panels e and f show results for Hamilton (2016) filter and the Baxter-King (BK) filter (Baxter and King, 1999). Panels g and h show the results of moving average (MA) filters. As expected, the larger the bandwidth used to calculate the mean value is, the more smoothed the filtered GDP line is, and the larger variation there is in the residuals.

C1. Characteristics of GDP residuals

C1.1 Correlation of GDP residuals with Unemployment and Autocorrelation

The first column in Table C1 reports the standard deviations for the GDP residuals from the various filters used for all the 32 countries from 1800 to 2008 (N=6,688). Consistently, more smoothed GDP line yields larger variation in the residuals. For example, the standard deviation of residuals from HP 500 filter is 0.088 but that for HP 10 is only 0.038. The largest variation in the residuals are those from polynomial time trend filters. The standard deviation is about 2-3 times of that for others.

Given all these different filters and the corresponding residuals, a natural question is which method is more accurate. We take two approaches to answer this question. The first way to judge is to see which is more correlated with other macroeconomic indicators; the second way is to examine whether our results are sensitive to the smoothing methods used.

Columns 2 through 7 of Table C1 present the relationship of the residuals with unemployment rates in 1,438 country-year cells. Columns 2 and 3 present the OLS regressions without any controls. The next two columns control for country and year fixed effects, and columns 6 and 7 further control for country specific linear and quadratic year trends.

In almost all cases, the residuals are negatively correlated with the unemployment rates. However, the performance for the filters differs. For example, the residuals from the polynomial filters and Hamilton (2016) filter are not so strongly correlated with unemployment rates when country and year fixed effects are included. Another fit index is the R^2. The R^2 for the HP 500 residuals are always higher than those for all the other HP filters, most MA filters, and BK filter. These results suggest that HP 500 filter is a good candidate.

The last column reports the coefficients for AR(1) model of the residuals, which vary from 0.25 for BK filter residuals to 0.96 for the polynomial residuals. Since we use the three-year average to measure contemporary economic conditions and five-year average for the economic conditions in early life, we also investigate the autocorrelations among three-year and five-year averages. We find that the HP 500 and HP 1000 are almost not serially correlated after five-year average.

For these reasons, we use HP filter with smoothing parameter 500 as the main filter used in this study.

C1.2 A Summary of GDP HP 500 residuals

Panel a in Figure C2 presents the relationship between GDP residuals from HP 500 filter and unemployment rates in the United States, The correlation coefficient is -0.56. Panel b shows the data points for all observations.[4]

The upper two panels in Figure C3 show the country-year combinations with GDP fluctuations over |10%|. One can see the Great Depression clearly. Many countries suffered large recessions after World War II. Countries in the former Soviet Union saw adverse shocks in the late 1990s. There are also a number of booms in the first half of the 20th Century. The bottom two panels show the time series mean and standard deviation of GDP fluctuations measured using the HP 500 filter. These mirror the results in panels a and b.

C1.3 Autocorrelation in Mortality Residuals

We also use the different filters on log(mortality) and show the AR(1) results in Table C2. After the linear and quadratic time trend filter, the AR(1) coefficient for the residuals is 0.38. Using HP 10, HP 100, and some moving average filters makes the residuals negatively autocorrelated, which suggest that HP 10 filter may keep too little information in the residuals.[5] Therefore, the main setting in our paper uses the 2nd order polynomial trend smoothing. However, we show below that our short-run

[4]The covariates include country dummies, year dummies, and country specific linear and square trends in years.

[5]The results for BK filter are not shown because BK is a frequency Band-pass filter which may not be applied on mortality.

results are robust to many different filters but the long-run effects will be present when we do not detrend the mortality “too” much.

C2. Results of different filters on GDP and Mortality

C2.1 Results from different GDP residuals

In this section, we show the robustness of our results when detrending GDP in different ways. The first three columns in Table C3 are almost the same as those in Table 1.[6] Columns 4-6 show the results using the BK filter, and the next three columns show the results using MA (+/-3 years) filter. The residuals from these filters are significantly correlated with unemployment and relatively weakly or negatively autocorrelated after 5 years.

The results are consistent across different columns. The magnitude differs mainly because of the different standard deviations in the residuals. For example, based on the estimates in columns 1, 4, and 7, one-stand deviation increase in GDP contemporary residuals leads to 1.2, 0.7, and 1.0 percent increases in mortality, respectively. Similarly, a one-standard deviation increase in GDP fluctuations at ages 6-10 would decrease mortality by 0.6, 1.0 and 0.9 percent, based on the estimates in columns 3, 6, and 9, respectively.

Table C4 shows the result using alternative HP filter parameters, and Table C5 shows the results for different moving average intervals. For the long-term effects, the results are negative but not significant for HP 10 filter residuals. The reason

[6] They are a bit different because of different definition of big boom and big recession. Negative 5 percent and positive 5 percent are around but not exactly at 10th and 90th percentile of HP 500 GDP residuals.

for this is that five-year average is too long for HP 10 residuals.[7] Therefore, we face a trade-off between collinearity and variation. The long term results hold if a-the method for detrending GDP yields residuals that are highly correlated with unemployment, b-both mortality and (5-year average) GDP residuals have AR(1) coefficients that are positive but far from one. We view these as fairly robust, since these are reasonable requirements for the choice of detrending.

Figure C4 graphically show the short-term effects. Similar to figure 1 in the paper, we plot the predicted values in each GDP residual intervals. To make the results comparable from different models, the X-axis is the percentiles of the GDP residuals rather than the absolute ln(GDP) residuals values because the magnitude of the residuals from different filters are not comparable. These figures show the effects of big booms or busts much more clearly. In general, the effects of big recessions are robust to the choice of filter. But the effects of big booms is not apparent when using BK filter, HP 10, and MA +/2 filters. In part, this is because the residuals generated by these filters have a much smaller variation. As the variation in residuals becomes larger, the effects of big booms are more apparent.

We also explored the impact of detrending mortality rates. We systematically investigated this question and estimated 144 different regressions, with 8 filters for mortality (HP 100, 500, 1000; quadratic, cubic and quartic time trends for each country age gender group, 4- and 5-year moving average), and 9 filters for GDP (HP 10, 100, 500, 1000, BK, and 2-, 3-, 4- and 5-year moving averages) and with or without country*year/cohort fixed effects.

[7]As shown in Appendix C1, HP 10 filter GDP residuals AR(1) coefficient is -0.6 for five-year average, and we will show later that the long-run effects are robust if we use GDP residuals at separate ages.

Table C6 shows the short-term effects (in 10th-90th GDP fluctuation region) and Table C7 shows the long-term effects of GDP fluctuations at age 11-15. Short term effects are very robust to how we detrend mortality and GDP. As expected, the coefficients vary because magnitude of the residuals varies with the detrending method. But the sign of GDP fluctuations in the "small" range is positive in 100% of the regressions, and statistically significant (at the 5 percent) in 60 percent of the cases.

The long term results are more sensitive to our detrending choices. If we concentrate attention on the coefficient for economic conditions in adolescence, we find that 101 out of 144 of the regressions give a negative coefficient. Among the 101 negative coefficients, 70 are statistically significant. Among the 31 with positive coefficients, none are statistically significant. There is a pattern to these results. The long term results are always positive and insignificant when we detrend mortality in a way that results in negative serial correlation (HP 10, 100 or moving average of 2, 3 or 4) because the results are then very sensitive to the exact timing of GDP and the years over which we average. Similarly, certain de-trending methods for GDP do not yield significant results. When residuals are small (e.g., those resulting from HP 10), averaging over years reduces the size of fluctuations immensely,[8] and the coefficients are insignificant. An obvious solution is to include GDP fluctuations annually. But if we enter GDP fluctuations annually, collinearity becomes a problem: even with detrending lagged GDP remains significantly related to current GDP, unless we average over five years.

[8] For example, the cohort that was age 16 in the US in 1930 experienced a GDP fluctuation of only -3.8 percent between ages 16-20 with an HP value of 10, but a fluctuation of -17.8 percent with an HP value of 500.

C2.2 Different length of years used to measure economic conditions

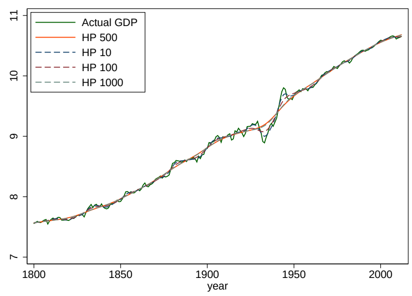
In our paper, we use three-year average HP-filtered GDP residuals to measure the contemporary economic conditions, and five-year averages to measure economic conditions in early life. This section provides results to show the robustness of these assumptions.

Figure C5 shows the short-term effects when using mean value of GDP fluctuations at current year and the year before (i.e., two-year average) to measure the con- temporary economic conditions. These results are comparable to Figure C4. Interestingly, the impact of big booms is larger when we only use two-year averages. Compared to those in Figure C1, the GDP 90-95th percentile residuals of the BK filter, MA (+/- 2 years) filter and HP 10 filter are more likely to be associated with a lower mortality.

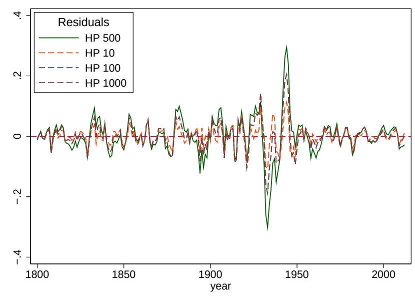
Figure C6 reports the results when we use age-specific GDP residuals at ages birth to 30. Because of different standard deviations of the residuals, the coefficients are not directly comparable. Thus, figure C6 reports the effects of one standard deviation increase in the GDP residuals. Panel a presents the results for HP 10, MA (+/- 3 years), and BK filters. The three show a very consistent pattern, with similar effects of a 1 standard deviation change.

Panels b and c of Figure C6 shows the results of using different HP filters and those of using different MA filters, respectively. The patterns in the two figures echoes the AR(1) results: the results are more salient when the autocorrelation is weaker. Compared to the insignificant results of using 5-year average HP 10 filter GDP residuals, the results using the HP 10 residuals at separate ages are most salient, as shown in Panel b. Consistently, Panel c presents a similar pattern: when the bandwidth becomes larger, autocorrelation is stronger (Table C1), and the magnitude is smaller when using age-specific GDP fluctuations. Therefore, we face a trade-off between collinearity and variation. As a result, in our paper, we use five-year average for the HP 500 filtered GDP residuals.

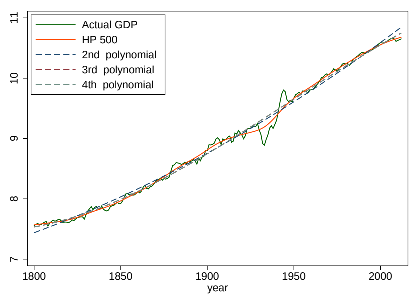
Figure C1: Actual and Smoothed GDP in the United States



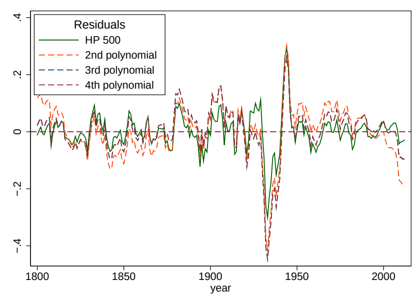
(a) HP filters



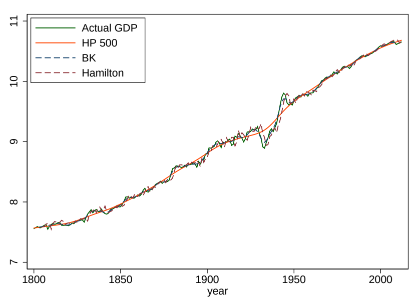
(b) Residuals from HP filters



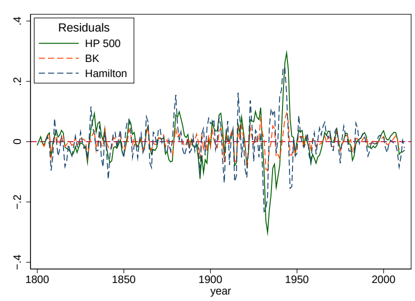
(c) Polynomial-smoothed GDP



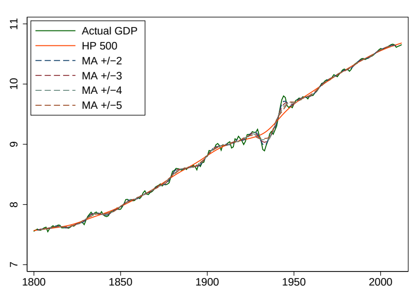
(d) Residuals from Polynomial filters



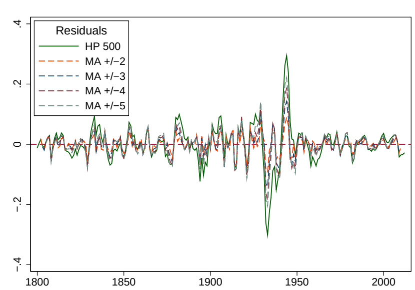
(e) BK and Hamilton Filters



(f) Residuals from BK, Hamilton filter



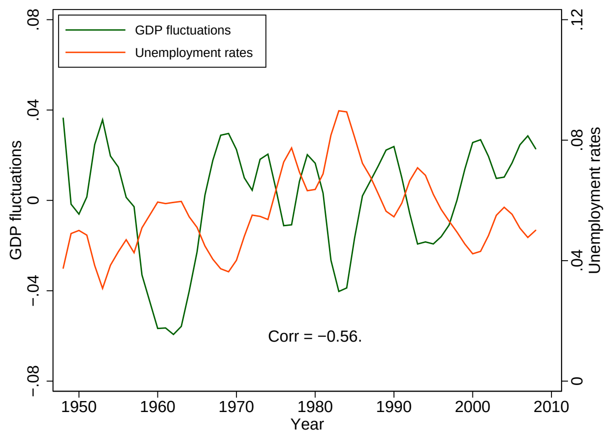
(g) Moving Average smoothed GDP



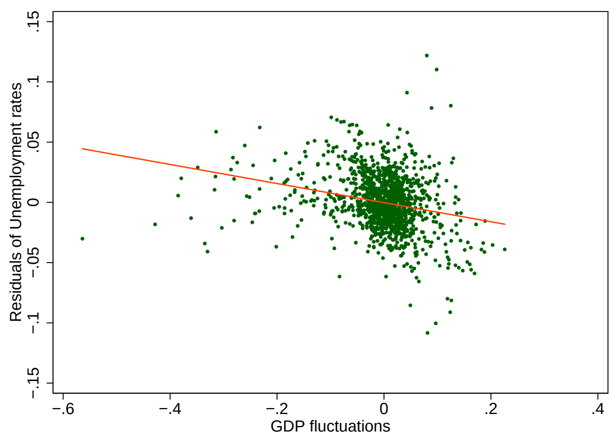
(h) Residuals from Moving Average

Note: Data of the GDP are from the Gapminder website. The actual and the smoothed values are plotted against the calendar year in the panels in left column. The GDP residuals are plotted in the panels in the right column.

Figure C2: Comparison of Unemployment Rate and GDP Residuals from HP 500



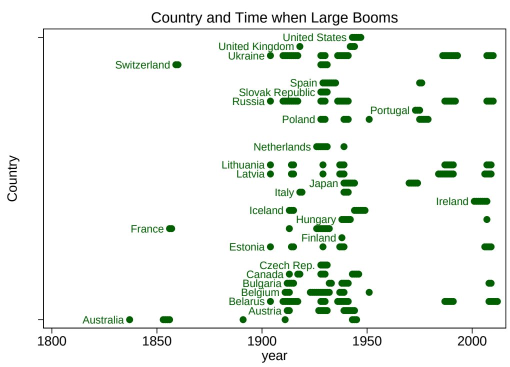
(a) Time Series in United States



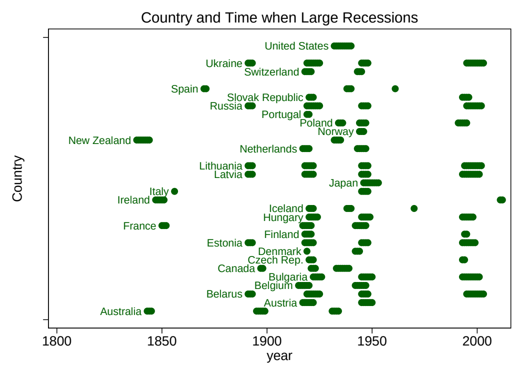
(b) GDP fluc. and unemployment rate residuals

Note: The data of unemployment rates are from World Development Index (WDI), Layard et al. (2005), OECD website and Mitchell (1998). In Panel B, to form residual unemployment rate, we regress the unemployment rate on country dummies, year dummies, and country specific linear and square trends in years.

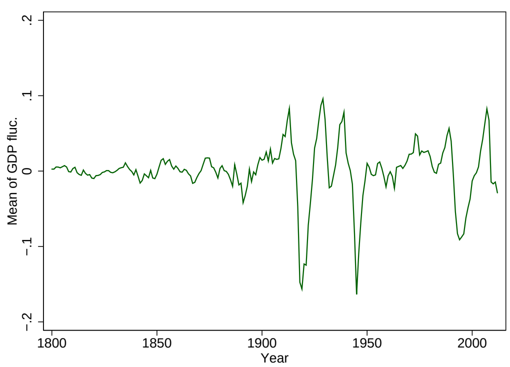
Figure C3: Country and Periods with large booms and recessions



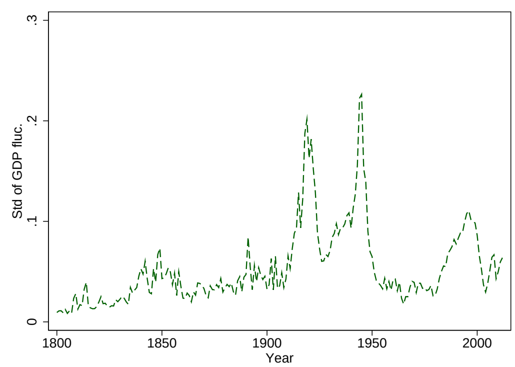
(a) Country and Periods with large booms



(b) Country and Periods with large recessions



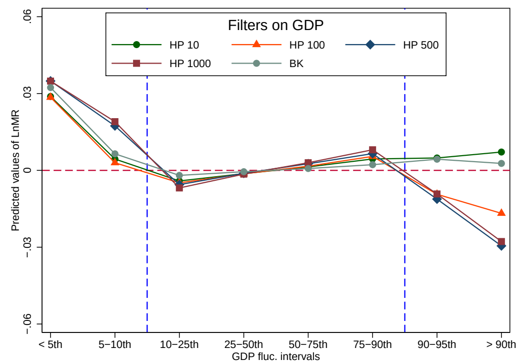
(c) Mean



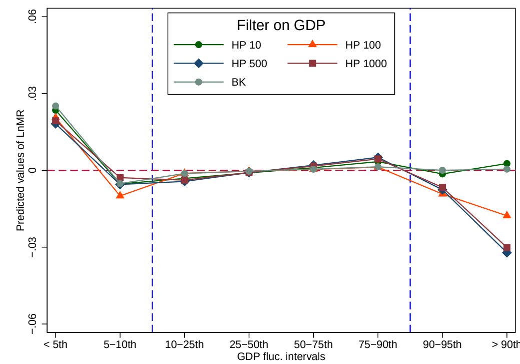
(d) Standard Deviation

Note: The left figure shows the countries and years when contemporaneous GDP fluctuations larger than 0.1 and the right one shows the countries and years when contemporaneous GDP fluctuations lower than -0.1. The bottom two figures figures show the mean and standard deviations of the 32 countries used in the study over time, respectively.

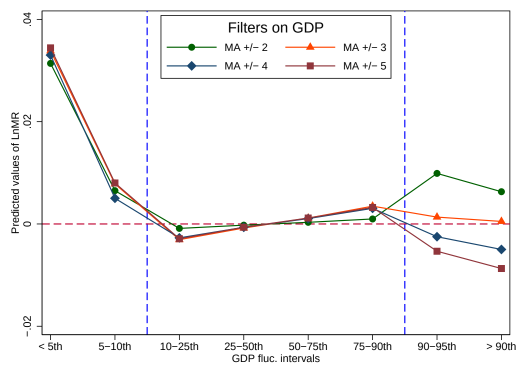
Figure C4: Contemporary effects: Different filters on GDP



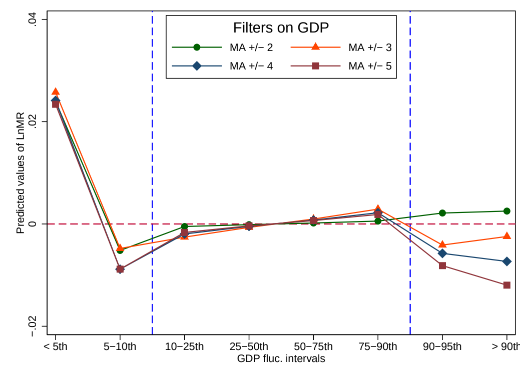
(a) HP filter and BK filter



(b) HP filter and BK filter, with Country-Cohort FE



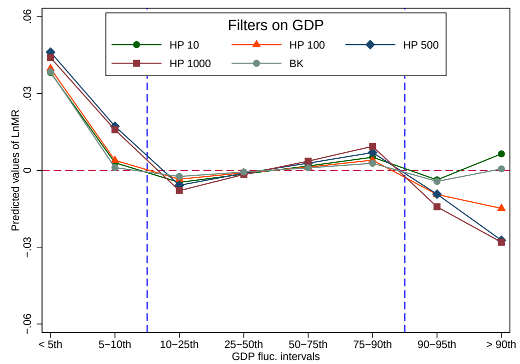
(c) MA(s) Filters



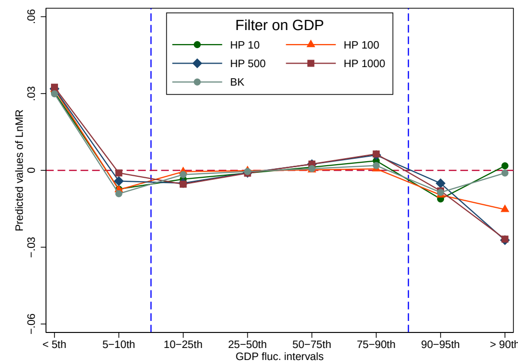
(d) MA(s) Filters, Country-Cohort FE

Note: Results of contemporary effects using different filters are shown. Contemporary GDP fluctuations are using average of GDP current year, last year and the year before last year (three-year average). Regressions used for panel a and panel c are the same as column 1 of Table 1, and those for panel b and panel d are the same as column 2 of Table 1.

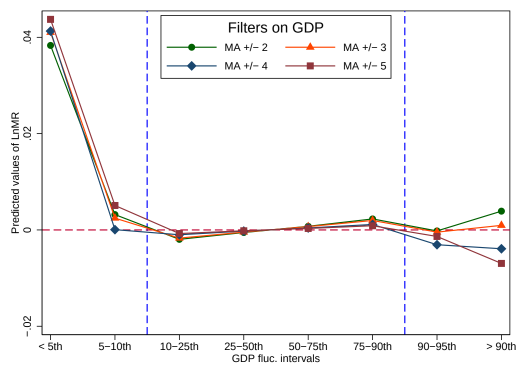
Figure C5: Using current and last year GDP residuals and different filters



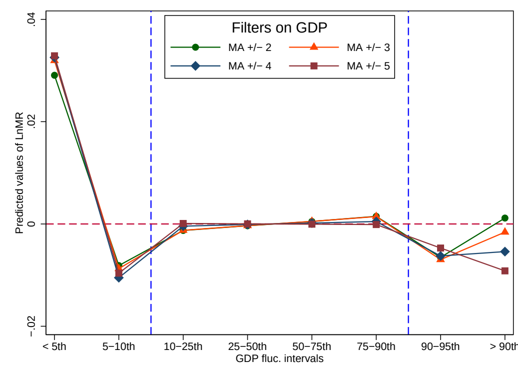
(a) HP filter and BK filter



(b) HP filter and BK filter, with Country-Cohort FE



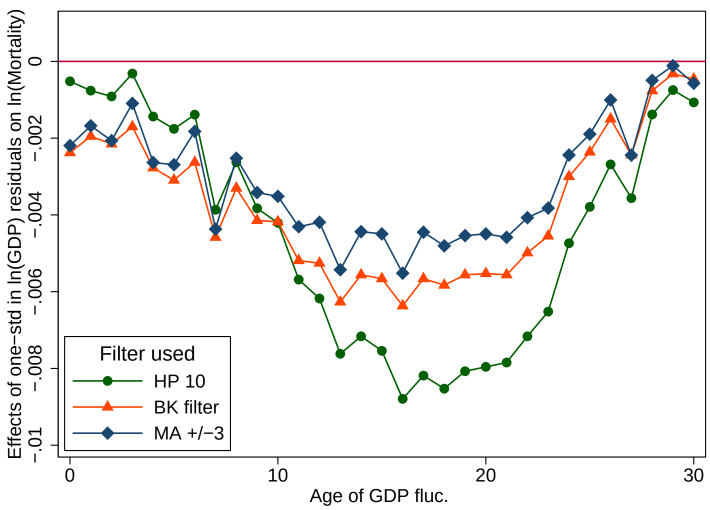
(c) MA(s) Filters



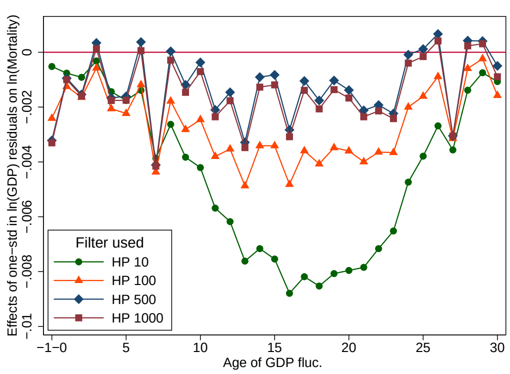
(d) MA(s) Filters, Country-Cohort FE

Note: Results of contemporary effects using different filters are shown. Contemporary GDP fluc. are using average of GDP current year and last year (Two-year average). Regressions used for panel a and panel c are the same as column 1 of Table 1, and those for panel b and panel d are the same as column 2 of Table 1.

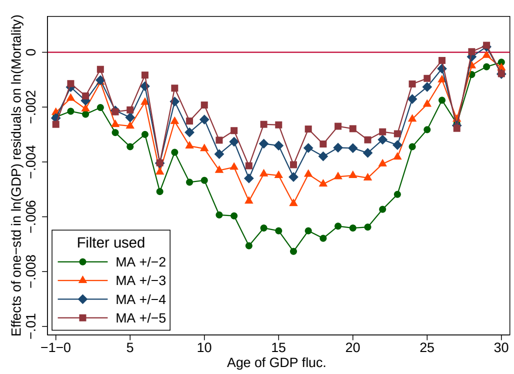
Figure C6: Effects of GDP fluc. from different HP filters at separate ages



(a) Different Filters - HP, BK and MA



(b) Different HP Filters



(c) Different MA Filters

Note: The figure reports the long-term effects of one-std change in the GDP fluctuation from different HP filters at separate ages. Regressions used for all panels are the same as that in column 3 of Table 1.

Table C1: Relationship between GDP residuals and Unemployment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Variable	Std of	Relationship with Unemployment rates						AR(1)		
	shock	beta (se)	R^2	beta (se)	R^2	beta (se)	R^2	1-year	3-year	5-year
HP filter residuals										
500 filter	0.088	-14.0***	0.043	-11.4***	0.680	-21.6***	0.829	0.826***	0.409***	0.0397
		(3.31)		(3.20)		(4.84)		(0.0125)	(0.0309)	(0.0424)
10 filter	0.038	-27.8***	0.023	-11.6*	0.667	-17.0***	0.805	0.381***	-0.399***	-0.684***
		(4.39)		(5.77)		(5.05)		(0.0225)	(0.0233)	(0.0257)
100 filter	0.059	-19.3***	0.030	-12.3***	0.671	-18.3***	0.812	0.666***	-0.00473	-0.497***
		(4.21)		(3.98)		(4.73)		(0.0146)	(0.0272)	(0.0226)
1000 filter	0.083	-14.7***	0.040	-12.2***	0.679	-21.3***	0.826	0.805***	0.348***	-0.0489
		(3.53)		(3.42)		(4.82)		(0.0127)	(0.0312)	(0.0404)
BK filter	0.034	-34.2***	0.026	-16.1**	0.669	-21.3***	0.818	0.250***	-0.359***	-0.518***
		(5.33)		(6.47)		(5.03)		(0.0229)	(0.0296)	(0.0290)
Hamilton (2016)	0.085	-8.87**	0.015	3.05	0.666	-4.88*	0.802	0.512***	0.110***	-0.121**
method		(3.36)		(2.27)		(2.40)		(0.00903)	(0.0311)	(0.0516)
Moving average										
MA +/- 2	0.034	-35.4***	0.028	-17.1***	0.669	-23.3***	0.811	0.185***	-0.413***	-0.567***
		(4.98)		(5.94)		(5.08)		(0.0228)	(0.0322)	(0.0285)
MA +/- 3	0.045	-26.1***	0.029	-12.8**	0.670	-16.8***	0.818	0.442***	-0.316***	-0.520***
		(4.42)		(5.14)		(4.37)		(0.0188)	(0.0291)	(0.0296)
MA +/- 4	0.054	-21.3***	0.030	-10.9**	0.673	-12.2**	0.827	0.604***	-0.178***	-0.507***
		(4.33)		(4.82)		(4.78)		(0.0174)	(0.0300)	(0.0317)
MA +/- 5	0.064	-19.2***	0.033	-10.5**	0.676	-11.6**	0.834	0.683***	-0.0383	-0.462***
		(4.16)		(4.38)		(4.77)		(0.0146)	(0.0316)	(0.0360)
Polynomial time trends										
GDP residuals	0.19	-6.95***	0.054	-3.04	0.670	-16.87***	0.827	0.964***	0.865***	0.772***
(2nd order)		(2.07)		(2.09)		(4.890)		(0.00633)	(0.0197)	(0.0281)
GDP residuals	0.18	-9.11***	0.073	-3.62*	0.670	-16.07***	0.825	0.958***	0.839***	0.726***
(3rd order)		(1.88)		(2.01)		(4.955)		(0.00669)	(0.0214)	(0.0305)
GDP residuals	0.16	-7.72***	0.046	-1.85	0.666	-15.10***	0.823	0.948***	0.798***	0.652***
(4th order)		(1.84)		(1.60)		(4.794)		(0.00686)	(0.0227)	(0.0330)
Country, Year FE	---	No		Yes		Yes			No	
Country specific linear & quadratic trends	---	No		No		Yes			No	

Notes: The sample for each regression is country-year observations with both unemployment rates and GDP residuals (N = 1,438 for columns 2-7; N = 2,923 for column 8, N = 964 for column 9, and N = 573 for column 10). Standard errors are clustered at country level.
*** p<0.01, ** p<0.05, * p<0.1

Table C2: AR(1) model for ln(Mortality rates)

	(1)	(2)	(3)
	AR(1) Model in Residuals of Ln(Mortality)		
VARIABLES	All ages	Age <= 5	Age > 45
Polynomial time trends			
Ln(Mortality) res.	0.375***	0.229**	0.263**
(2nd polynomial)	(0.093)	(0.090)	(0.102)
Ln(Mortality) res.	0.252***	0.115*	0.178**
(3rd polynomial)	(0.079)	(0.063)	(0.080)
Ln(Mortality) res.	0.209**	0.079	0.125*
(4th polynomial)	(0.079)	(0.056)	(0.065)
HP filter residuals			
10 filter	-0.252***	-0.277***	-0.240***
	(0.020)	(0.023)	(0.019)
100 filter	-0.081**	-0.125***	-0.088***
	(0.039)	(0.032)	(0.030)
500 filter	0.014	-0.043	-0.011
	(0.052)	(0.040)	(0.041)
1000 filter	0.051	-0.011	0.020
	(0.058)	(0.044)	(0.047)
Moving Average			
MA +/- 2	-0.278***	-0.294***	-0.263***
	(0.012)	(0.014)	(0.013)
MA +/- 3	-0.146***	-0.178***	-0.137***
	(0.025)	(0.031)	(0.023)
MA +/- 4	-0.068*	-0.111***	-0.070***
	(0.035)	(0.039)	(0.026)
MA +/- 5	-0.014	-0.071	-0.028
	(0.046)	(0.046)	(0.034)
Observations	497,932	33,300	242,632

Notes: Log(Mortality) is detrended within each country-gender-age cell. Standard errors clustered at the country level.
*** p<0.01, ** p<0.05, * p<0.1

Table C3: Alternative Filters on GDP (HP, BK and MA)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variable	ln(Mortality Rate)								
	HP 500 filter			BK filter			Moving Average (+/- 3 years)		
Settings	Original	Country-cohort FE	Country-year FE	Original	Country-cohort FE	Country-year FE	Original	Country-cohort FE	Country-year FE
Contemporary Economic Conditions									
Contemp.	0.144***	0.11***	—	0.202*	0.126	—	0.213**	0.178**	—
GDP fluc.	(0.0500)	(0.0398)		(0.110)	(0.111)		(0.0934)	(0.0752)	
Big Boom	0.0124	0.024**	—	0.0059	-0.0004	—	0.00216	-0.00574	—
(>90th)	(0.0111)	(0.00946)		(0.009)	(0.00961)		(0.00975)	(0.0116)	
Boom* Fluc.	-0.431***	-0.50***	—	-0.280	-0.104	—	-0.240	-0.125	—
	(0.121)	(0.125)		(0.354)	(0.345)		(0.212)	(0.233)	
Big bust	0.00561	-0.0214	—	-0.009	-0.024***	—	-0.00762	-0.0231***	—
(<10th)	(0.0148)	(0.0159)		(0.0100)	(0.008)		(0.0101)	(0.00837)	
Bust * Fluc.	-0.277***	-0.29**	—	-1.05***	-1.12***	—	-0.768***	-0.832***	—
	(0.0870)	(0.111)		(0.292)	(0.267)		(0.200)	(0.180)	
Early Economic Conditions									
GDP fluc	-0.0338**	—	-0.033***	-0.0274	—	-0.0395*	-0.0237	—	-0.0318**
Age -1-0	(0.0137)		(0.0120)	(0.0256)		(0.0217)	(0.0167)		(0.0133)
GDP fluc	-0.0495**	—	-0.057***	-0.0690	—	-0.164**	-0.0627	—	-0.130**
Age 1-5	(0.0185)		(0.0159)	(0.101)		(0.0699)	(0.0719)		(0.0494)
GDP fluc	-0.0597**	—	-0.070***	-0.104	—	-0.246**	-0.0998	—	-0.205**
Age 6-10	(0.0262)		(0.0228)	(0.173)		(0.119)	(0.126)		(0.0866)
GDP fluc	-0.0892***	—	-0.095***	-0.283	—	-0.424***	-0.224	—	-0.331***
Age 11-15	(0.0294)		(0.0279)	(0.205)		(0.149)	(0.152)		(0.112)
GDP fluc	-0.0847***	—	-0.091***	-0.304	—	-0.435**	-0.236	—	-0.336**
Age 16-20	(0.0297)		(0.0298)	(0.217)		(0.170)	(0.160)		(0.126)
GDP fluc	-0.0668***	—	-0.072***	-0.213	—	-0.316**	-0.164	—	-0.244**
Age 21-25	(0.0242)		(0.0198)	(0.186)		(0.137)	(0.135)		(0.0983)
GDP fluc	-0.00825	—	-0.0115	-0.0145	—	-0.0660	-0.0150	—	-0.0544
Age 26-30	(0.0132)		(0.0130)	(0.0752)		(0.0585)	(0.0574)		(0.0444)
N	245,512	245,404	245,512	243,880	245,404	243,880	243,880	245,404	243,880
R2	0.995	0.997	0.997	0.995	0.997	0.997	0.995	0.997	0.997

Note: Data of mortality are from HMD. Data of GDP are from Gapminder. All regressions include country-gender-age fixed effects, country-gender-age specific linear and square trends in calendar years, gender-birth year fixed effects, and gender-year fixed effects. All the regressions are weighted by the square root of the population size in the corresponding observation. For each filter, three regressions are reported. The standard errors are clustered at the country level.
*** p<0.01, ** p<0.05, * p<0.1

Table C4: Alternative Filters (HP filters)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variable	ln(Mortality Rate)								
	HP 10			HP 100			HP 1000		
Settings	Original	Cty-cohort FE	Cty-year FE	Original	Cty-cohort FE	Cty-year FE	Original	Cty-cohort FE	Cty-year FE
Contemporary Economic Conditions									
Contemp.	0.319**	0.243*	—	0.211***	0.0493	—	0.195***	0.109**	—
GDP fluc.	(0.136)	(0.142)		(0.0660)	(0.0829)		(0.0522)	(0.0498)	
Big Boom	0.00264	-0.00522	—	-0.00139	-0.000155	—	0.0155	0.0245**	—
(>90th)	(0.00768)	(0.00763)		(0.00980)	(0.0116)		(0.0116)	(0.0103)	
Boom* Fluc.	-0.234	-0.0961	—	-0.366***	-0.227	—	-0.509***	-0.505***	—
	(0.280)	(0.282)		(0.127)	(0.172)		(0.120)	(0.125)	
Big bust	-0.0120	-0.0248***	—	-0.0121	-0.0282***	—	0.00899	-0.0174	—
(<10th)	(0.01000)	(0.00862)		(0.00884)	(0.00813)		(0.0149)	(0.0155)	
Bust * Fluc.	-1.023***	-1.077***	—	-0.554***	-0.462***	—	-0.324***	-0.291**	—
	(0.261)	(0.235)		(0.132)	(0.146)		(0.0952)	(0.125)	
Early Economic Conditions									
GDP fluc	0.00780	—	0.00483	-0.0258**	—	-0.028***	-0.036***	—	-0.035***
Age -1-0	(0.0201)		(0.0207)	(0.0103)		(0.0095)	(0.0132)		(0.0118)
GDP fluc	0.105*	—	0.0652	-0.0700*	—	-0.093***	-0.059***	—	-0.067***
Age 1-5	(0.0608)		(0.0641)	(0.0359)		(0.0331)	(0.0204)		(0.0181)
GDP fluc	0.133	—	0.0846	-0.138**	—	-0.170***	-0.0783**	—	-0.088***
Age 6-10	(0.0836)		(0.0837)	(0.0663)		(0.0595)	(0.0299)		(0.0271)
GDP fluc	-0.0275	—	-0.0574	-0.236***	—	-0.261***	-0.113***	—	-0.118***
Age 11-15	(0.0778)		(0.0678)	(0.0842)		(0.0780)	(0.0344)		(0.0336)
GDP fluc	-0.108	—	-0.128	-0.258***	—	-0.276***	-0.109***	—	-0.114***
Age 16-20	(0.0955)		(0.0875)	(0.0880)		(0.0857)	(0.0346)		(0.0354)
GDP fluc	-0.113	—	-0.126	-0.204***	—	-0.213***	-0.086***	—	-0.089***
Age 21-25	(0.0950)		(0.0901)	(0.0695)		(0.0655)	(0.0270)		(0.0235)
GDP fluc	-0.0217	—	-0.0255	-0.0746**	—	-0.074**	-0.0220	—	-0.022
Age 26-30	(0.0398)		(0.0411)	(0.0325)		(0.0350)	(0.0141)		(0.0152)
N	245,512	245,404	245,512	245,512	245,404	245,512	245,512	245,404	245,512
R2	0.995	0.997	0.997	0.995	0.997	0.997	0.995	0.997	0.997

Note: Data of mortality are from HMD. Data of GDP are from Gapminder. All regressions include country-gender-age fixed effects, country-gender-age specific linear and square trends in calendar years, gender-birth year fixed effects, and gender-year fixed effects. All the regressions are weighted by the square root of the population size in the corresponding observation. For each filter, three regressions are reported. The standard errors are clustered at the country level.
*** p<0.01, ** p<0.05, * p<0.1

Table C5: Alternative Filters (Moving Average)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variable	ln(Mortality Rate)								
	Moving Average (+/- 2 years)			Moving Average (+/- 4 years)			Moving Average (+/- 5 years)		
Settings	Original	Country-cohort FE	Country-year FE	Original	Country-cohort FE	Country-year FE	Original	Country-cohort FE	Country-year FE
Contemporary Economic Conditions									
Contemp.	0.0952	0.0547	—	0.140*	0.101	—	0.120	0.0692	—
GDP fluc.	(0.134)	(0.124)		(0.0766)	(0.0646)		(0.0822)	(0.0686)	
Big Boom	0.0132	0.00178	—	0.000105	-0.00410	—	-0.00161	-0.00395	—
(>90th)	(0.00872)	(0.0094)		(0.00979)	(0.0116)		(0.0116)	(0.0112)	
Boom* Fluc.	-0.276	-0.0355	—	-0.202	-0.140	—	-0.192	-0.150	—
	(0.396)	(0.380)		(0.147)	(0.186)		(0.119)	(0.150)	
Big bust	-0.00895	-0.023***	—	-0.0113	-0.0282***	—	-0.00736	-0.028**	—
(<10th)	(0.0103)	(0.00829)		(0.0101)	(0.00879)		(0.0127)	(0.0109)	
Bust * Fluc.	-0.987***	-1.10***	—	-0.57***	-0.610***	—	-0.45***	-0.47***	—
	(0.322)	(0.283)		(0.173)	(0.150)		(0.146)	(0.125)	
Early Economic Conditions									
GDP fluc	-0.0186	—	-0.0311	-0.0237	—	-0.032**	-0.0252*	—	-0.031***
Age -1-0	(0.0281)		(0.0247)	(0.0167)		(0.0133)	(0.0124)		(0.00889)
GDP fluc	-0.0459	—	-0.140*	-0.0627	—	-0.130**	-0.0576	—	-0.099***
Age 1-5	(0.103)		(0.0724)	(0.0719)		(0.0494)	(0.0453)		(0.0310)
GDP fluc	-0.0682	—	-0.202*	-0.0998	—	-0.21**	-0.0875	—	-0.16***
Age 6-10	(0.170)		(0.119)	(0.126)		(0.0866)	(0.0791)		(0.0544)
GDP fluc	-0.250	—	-0.377**	-0.224	—	-0.33***	-0.153	—	-0.23***
Age 11-15	(0.198)		(0.145)	(0.152)		(0.112)	(0.0947)		(0.0705)
GDP fluc	-0.276	—	-0.393**	-0.236	—	-0.34**	-0.159	—	-0.23***
Age 16-20	(0.209)		(0.167)	(0.160)		(0.126)	(0.0981)		(0.0762)
GDP fluc	-0.197	—	-0.287**	-0.164	—	-0.24**	-0.109	—	-0.17***
Age 21-25	(0.181)		(0.139)	(0.135)		(0.0983)	(0.0821)		(0.0568)
GDP fluc	-0.0113	—	-0.0570	-0.0150	—	-0.054	-0.0117	—	-0.042
Age 26-30	(0.0689)		(0.0567)	(0.0574)		(0.0444)	(0.0375)		(0.0280)
N	244,444	245,404	244,444	243,880	245,404	243,880	242,692	245,404	242,692
R2	0.995	0.997	0.997	0.995	0.997	0.997	0.995	0.997	0.997

Note: Data of mortality are from HMD. Data of GDP are from Gapminder. All regressions include country-gender-age fixed effects, country-gender-age specific linear and square trends in calendar years, gender-birth year fixed effects, and gender-year fixed effects. All the regressions are weighted by the square root of the population size in the corresponding observation. For each filter, three regressions are reported. The standard errors are clustered at the country level.
*** p<0.01, ** p<0.05, * p<0.1

Table C6: Short-term effects of GDP on log(Mortality)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Filter	Filter on ln(Mortality)							
on GDP	Polynomial 2	Polynomial 3	Polynomial 4	MA +/- 5	HP 500	HP 1000	MA +/- 4	HP 100
Panel A: Without country-cohort FE								
HP 10	0.335**	0.251*	0.314**	0.276**	0.297**	0.313**	0.266**	0.263**
	(0.132)	(0.137)	(0.123)	(0.128)	(0.119)	(0.120)	(0.117)	(0.110)
Hp 100	0.208***	0.0699	0.110*	0.0486	0.0921	0.111	0.0595	0.0675
	(0.0655)	(0.0814)	(0.0620)	(0.0781)	(0.0661)	(0.0671)	(0.0625)	(0.0585)
HP 500	0.146***	0.0938*	0.113**	0.0745*	0.125***	0.139***	0.0667**	0.0853***
	(0.0497)	(0.0461)	(0.0449)	(0.0366)	(0.0353)	(0.0370)	(0.0310)	(0.0284)
HP 1000	0.201***	0.101*	0.118**	0.0838*	0.132***	0.150***	0.0759*	0.0940**
	(0.0520)	(0.0535)	(0.0504)	(0.0440)	(0.0404)	(0.0419)	(0.0389)	(0.0347)
MA +/- 2	0.0729	0.0229	0.0696	0.0942	0.0855	0.0857	0.131	0.110
	(0.137)	(0.131)	(0.130)	(0.147)	(0.145)	(0.146)	(0.142)	(0.131)
MA +/- 3	0.219**	0.180**	0.200***	0.180**	0.207***	0.222***	0.210***	0.188***
	(0.0934)	(0.0752)	(0.0695)	(0.0727)	(0.0723)	(0.0726)	(0.0668)	(0.0664)
MA +/- 4	0.122	0.0726	0.0957*	0.115*	0.125**	0.136**	0.143**	0.111*
	(0.0723)	(0.0584)	(0.0510)	(0.0639)	(0.0601)	(0.0596)	(0.0614)	(0.0567)
MA +/- 5	0.117	0.0593	0.0851	0.0659	0.0857	0.100	0.0846	0.0654
	(0.0822)	(0.0717)	(0.0619)	(0.0700)	(0.0655)	(0.0673)	(0.0597)	(0.0574)
BK	0.191*	0.116	0.155	0.192*	0.174	0.178	0.229**	0.186*
	(0.106)	(0.106)	(0.0946)	(0.110)	(0.105)	(0.105)	(0.104)	(0.0957)

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Table C6: Short-term effects of GDP on log(Mortality) (Con't)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Filter	Filter on ln(Mortality)							
on GDP	Polynomial 2	Polynomial 3	Polynomial 4	MA +/- 5	HP 500	HP 1000	MA +/- 4	HP 100
Panel B: With country-cohort FE								
HP 10	0.247	0.272*	0.323**	0.250**	0.288**	0.290**	0.238**	0.266**
	(0.146)	(0.134)	(0.127)	(0.119)	(0.125)	(0.127)	(0.104)	(0.114)
Hp 100	0.0454	0.0676	0.106	0.0343	0.0627	0.0662	0.0456	0.0580
	(0.0829)	(0.0760)	(0.0690)	(0.0839)	(0.0707)	(0.0734)	(0.0698)	(0.0609)
HP 500	0.114***	0.114***	0.129**	0.0716*	0.118***	0.127***	0.0718**	0.0840***
	(0.0390)	(0.0413)	(0.0477)	(0.0372)	(0.0348)	(0.0366)	(0.0318)	(0.0274)
HP 1000	0.109**	0.111**	0.133**	0.0791*	0.114***	0.122***	0.0793*	0.0891**
	(0.0491)	(0.0516)	(0.0560)	(0.0453)	(0.0407)	(0.0432)	(0.0396)	(0.0326)
MA +/- 2	0.0356	0.0662	0.108	0.114	0.0865	0.0794	0.135	0.117
	(0.123)	(0.120)	(0.122)	(0.150)	(0.142)	(0.143)	(0.142)	(0.130)
MA +/- 3	0.179**	0.183**	0.214***	0.184**	0.196**	0.200**	0.204***	0.190***
	(0.0751)	(0.0718)	(0.0703)	(0.0729)	(0.0726)	(0.0735)	(0.0642)	(0.0660)
MA +/- 4	0.0904	0.0899	0.115**	0.118*	0.113*	0.114*	0.143**	0.111*
	(0.0627)	(0.0590)	(0.0564)	(0.0664)	(0.0619)	(0.0627)	(0.0628)	(0.0567)
MA +/- 5	0.0659	0.0645	0.0877	0.0597	0.0738	0.0790	0.0794	0.0638
	(0.0687)	(0.0657)	(0.0635)	(0.0713)	(0.0666)	(0.0682)	(0.0604)	(0.0577)
BK	0.114	0.140	0.182*	0.213*	0.173	0.169	0.231**	0.193**
	(0.106)	(0.0975)	(0.0914)	(0.113)	(0.103)	(0.104)	(0.102)	(0.0943)

Note: Only the coefficients on contemporary GDP fluctuations are reported. Each coefficient presents a separate regression. All regressions include country-gender-age fixed effects, country-gender-age specific linear and square trends in calendar years, gender-birth year fixed effects, and gender-year fixed effects. All the regressions are weighted by the square root of the population size in the corresponding observation. The standard errors in parentheses are clustered at the country level.
*** p<0.01, ** p<0.05, * p<0.1

Table C7: Long-term effects of GDP on log(Mortality), GDP fluc. at age 11-15

Filter on GDP	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Filter on ln(Mortality)							
	Polynomial 2	Polynomial 3	Polynomial 4	MA +/- 5	HP 500	HP 1000	MA +/- 4	HP 100
Panel A: Without country-year FE								
HP 10	-0.0275	-0.00177	0.0243	0.0331	0.0832	0.0706	0.0392	0.0819
	(0.0779)	(0.0723)	(0.0777)	(0.0697)	(0.0688)	(0.0689)	(0.0757)	(0.0678)
Hp 100	-0.236***	-0.170***	-0.119**	0.0234	-0.00845	-0.0407	0.0234	0.0225
	(0.0842)	(0.0505)	(0.0464)	(0.0246)	(0.0212)	(0.0270)	(0.0230)	(0.0189)
HP 500	-0.0892***	-0.0739***	-0.0549***	-0.00871**	-0.0230***	-0.0340***	-0.00539	-0.00898***
	(0.0294)	(0.0147)	(0.0111)	(0.00409)	(0.00467)	(0.00683)	(0.00359)	(0.00286)
HP 1000	-0.113***	-0.0903***	-0.0667***	-0.00774	-0.0262***	-0.0401***	-0.00422	-0.00874**
	(0.0344)	(0.0173)	(0.0136)	(0.00510)	(0.00580)	(0.00847)	(0.00430)	(0.00358)
MA +/- 2	-0.250	-0.263**	-0.184*	0.0249	0.0122	-0.0407	0.0397	0.0632
	(0.198)	(0.106)	(0.0948)	(0.0543)	(0.0537)	(0.0610)	(0.0580)	(0.0496)
MA +/- 3	-0.224	-0.238***	-0.174**	0.00934	-0.0219	-0.0641*	0.0155	0.0218
	(0.152)	(0.0791)	(0.0668)	(0.0311)	(0.0294)	(0.0368)	(0.0329)	(0.0252)
MA +/- 4	-0.190	-0.203***	-0.151***	0.00354	-0.0296	-0.0638**	0.00716	0.00712
	(0.120)	(0.0625)	(0.0508)	(0.0208)	(0.0186)	(0.0252)	(0.0211)	(0.0148)
MA +/- 5	-0.153	-0.165***	-0.124***	7.23e-05	-0.0290**	-0.0560***	0.00311	0.000557
	(0.0947)	(0.0488)	(0.0382)	(0.0146)	(0.0125)	(0.0178)	(0.0139)	(0.00940)
BK	-0.283	-0.300***	-0.215**	0.0178	-0.0102	-0.0663	0.0296	0.0462
	(0.205)	(0.109)	(0.0951)	(0.0503)	(0.0478)	(0.0563)	(0.0536)	(0.0433)

(Continued on the next page)

Table C7: Long-term effects of GDP on log(Mortality), GDP fluc. at age 11-15 (Con't)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Filter	Filter on ln(Mortality)							
on GDP	Polynomial 2	Polynomial 3	Polynomial 4	MA +/- 5	HP 500	HP 1000	MA +/- 4	HP 100
Panel B: With country-year FE								
HP 10	-0.0574	-0.0145	0.0116	0.0212	0.0608	0.0462	0.0309	0.0693
	(0.0678)	(0.0711)	(0.0776)	(0.0719)	(0.0693)	(0.0687)	(0.0767)	(0.0683)
Hp 100	-0.261***	-0.172***	-0.125***	0.0111	-0.0325	-0.0665**	0.0172	0.00965
	(0.0780)	(0.0444)	(0.0439)	(0.0275)	(0.0225)	(0.0262)	(0.0251)	(0.0205)
HP 500	-0.0953***	-0.0701***	-0.0524***	-0.00896**	-0.0261***	-0.0371***	-0.00463	-0.0107***
	(0.0279)	(0.0134)	(0.00894)	(0.00403)	(0.00458)	(0.00677)	(0.00336)	(0.00295)
HP 1000	-0.118***	-0.0856***	-0.0637***	-0.00881*	-0.0306***	-0.0444***	-0.00380	-0.0113***
	(0.0336)	(0.0161)	(0.0113)	(0.00511)	(0.00568)	(0.00846)	(0.00423)	(0.00353)
MA +/- 2	-0.377**	-0.265***	-0.192*	0.00870	-0.0304	-0.0859	0.0336	0.0375
	(0.145)	(0.0933)	(0.0944)	(0.0614)	(0.0520)	(0.0550)	(0.0623)	(0.0513)
MA +/- 3	-0.331***	-0.238***	-0.180***	-0.00186	-0.0561*	-0.101***	0.0122	0.000675
	(0.112)	(0.0654)	(0.0633)	(0.0351)	(0.0284)	(0.0328)	(0.0350)	(0.0268)
MA +/- 4	-0.280***	-0.202***	-0.155***	-0.00422	-0.0562***	-0.0927***	0.00535	-0.00859
	(0.0891)	(0.0517)	(0.0466)	(0.0236)	(0.0176)	(0.0224)	(0.0225)	(0.0157)
MA +/- 5	-0.226***	-0.164***	-0.126***	-0.00444	-0.0483***	-0.0773***	0.00367	-0.0100
	(0.0705)	(0.0409)	(0.0344)	(0.0160)	(0.0118)	(0.0164)	(0.0140)	(0.00962)
BK	-0.424***	-0.302***	-0.224**	0.00107	-0.0573	-0.116**	0.0236	0.0168
	(0.149)	(0.0924)	(0.0932)	(0.0566)	(0.0468)	(0.0507)	(0.0573)	(0.0459)

Note: Only the coefficients on GDP fluctuations at ages 11-15 are reported. Each coefficient presents a separate regression. All regressions include country-gender-age fixed effects, country-gender-age specific linear and square trends in calendar years, gender-birth year fixed effects, and gender-year fixed effects. All the regressions are weighted by the square root of the population size in the corresponding observation. The standard errors in parentheses are clustered at the country level.
*** p<0.01, ** p<0.05, * p<0.1

D. Additional Results

There are several comments that we note in the paper and explain more here.

D1. Relationship to van den Berg et al. (2006)

Table D1 shows the original results in van den Berg et al. (2006) and our replication. Panel A shows the coefficient on "Boom at birth" in Table 3 from van den Berg et al. (2006).

The first row of Panel B shows our replication using the Historical Sample of the Netherlands (HSN) data. The sample used by van den Berg et al. (2006) covers the birth cohorts 1812-1903. Although the sample has been updated in 2010 and the birth cohorts now range from 1850 to 1903, we get very similar results. In the next row, we use the HSN data and the same methodology as van den Berg et al. (2006) but trim the sample to those aged over 45. The coefficient is actually positive in this case, but not statistically significant. This suggests that survival to age 45 is crucial for these cohorts.

Next, we use the HMD data for the Netherlands, again with ages over 45, and using the van den Berg methodology (Step 2). We get a negative but statistically insignificant effect. The effect is even smaller when we use the empirical specification in our paper (Step 3). In Step 4, we replace the boom defined by GNP fluctuations by that defined by GDP fluctuations, and get very similar estimates.

In Step 5, we keep all the other features the same but expand our analysis to birth cohorts up to 1930. The effect becomes more negative and statistically significant. This is consistent with Table 1, where the effects on mortality after age 45 are stronger among these in later cohorts. In step 6, we use the same birth cohorts and analysis framework, but expand the analysis to all 32 countries. The effect is smaller in magnitude but the estimate is more precise and is statistically significant.

In Step 7, we further include all birth cohorts in the HMD sample used in the paper, which yields a bit larger effects. The magnitude suggests that an economic boom at birth defined by GDP lead to a 0.3 percent decline in mortality after age 45. Finally, we replace the boom by the GDP fluctuations, and obtain the estimates reported in column 3 of Table 1.

D2. Robust results for Table 1

We have explored the sensitivity of our main results in Table 1 in several ways. Table D2 shows many of these specifications. For convenience, the first column of Table D2 repeats column 1 of Table 1. A first question is whether the results depend on a particular set of countries. We have a modest number of former Soviet bloc countries (Belarus, Bulgaria, Czech Republic, Estonia, Latvia, Lithuania, Russia, the Slovak Republic, and Ukraine), and these countries have experienced unusual mortality increases in recent times. Since mortality data for these countries all start in 1959, we first divide the sample into pre and post-1959. Consistent with Table 1, we find both short- and long- term effects are more salient in recent years.

The next column shows that our results are not sensitive to the exclusion of Eastern European countries. Among non-Eastern European countries, the coefficient on contemporary GDP fluctuations is 0.29, which is very close to that in the third column. The fifth column shows the results for Eastern European countries. Among Eastern European countries, higher GDP lowers mortality, perhaps picking up the impacts of transition. Long-run effects of GDP fluctuations are also much smaller.

The possibility of third factors that may influence both mortality and GDP is a potential issue in our findings. It could be that particular events such as wars or social unrest both increase mortality and lead to reductions in GDP. To test this, we consider whether the results are driven by unusual relationships during war years. Specifically, we re-estimate the model without observations in 1914-1918 and 1939-1945. To consider similar relationships for the cohorts that fought in the world wars, we drop cohorts born between 1891 and 1899 and those born between 1915 and 1924 (these cohorts were 15-24 at some point during World War I and World War II). Column 6 in Table D2 shows that the results are qualitatively similar and remain statistically significant.

Our primary analysis weights observations by the square root of population in the cell, consistent with Ruhm's analysis. Columns 7 and 8 report the results with two other weighting methods: equal weights for all countries, and population weights. The results are very similar to those in column 1, in both sign and magnitude.

Finally, we have experimented with alternative age groups for the estimation. Column 9 shows one such differential sample: restricting analysis to people aged 55-85. This change has very little impact on the results.

D3. Robustness to using unemployment rates

Table D3 shows the results for how mortality relates to unemployment for the sub-sample of 31 countries with unemployment rates series, which are mostly available since 1950.[9] The first column uses the GDP fluctuations from HP 500 filter but restricts the sample to the observations with valid contemporary unemployment rates.

[9]For non-OECD and eastern European countries, the unemployment rates are only available in later years.

We find very consistent results as shown in the paper.

Starting from column 2, we use unemployment rate as the measure of economic conditions. Column 2 investigates the effects of contemporary unemployment rates. The negative coefficient suggests that a one percentage point increase in unemployment rate decreases mortality by 0.14 percent. It is a consistent estimate with Ruhm (2000), who finds that a one percentage point increase in unemployment rate decreases mortality by 0.5 percent.

Column 3 reports both the contemporary effects and the effects at ages 16-20. The sample size is smaller than one-third of that in column 2 because unemployment rate is not available at ages 16-20 for many birth cohorts in the data. Still, we find qualitatively consistent results. Columns 4 and 5 report the effects of unemployment rate at ages 21-25 and 26-30, respectively. In general, we find robust results using unemployment rates as with GDP fluctuations.

D4. ECHP results with migrants

The ECHP provide information on where the individuals were born. In our primary results, we only keep individuals with the same birth and current living country. Table D4 shows the results with migrants. These results are comparable to those in Table 5 in our paper.

As migrants are more likely to move to countries with better outcomes, it is expected that the results with migrants may underestimate the actual effects. Consistently, Table D4 shows some evidence for this. For self-reported health, income, and satisfaction, we find that the results with migrants have smaller coefficients than their counterpart in Table 5.

D5. Life Expectancy Estimation

To estimate how life expectancy at age 45 would change if there had been no economic fluctuations in early life (i.e., ages 0-30), we use column 3 in Table 1, and predict the mortality. Then we assume all the coefficients on the GDP fluctuations in early life equal to zero and re-predict mortality. The difference between the two mortality estimates are fed into the US 1997 life table to calculate the change in life expectancy. Figure D1 shows the results.

D6. Agriculture share and effects for agriculture and non-agriculture economy

To investigate the contemporary effects for agriculture and non-agriculture economy, we interact both the agriculture share and its interactions with the contemporary GDP fluctuation terms (i.e., the contemporary GDP fluctuations, big boom, big recession, boom* GDP fluctuation, and recession*GDP fluctuation). Then we use the coefficients in the regression with all other covariates to predict the contemporary effects when agriculture share equals to actual value, 5 percent (25th percentile in the data) and 22 percent (75th percentile in the data), respectively. Figure D2a shows the results. The adverse effects of economic growth are more significant in the case of lower agriculture share. In contrast to this, the positive correlation is weak (and even reverses) in situations of high agriculture share.

To investigate the long-term impacts for agriculture and industrial economies, we control for the main effects of agriculture share and interact both the agriculture share and non-agriculture share (i.e., which equals to one minus agriculture share) with the GDP fluctuations in early life (i.e., the GDP fluctuations at birth, at ages 1-5, ... , at ages 26-30). Then we report the coefficients and corresponding confidential intervals in Figure D2b and Figure D2c.

Panel b follows the methodology in Table 2 of the paper and reports the results when the dependent variable is the proportion of people living to age 45. Panel c follows the methodology of column 3 in Table 1 and reports the results for mortality rates at ages 45 and older. We find that the effects on survival up to age 45 larger when the agriculture share is higher. But the effect does not differ much for the post-45 mortality.

D7. Mediators and Short-term effects

D7.1 How Mediators explain the short-term effects

Figure D3 graphically shows how the short-term effect changes when adding mediators in the regressions. The patterns here are consistent with what is shown in the paper. Furthermore, for each mediator, we also present the graphics and regression results (See Table D5) for high and low government expenditure countries.

D7.2 Dropping one country at a time

Tables D6a-D6c present the results when dropping one country at one time. The top two rows report the results when no country is dropped. Because we cover a much smaller period of time (i.e., the longest period is 1960-2008), we cannot estimate the effects of large booms and busts with much precision. Therefore, only the coefficients on GDP fluctuations are reported. The CO2 results in the first few columns are very consistent across all rows. But the alcohol results are sensitive to whether Russia is included or not. Specifically, controlling for alcohol explains a much smaller share of the GDP fluctuation effect when Russia is omitted from the model than when it is included. Note also that the results of working time are are sensitive to whether Japan is included or not.

D7.3 Other results for mediators

Table D7 presents additional results for the mediators mentioned in the paper. For alcohol consumption, we drop Russia, and conduct the regression in men, women, younger and older sample, respectively. The results are shown in columns 1 throughout column 10. Columns 11-12 report the results for the flu.

D8. Additional results in EB and SHARE

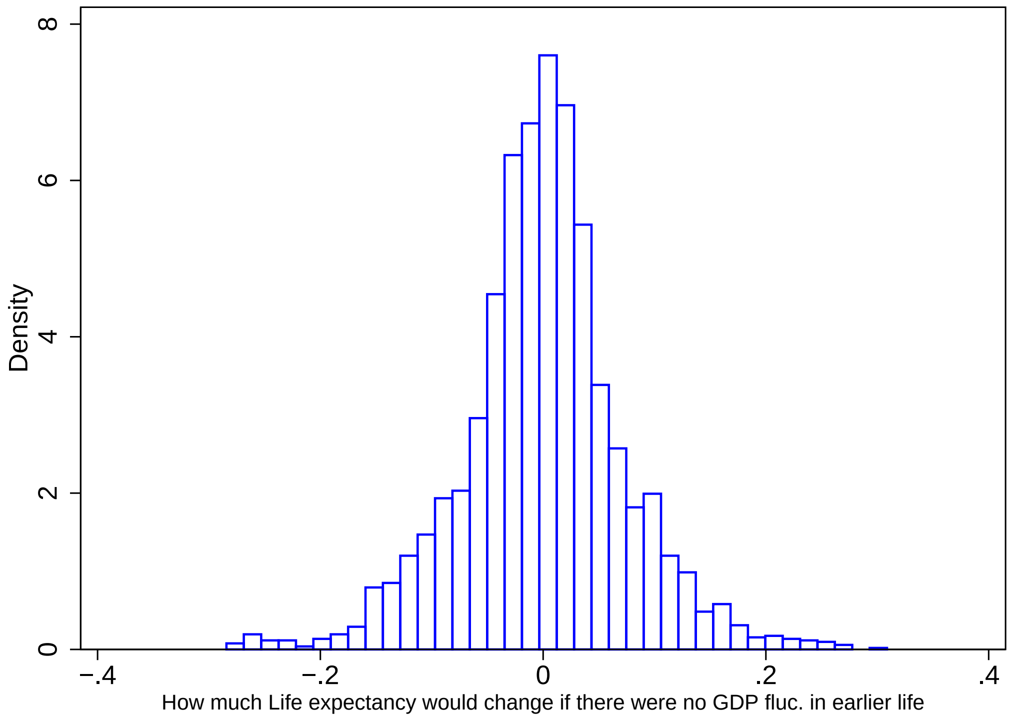
Table D8 reports the results for mental health. The mental health score is the principal component of the answers to the nine questions. For each of them, we conduct a separate regression. For the questions about feeling full of life (column 1), calm (column 4), having a lot of energy (column 5), and happy (column 8), the larger number the answer is, the better mental health is. To the contrary, for the questions about feeling particularly tense (column 2), down in dumps (column 3), downhearted (column 6), worn out (column 7), and tired (column 9), the worse mental health is if the answer is a larger number. Across all the columns, there is a consistent pattern that better economic conditions in early life are associated with better mental health, especially for booms at ages 11-25.

Columns 1-4 in Table D9 report the results for individual outcomes in SHARE. The first column echoes the results in ECHP: better economic conditions in adolescence are associated with improved self-reported health later in life. The next three columns show the results for three dimensions of cognition. In general, the results are consistent across different measures, although some coefficients for verbal fluency and word recall are not as significant as those for numeracy.

Then the next two columns in Table D9 report the results for working status and years of tenure in ECHP. We do not find significant evidence that economic conditions impact the working behavior in later life. But those who experience booms in early life are more likely to have longer tenure.

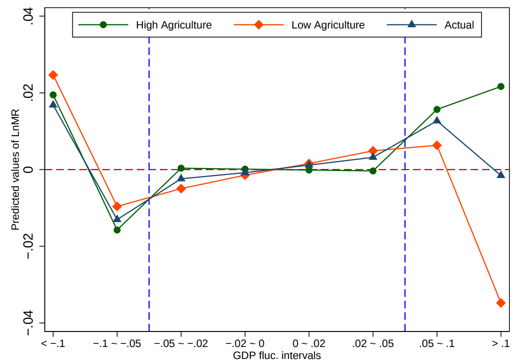
Figure D4 divides the countries in SHARE into high and low government spending. For each dimension of cognition, we present the effects of economic conditions in early life. Again, the impact of economic conditions in early life is larger among the countries with lower government expenditure, for all the three cognition measures.

Figure D1: Life expectancy change if there were no Economic fluctuations in early life

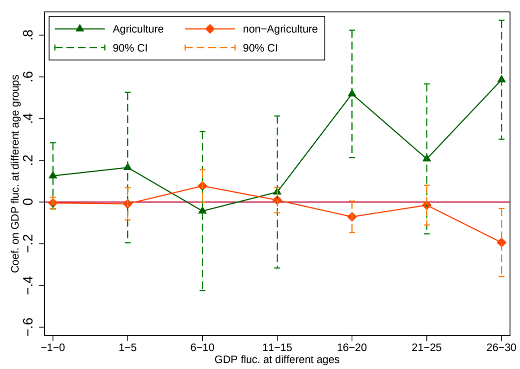


Note: Results of column 6 in Table 1 are used. For each cohort in the data, we use the estimated coefficients to predict the log(mortality) with and without early life GDP fluctuations. Then we calculate the differences in mortality and differences in life expectancy based on the 1997 US life table. The distribution for all the birth cohorts are plotted.

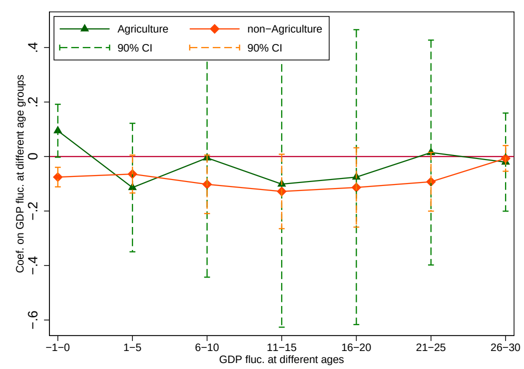
Figure D2: Contemporary and Long-term Effects of agriculture and non-agriculture share in GDP



(a) GDP shares and contemporary effects



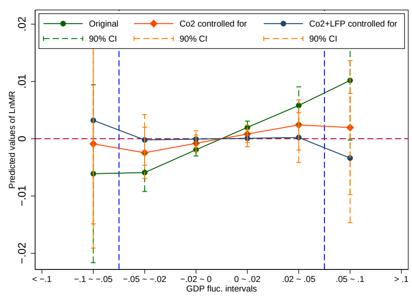
(b) Survival up to age 45



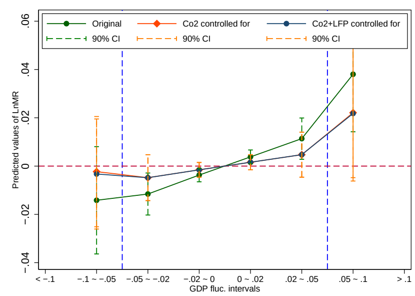
(c) Mortality after age 45

Note: The data for agriculture share are from IHS. The predicted contemporary effects with low, high and average agriculture share of GDP are plotted in panel a. The long-term effects on survival to age 45 and mortality after age 45 are plotted in panel b and panel c, respectively. For each outcome, the effects in agriculture economy and non-agriculture economy are plotted.

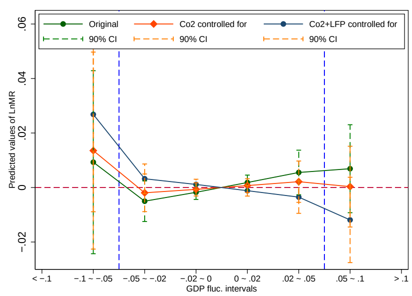
Figure D3: Effects of Contemporary Economic Conditions and Mediators (1)



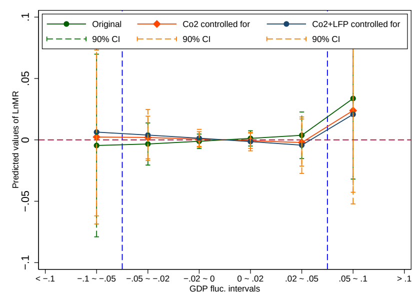
(a) Co2 and LFP



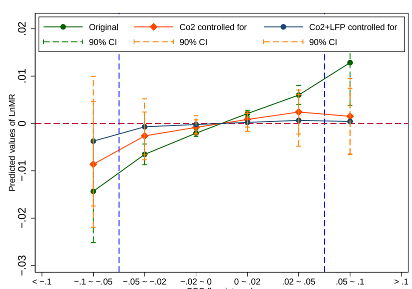
(b) Co2 and LFP, age <= 5



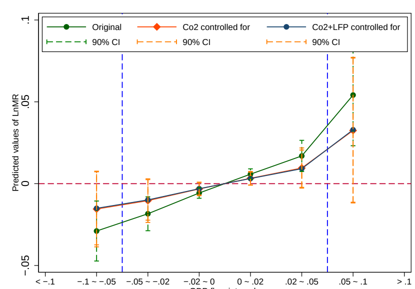
(c) Co2 and LFP (High G)



(d) Co2 and LFP (High G)

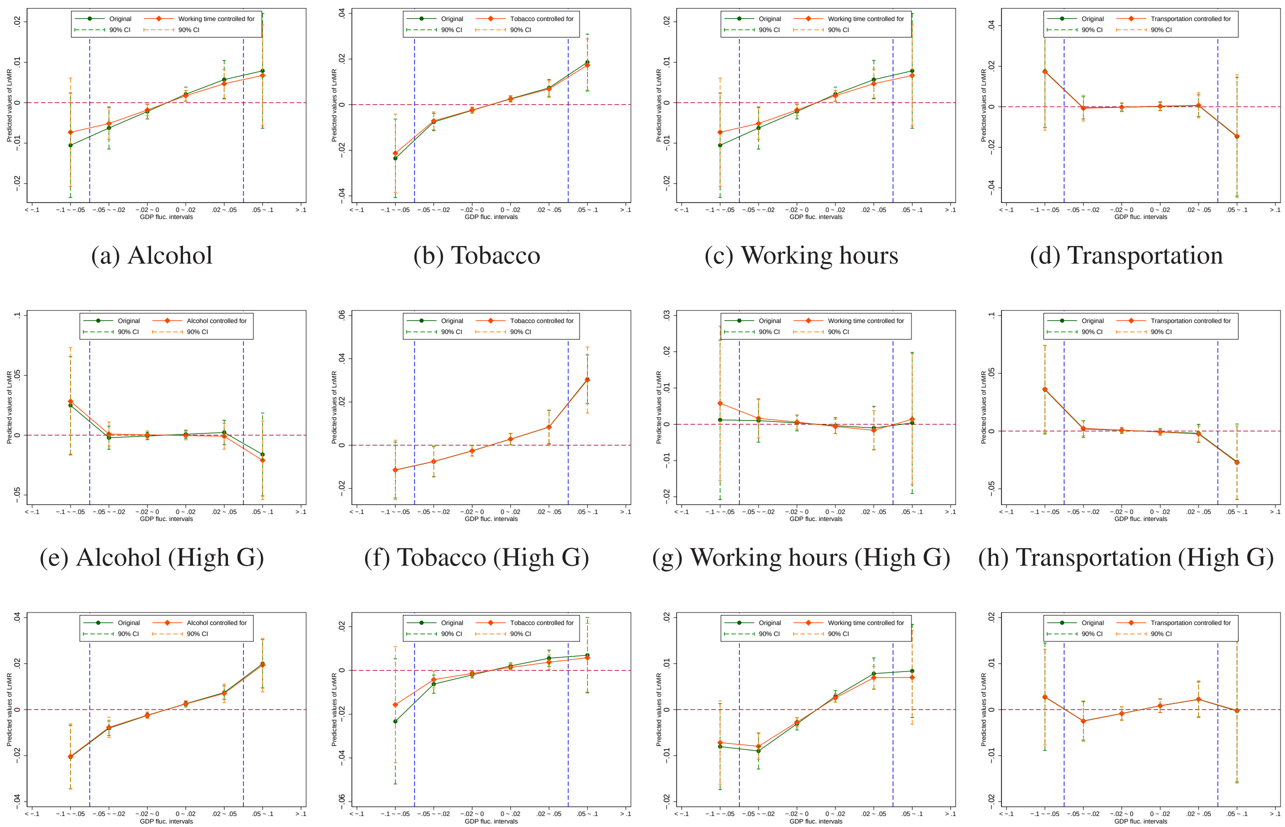


(e) Co2 and LFP (Low G)



(f) Co2 and LFP (Low G)

Figure D3: Effects of Contemporary Economic Conditions and Mediators (2)



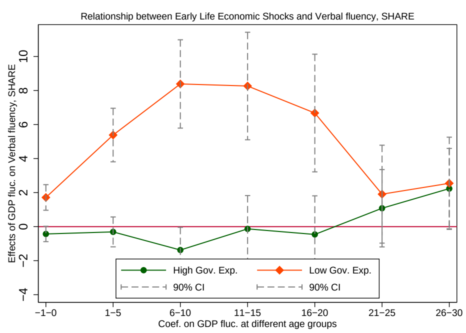
(a) Alcohol (b) Tobacco (c) Working hours (d) Transportation

(e) Alcohol (High G) (f) Tobacco (High G) (g) Working hours (High G) (h) Transportation (High G)

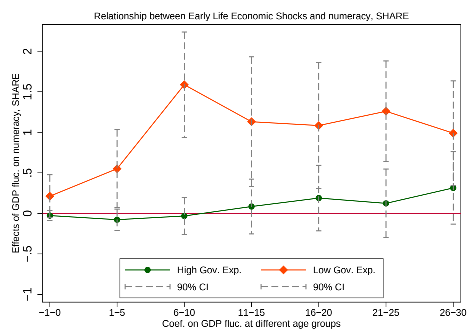
(i) Alcohol (Low G) (j) Tobacco (Low G) (k) Working hours (Low G) (l) Transportation (Low G)

Note: The contemporary effects are plotted for each mediator under the corresponding setting. The effects at |GDP fluctuation| > 0.1 are not plotted because there are very few observations.

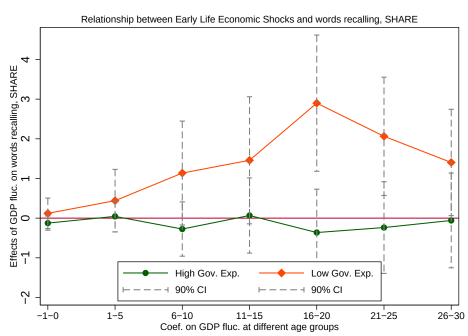
Figure D4: The Impact of Early Life GDP on Quality of Life at Older Ages, SHARE



(a) Verbal fluency, SHARE



(b) Numeracy, SHARE



(c) Words recall, SHARE

Note: Results in Panels a - c are from SHARE. The methodology follows that in Figure 5 in the paper.

Table D1: Reconciliation of magnitudes: van den Berg et al. (2006) replication

Dependent variable: ln(mortality rate)	Boom at birth (Yes = 1)
Panel A: Original results in Van der Berg et al. (2006)	
Table 3 from publication	-0.09
	T-stat: 3.5
Panel B: From Van der Berg et al. (2006) to CHLM (2016)	
Step 0: Replication	-0.10***
	(0.03)
Step 1: Restrict to age 45 and over	0.07
(Using the same data and methodology)	(0.10)
Step 2: Use HMD aggregate data for Holland	-0.015
(Age > 45 but the same methodology)	(0.029)
Step 3: Use CHLM specification	-0.005
	(0.006)
Step 4: Use GDP instead of GNP to define booms	-0.004
	(0.006)
Step 5: Include cohorts up to 1930	-0.008*
(Still Dutch HMD data)	(0.004)
Step 6: Include all 32 countries	-0.002**
(Birth cohorts 1850-1930)	(0.001)
Step 7: Include all 32 countries	-0.003*
(All birth cohorts)	(0.002)
Step 8: Use fluctuation level as explanatory variable	-0.033***
(All birth cohorts)	(0.012)

Note: Data in Panel A are from van den Berg et al. (2006). We use the HSN data to obtain the results in step 0 and step 1. The HMD data are used for the rest. The standard errors in steps 0-5 are clustered at the birth year level, and those in step 6-8 are clustered at the country level.
*** p<0.01, ** p<0.05, * p<0.1

Table D2: Results in Alternative Subgroups and under Different settings

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variable	ln(Mortality Rate)								
Settings	Basic Regression	Earlier than 1959	1959 or later	1959 or later & no east-euro countries	East-euro countries only	Drop war years and cohorts	Equal weights for each country	Population size as weights	Ages 55-85
Mean	0.700	0.996	0.561	0.499	0.838	0.630	0.400	0.388	0.833
Contemporary Economic Conditions									
Contemp. GDP fluc.	0.170**	0.032	0.332***	0.297***	-0.429*	0.142**	0.193**	0.204**	0.142*
	(0.070)	(0.075)	(0.069)	(0.068)	(0.211)	(0.0653)	(0.0762)	(0.0780)	(0.0701)
Big Boom	0.030***	0.013	0.042***	0.032**	-0.054	0.0363***	0.0396***	0.0249**	0.0286***
	(0.007)	(0.011)	(0.011)	(0.013)	(0.027)	(0.00765)	(0.00781)	(0.00974)	(0.00780)
Boom* Fluc.	-0.559***	-0.163	-0.893***	-0.507**	0.647*	-0.630***	-0.686***	-0.657***	-0.483***
	(0.133)	(0.095)	(0.179)	(0.239)	(0.297)	(0.154)	(0.105)	(0.158)	(0.130)
Big bust	0.003	-0.028*	-0.012	-0.061***	0.049	0.0134	-0.00613	0.0172	0.00300
	(0.009)	(0.015)	(0.019)	(0.012)	(0.031)	(0.00949)	(0.0109)	(0.0131)	(0.00895)
Bust * Fluc.	-0.326***	-0.311**	-0.561***	-1.026***	0.357	-0.205**	-0.470***	-0.281***	-0.271***
	(0.090)	(0.145)	(0.149)	(0.140)	(0.238)	(0.0984)	(0.130)	(0.0924)	(0.0849)

(Continue next page)

Table D2: Results in Alternative Subgroups and under Different settings (continue)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variable	ln(Mortality Rate)								
Settings	Basic Regression	Earlier than 1959	1959 or later	1959 or later & no east-euro countries	East-euro countries only	Drop war years and cohorts	Equal weights for each country	Population size as weights	Ages 55-85
Mean	0.700	0.996	0.561	0.499	0.838	0.630	0.400	0.388	0.833
Early Economic Conditions									
GDP fluc Age -1-0	-0.034**	0.030	-0.035***	-0.054***	0.028*	-0.0423***	-0.0508***	-0.0469***	-0.0238
	(0.014)	(0.045)	(0.012)	(0.014)	(0.013)	(0.0146)	(0.0129)	(0.0156)	(0.0149)
GDP fluc Age 1-5	-0.050**	-0.132***	-0.043**	-0.068***	-0.023	-0.0384	-0.0634***	-0.0459**	-0.0513**
	(0.018)	(0.044)	(0.017)	(0.023)	(0.016)	(0.0248)	(0.0179)	(0.0214)	(0.0227)
GDP fluc Age 6-10	-0.060**	-0.056	-0.056**	-0.086***	0.030	-0.0332	-0.0896***	-0.0562**	-0.0453
	(0.026)	(0.053)	(0.025)	(0.027)	(0.032)	(0.0323)	(0.0317)	(0.0266)	(0.0299)
GDP fluc Age 11-15	-0.089***	-0.106*	-0.081***	-0.121***	0.006	-0.0621*	-0.119***	-0.0906**	-0.0654*
	(0.029)	(0.059)	(0.027)	(0.038)	(0.031)	(0.0364)	(0.0316)	(0.0345)	(0.0329)
GDP fluc Age 16-20	-0.085***	-0.080	-0.075***	-0.099**	0.026	-0.0563*	-0.124***	-0.0770**	-0.0701*
	(0.030)	(0.049)	(0.026)	(0.039)	(0.033)	(0.0322)	(0.0343)	(0.0306)	(0.0349)
GDP fluc Age 21-25	-0.066***	-0.062	-0.058***	-0.063***	0.003	-0.0822**	-0.0864***	-0.0566*	-0.0615**
	(0.024)	(0.051)	(0.017)	(0.022)	(0.031)	(0.0335)	(0.0315)	(0.0278)	(0.0226)
GDP fluc Age 26-30	-0.008	-0.055*	-0.008	-0.012	0.028	0.00551	-0.0274	0.00536	0.00150
	(0.013)	(0.031)	(0.010)	(0.020)	(0.026)	(0.0210)	(0.0228)	(0.0184)	(0.0149)
N	245,512	102,232	143,190	116,460	26,730	181,444	245,512	245,512	186,482
R2	0.995	0.994	0.997	0.998	0.997	0.996	0.988	0.996	0.994

Note: All regressions include country-gender-age fixed effects, country-gender-age specific linear and square trends in calendar years, gender-birth year fixed effects, and gender-year fixed effects. All the regressions are weighted by the square root of the population size in the corresponding observation. Standard errors in parentheses are clustered at the country level.
*** p<0.01, ** p<0.05, * p<0.1

Table D3: Comparison of GDP Fluctuations and Unemployment Rate

	(1)	(2)	(3)	(4)	(5)
Variable	ln(Mortality Rate)				
Economic variables	GDP fluc.	Unemployment rate			
Contemporaneous	0.0369**	-0.137***	-0.322***	-0.330***	-0.284***
economic conditions	(0.0169)	(0.0191)	(0.0470)	(0.0413)	(0.0371)
	[0.0749]	[0.0994]	[0.175]	[0.167]	[0.145]
Economic conditions in early life					
Economic conditions	-0.0376***				
at Age -1-0	(0.0114)				
	[0.0139]				
Economic conditions	-0.0281**				
at Age 1-5	(0.0132)				
	[0.0202]				
Economic conditions	-0.0215				
at Age 6-10	(0.0148)				
	[0.0288]				
Economic conditions	-0.0407***				
Age 11-15	(0.0155)				
	[0.0288]				
Economic conditions	-0.0276*		-0.00537		
Age 16-20	(0.0160)		(0.0509)		
	[0.0380]		[0.0538]		
Economic conditions	-0.0117			0.169***	
Age 21-25	(0.0140)			(0.0370)	
	[0.0370]			[0.0596]	
Economic conditions	0.0242*				0.0796**
Age 26-30	(0.0134)				(0.0402)
	[0.0207]				[0.0478]
Observations					
N	118,708	118,708	29,876	35,042	40,924
Country cohorts	2,763	2,763	655	752	871
Countries	31	31	20	21	28
R2	0.998	0.998	0.998	0.998	0.998

Note: All regressions include country-gender-age fixed effects, country-gender-age specific linear and square trends in calendar years, gender-birth year fixed effects, and gender-year fixed effects. All the regressions are weighted by the square root of the population size in the corresponding observation. Standard errors in parentheses are clustered at country-cohort level and those in brackets are clustered at country level.
*** p<0.01, ** p<0.05, * p<0.1

Table D4: Early Life Economic Conditions and Middle and Late Life Outcomes, Results with Migrants

	Health	Income	Satisfaction			Health Behaviors		Social relations	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variables	Self-rated health	Ln(Ind. income)	Life in general	Financial situation	Leisure time	Current smoker	Obese	Talking with others	Meeting friends
Mean	2.40	11.4	4.18	3.62	4.20	0.33	0.13	4.18	4.00
Economic Conditions in Earlier Life									
GDP fluc -1-0	-0.005	0.100**	0.079*	0.049	0.033	0.036*	-0.003	0.061	0.017
	(0.025)	(0.046)	(0.042)	(0.042)	(0.040)	(0.021)	(0.029)	(0.039)	(0.029)
GDP fluc 1-5	-0.066	0.176**	0.271***	0.328***	0.129	-0.006	-0.056	0.196***	0.138***
	(0.052)	(0.083)	(0.085)	(0.085)	(0.079)	(0.053)	(0.057)	(0.062)	(0.053)
GDP fluc 6-10	-0.096	0.243*	0.247**	0.189	-0.007	0.069	0.087	0.205**	0.199**
	(0.082)	(0.130)	(0.126)	(0.120)	(0.120)	(0.085)	(0.080)	(0.085)	(0.080)
GDP fluc 11-15	-0.204*	0.100	0.549***	0.462***	0.015	0.125	-0.058	0.234**	0.180*
	(0.104)	(0.164)	(0.148)	(0.143)	(0.141)	(0.107)	(0.098)	(0.104)	(0.099)
GDP fluc 16-20	-0.189	0.843***	0.521***	0.393**	0.015	0.175*	0.014	0.269**	0.205*
	(0.121)	(0.242)	(0.159)	(0.159)	(0.151)	(0.104)	(0.107)	(0.113)	(0.111)
GDP fluc 21-25	-0.061	0.112	0.392**	0.509***	0.048	0.050	0.011	0.219*	-0.004
	(0.123)	(0.229)	(0.153)	(0.150)	(0.142)	(0.094)	(0.096)	(0.112)	(0.116)
GDP fluc 26-30	-0.147	-0.210	0.253*	0.368**	0.030	0.073	-0.131	0.093	-0.187*
	(0.147)	(0.198)	(0.148)	(0.153)	(0.142)	(0.089)	(0.083)	(0.118)	(0.108)
Observations									
Total	772,314	548,048	662,462	695,596	662,640	248,382	219,274	684,455	754,932
R^2	0.255	0.794	0.139	0.168	0.191	0.186	0.034	0.174	0.198

Notes: The data in the first nine columns are from the European Household Community Panel, from 1994-2001. Standard errors clustered by country-cohort cells are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table D5: Effects of Contemporary Economic Conditions and Mediators (1)

	(1)	(2)	(3)	(4)	(5)	(6)
	ln(Mortality rate) (1960-)					
Age sample	Age > 45			Age $\leq$ 5		
Panel A: Higher Government Expenditure Countries						
Contemporary	0.168	0.0652	-0.108	0.113	-0.0653	-0.131
GDP fluc.	(0.152)	(0.141)	(0.111)	(0.349)	(0.354)	(0.423)
Co2 emission	---	0.0911**	0.0771*	---	0.229**	0.245**
		(0.0413)	(0.0381)		(0.0844)	(0.0843)
LFP of women	---	---	0.0883	---	---	0.0680
			(0.0605)			(0.144)
LFP of men	---	---	0.582***	---	---	0.248
			(0.187)			(0.517)
Observations	46,750	46,750	46,750	6,190	6,190	6,190
Country-year cells		520			520	
Panel B: Lower Government Expenditure Countries						
Contemporary	0.196***	0.0791	0.0212	0.552**	0.311	0.298
GDP fluc.	(0.0400)	(0.0924)	(0.108)	(0.189)	(0.243)	(0.226)
Co2 emission	---	0.124	0.0837	---	0.301	0.309
		(0.0840)	(0.0785)		(0.173)	(0.186)
LFP of women	---	---	-0.0539	---	---	0.0883
			(0.0833)			(0.143)
LFP of men	---	---	0.403***	---	---	-0.00540
			(0.132)			(0.412)
Observations	60,060	60,060	60,060	7,956	7,956	7,956
Country-year cells		668			668	

Note: All regressions include country-gender-age fixed effects, country-gender-age specific linear and square trends in calendar years, country-gender-birth year fixed effects, and gender-year fixed effects. All the regressions are weighted by the square root of the population size in the corresponding observation. The big boom, big recession and their interactions with GDP fluctuations are also included. Only the coefficients on contemporary GDP fluctuations and those on the mediators are reported. Standard errors in parentheses are clustered at the country level.
*** p<0.01, ** p<0.05, * p<0.1

Table D5: Effects of Contemporary Economic Conditions and Mediators (2)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mediators	Alcohol consumption		Tobacco consumption		Working Hours		Vehicle Miles Driven	
Variables	(1960 -)		(1960 -)		(1981-)		(1970-)	
Panel A: Higher Government Expenditure Countries								
Contemp. GDP	0.0692	-0.0293	0.255	0.254	-0.0326	-0.0534	-0.0605	-0.0768
fluctuation	(0.189)	(0.198)	(0.142)	(0.147)	(0.117)	(0.106)	(0.146)	(0.128)
Mediator	---	0.0135*	---	0.00291	---	-0.393**	---	0.0482
		(0.00675)		(0.0287)		(0.156)		(0.0615)
Total	51,072	51,072	37,212	37,212	23,890	23,890	37,302	37,302
Countries	12	12	10	10	12	12	12	12
Country-year cells	567	567	414	414	266	266	415	415
Panel B: Lower Government Expenditure Countries								
Contemp. GDP	0.243***	0.231**	0.190**	0.128*	0.264***	0.234***	0.0725	0.0739
fluctuation	(0.0581)	(0.0804)	(0.0770)	(0.0700)	(0.0699)	(0.0501)	(0.0755)	(0.0794)
Mediator	---	0.00151	---	0.0273***	---	-0.326***	---	-0.00102
		(0.00356)		(0.00736)		(0.104)		(0.0257)
Total	60,330	60,330	35,812	35,812	29,190	29,190	31,804	31,804
Countries	15	15	13	13	15	15	12	12
Country-year cells	670	670	399	399	325	325	354	354

Note: All regressions include country-gender-age fixed effects, country-gender-age specific linear and square trends in calendar years, country-gender-birth year fixed effects, and gender-year fixed effects. All the regressions are weighted by the square root of the population size in the corresponding observation. The big boom, big recession and their interactions with GDP fluctuations are also included. Only the coefficients on contemporary GDP fluctuations and those on the mediators are reported. Standard errors in parentheses are clustered at the country level.
*** p<0.01, ** p<0.05, * p<0.1

Table D6: Mediator results by dropping one country in a time (1)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Mediators	CO2 (1960-2008)			Time (1981-2008)		Transport (1970-2008)		Alcohol (1960-2008)		Tobacco (1960-2008)	
Country dropped	Basic	Control Co2	Co2+LFP	Basic	Working time	Basic	Transportation	Basic	Alcohol	Basic	Tobacco
None	0.184***	0.0763	0.00667	0.190*	0.156**	0.0169	0.0230	0.190**	0.114	0.238***	0.222***
	(0.0626)	(0.0843)	(0.0837)	(0.0959)	(0.0718)	(0.103)	(0.119)	(0.0806)	(0.0985)	(0.0726)	(0.0744)
Australia	0.185	0.0679	0.00590	0.196	0.161**	0.0250	0.0328	0.189**	0.110	0.248***	0.233***
	(0.0649)	(0.0920)	(0.0909)	(0.100)	(0.0760)	(0.106)	(0.122)	(0.0819)	(0.102)	(0.0727)	(0.0743)
Austria	0.183	0.0711	-0.000632	0.191	0.157**	0.0138	0.0204	0.194**	0.109	0.239***	0.223***
	(0.0640)	(0.0855)	(0.0842)	(0.0959)	(0.0715)	(0.103)	(0.119)	(0.0808)	(0.0997)	(0.0761)	(0.0778)
Belarus	0.184	0.0771	0.00789					0.188**	0.114		
	(0.0628)	(0.0849)	(0.0843)					(0.0801)	(0.0986)		
Belgium	0.179	0.0720	-0.000940	0.189	0.154**	0.0143	0.0205	0.192**	0.114	0.234***	0.217**
	(0.0638)	(0.0846)	(0.0839)	(0.0967)	(0.0665)	(0.101)	(0.117)	(0.0806)	(0.0986)	(0.0765)	(0.0783)
Bulgaria	0.189	0.0692	0.00210			-0.00687	-0.0177	0.186**	0.107		
	(0.0648)	(0.0839)	(0.0827)			(0.107)	(0.122)	(0.0851)	(0.102)		
Canada	0.195	0.0847	0.0159	0.212**	0.173**	0.0174	0.0236	0.197**	0.128	0.251***	0.233***
	(0.0616)	(0.0824)	(0.0804)	(0.0936)	(0.0705)	(0.103)	(0.119)	(0.0794)	(0.0938)	(0.0719)	(0.0750)
Czech Rep.	0.187	0.0782	0.00873	0.197**	0.163**	0.0250	0.0311	0.165*	0.0772	0.238***	0.223***
	(0.0624)	(0.0837)	(0.0831)	(0.0944)	(0.0704)	(0.0996)	(0.116)	(0.0824)	(0.0962)	(0.0729)	(0.0748)
Denmark	0.187	0.0772	0.0105	0.208**	0.171**	0.0165	0.0233	0.191**	0.114	0.246***	0.231***
	(0.0641)	(0.0854)	(0.0841)	(0.0960)	(0.0722)	(0.109)	(0.125)	(0.0829)	(0.101)	(0.0726)	(0.0745)
Estonia	0.181	0.0735	0.00413	0.189*	0.155**	0.0230	0.0212	0.191**	0.116		
	(0.0631)	(0.0845)	(0.0841)	(0.0962)	(0.0720)	(0.105)	(0.123)	(0.0805)	(0.0983)		
Finland	0.195	0.0775	0.0130	0.218**	0.185***	0.00603	0.0125	0.199**	0.124	0.258***	0.243***
	(0.0633)	(0.0921)	(0.0904)	(0.0911)	(0.0663)	(0.107)	(0.123)	(0.0831)	(0.101)	(0.0724)	(0.0734)
France	0.183	0.0845	0.0124	0.189*	0.160**	0.0138	0.0204	0.196**	0.119	0.234***	0.212**
	(0.0644)	(0.0855)	(0.0848)	(0.0943)	(0.0760)	(0.100)	(0.117)	(0.0807)	(0.0985)	(0.0809)	(0.0831)

Table D6: Mediator results by dropping one country in a time (2)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Mediators	CO2			Time		Transport		Alcohol		Tobacco	
Country dropped	Basic	Control Co2	Co2+LFP	Basic	Working time	Basic	Transportation	Basic	Alcohol	Basic	Tobacco
Hungary	0.148	0.0576	-0.00962	0.173	0.140*	-0.00900	-0.00350	0.160*	0.0953	0.183***	0.172**
	(0.0557)	(0.0832)	(0.0852)	(0.103)	(0.0778)	(0.106)	(0.122)	(0.0796)	(0.0994)	(0.0584)	(0.0632)
Iceland	0.188	0.0793	0.00808	0.186*	0.153**	0.0160	0.0222	0.193**	0.117	0.245***	0.230***
	(0.0628)	(0.0851)	(0.0853)	(0.0968)	(0.0726)	(0.103)	(0.119)	(0.0814)	(0.0993)	(0.0730)	(0.0748)
Ireland	0.178	0.0653	-0.000504	0.189*	0.156**			0.185**	0.113	0.231***	0.216***
	(0.0643)	(0.0865)	(0.0858)	(0.0960)	(0.0719)			(0.0818)	(0.0985)	(0.0729)	(0.0747)
Italy	0.206	0.0876	0.0109	0.191*	0.157**	0.0220	0.0267	0.217***	0.137	0.243***	0.228***
	(0.0617)	(0.0843)	(0.0887)	(0.0963)	(0.0718)	(0.103)	(0.122)	(0.0771)	(0.0931)	(0.0735)	(0.0753)
Japan	0.174	0.0612	-0.0170	0.0290	0.0386	-0.0190	-0.0108	0.190*	0.102	0.260**	0.251**
	(0.0840)	(0.0986)	(0.0955)	(0.0746)	(0.0716)	(0.117)	(0.128)	(0.104)	(0.123)	(0.106)	(0.107)
Latvia	0.179	0.0799	0.0113	0.189*	0.157**	0.00353	-0.00388	0.189**	0.118		
	(0.0629)	(0.0856)	(0.0853)	(0.0964)	(0.0722)	(0.109)	(0.123)	(0.0817)	(0.101)		
Lithuania	0.183	0.0776	0.00917	0.190*	0.156**	0.0185	0.0242	0.188**	0.109		
	(0.0628)	(0.0854)	(0.0850)	(0.0957)	(0.0718)	(0.103)	(0.119)	(0.0810)	(0.0998)		
Luxembourg	0.185	0.0732	0.00448	0.194*	0.160**			0.191**	0.115		
	(0.0630)	(0.0846)	(0.0839)	(0.0965)	(0.0728)			(0.0809)	(0.0990)		
Netherlands	0.158	0.0450	-0.0204	0.191*	0.154**	-0.00173	0.00323	0.170**	0.0912	0.202***	0.179**
	(0.0615)	(0.0832)	(0.0840)	(0.0951)	(0.0723)	(0.102)	(0.119)	(0.0788)	(0.0986)	(0.0709)	(0.0684)
New	0.182	0.0729	0.00300	0.181*	0.145*			0.186**	0.110	0.241***	0.225***
Zealand	(0.0644)	(0.0868)	(0.0864)	(0.0995)	(0.0744)			(0.0839)	(0.102)	(0.0757)	(0.0773)
Norway	0.191	0.0872	0.0201	0.196**	0.164**	0.0209	0.0297	0.194**	0.117	0.256***	0.239***
	(0.0637)	(0.0898)	(0.0876)	(0.0954)	(0.0727)	(0.111)	(0.129)	(0.0836)	(0.102)	(0.0730)	(0.0757)

Table D6: Mediator results by dropping one country in a time (3)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Mediators	CO2			Time		Transport		Alcohol		Tobacco	
Country dropped	Basic	Control Co2	Co2+LFP	Basic	Working time	Basic	Transportation	Basic	Alcohol	Basic	Tobacco
Poland	0.201	0.150**	0.0765	0.189*	0.155**	0.0293	0.0363	0.195**	0.132	0.238***	0.222***
	(0.0623)	(0.0586)	(0.0653)	(0.0962)	(0.0722)	(0.109)	(0.124)	(0.0864)	(0.0993)	(0.0726)	(0.0744)
Portugal	0.171	0.0701	-0.00260	0.185*	0.157**	0.00550	0.0159	0.181**	0.0921	0.241***	0.225***
	(0.0648)	(0.0861)	(0.0862)	(0.103)	(0.0740)	(0.105)	(0.121)	(0.0820)	(0.101)	(0.0725)	(0.0743)
Russia	0.208	0.113	0.0452	0.223***	0.190***	0.142**	0.180***	0.254***	0.217***		
	(0.0561)	(0.0759)	(0.0741)	(0.0782)	(0.0553)	(0.0511)	(0.0559)	(0.0586)	(0.0645)		
Slovak Rep.	0.185	0.0764	0.00668	0.191*	0.155**	0.0203	0.0257	0.183**	0.105		
	(0.0625)	(0.0837)	(0.0830)	(0.0956)	(0.0705)	(0.101)	(0.118)	(0.0837)	(0.101)		
Spain	0.195	0.0725	-0.00193	0.192*	0.141*	0.0352	0.0488	0.208**	0.127		
	(0.0646)	(0.0925)	(0.0911)	(0.0981)	(0.0757)	(0.0951)	(0.106)	(0.0775)	(0.0984)		
Sweden	0.195	0.0744	0.0136	0.193*	0.164**	0.0163	0.0210	0.196**	0.117	0.252***	0.237***
	(0.0623)	(0.0855)	(0.0835)	(0.0949)	(0.0717)	(0.107)	(0.124)	(0.0822)	(0.0991)	(0.0742)	(0.0763)
Switzerland	0.187	0.0781	0.00452	0.190*	0.157**	0.0158	0.0228	0.193**	0.119	0.241***	0.226***
	(0.0641)	(0.0853)	(0.0853)	(0.0963)	(0.0721)	(0.106)	(0.122)	(0.0833)	(0.100)	(0.0738)	(0.0756)
Ukraine	0.18	0.0762	0.00726					0.189**	0.126		
	(0.0646)	(0.0876)	(0.0876)					(0.0811)	(0.101)		
United	0.188	0.0725	-0.00652	0.202*	0.159**	0.00138	0.00554	0.195**	0.122	0.245***	0.236***
Kingdom	(0.0638)	(0.0838)	(0.0811)	(0.0992)	(0.0759)	(0.110)	(0.126)	(0.0835)	(0.100)	(0.0743)	(0.0755)
United	0.161	0.0489	-0.0277	0.184**	0.147**	0.0152	0.0264	0.153*	0.0733	0.206**	0.194**
States	(0.0639)	(0.0883)	(0.0866)	(0.0892)	(0.0646)	(0.104)	(0.123)	(0.0797)	(0.101)	(0.0740)	(0.0787)

Notes: Coefficients on contemporary GDP fluctuation are reported. The standard errors are clustered at country level.

Table D7: Other results for mediators, Alcohol and Flu

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Dependent variable: Ln(Mortality)											
Mediator	Alcohol consumption										Flu	
Sample	No Russia		No Russia & Male		No Russia & Female		No Russia & Younger (Age < 65)		No Russia & Older (Age $\geq$ 65)		All available countries	
Contempt.	0.254***	0.217***	0.242***	0.196***	0.265***	0.234***	0.250***	0.192**	0.226***	0.214**	0.214***	0.225***
GDP fluc.	(0.0586)	(0.0645)	(0.0659)	(0.0690)	(0.0579)	(0.0657)	(0.0847)	(0.0843)	(0.0776)	(0.0827)	(0.0584)	(0.0584)
Mediator		0.0045		0.0055		0.0036		0.007*		0.001		0.001***
		(0.0032)		(0.0037)		(0.0028)		(0.004)		(0.002)		(0.000)
N	121,818	121,818	60,909	60,909	60,909	60,909	51,358	51,358	67,618	67,618	105,726	105,726
R^2	0.998	0.998	0.998	0.998	0.998	0.998	0.993	0.993	0.998	0.998	0.998	0.998

Note: All regressions include country-gender-age fixed effects, country-gender-age specific linear and square trends in calendar years, country-gender-birth year fixed effects, and gender-year fixed effects. All the regressions are weighted by the square root of the population size in the corresponding observation. The big boom, big recession and their interactions with GDP fluctuations are also included. Only the coefficients on contemporary GDP fluctuations and those on the mediators are reported. Standard errors in parentheses are clustered at the country level.

*** p<0.01, ** p<0.05, * p<0.1

Table D8: Early Life Economic Conditions and Mental Health

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Mental health (1-5 for each)								
Variables	Felt full of life	Felt partic tense	Felt down in dumps	Felt calm	Had lot of energy	Felt downhearted	Felt worn out	Felt happy	Felt tired
Mean	3.476	2.390	1.721	3.527	3.307	1.914	2.290	3.493	2.765
GDP Fluc.	-0.091	-0.005	0.011	0.025	-0.065	-0.037	-0.093	0.098	-0.047
At Birth	(0.071)	(0.072)	(0.071)	(0.067)	(0.097)	(0.082)	(0.079)	(0.081)	(0.055)
GDP Fluc.	-0.006	-0.011	0.118	0.101	-0.148	0.030	-0.113	-0.073	-0.055
Age 1-5	(0.134)	(0.124)	(0.155)	(0.107)	(0.155)	(0.177)	(0.185)	(0.125)	(0.156)
GDP Fluc.	0.019	0.008	-0.028	0.112	0.012	0.013	-0.167	0.139	-0.120
Age 6-10	(0.240)	(0.191)	(0.272)	(0.240)	(0.245)	(0.253)	(0.321)	(0.235)	(0.228)
GDP Fluc.	0.263	-0.132	-0.188	0.365	0.051	-0.177	-0.329	0.270	-0.137
Age 11-15	(0.283)	(0.240)	(0.314)	(0.272)	(0.300)	(0.276)	(0.383)	(0.265)	(0.337)
GDP Fluc.	0.597**	-0.253	-0.543**	0.582**	0.256	-0.505*	-0.595*	0.415	-0.290
Age 16-20	(0.255)	(0.287)	(0.258)	(0.262)	(0.310)	(0.289)	(0.329)	(0.294)	(0.288)
GDP Fluc.	0.320	-0.247	-0.431	0.454	0.068	-0.429	-0.415	0.471*	-0.462
Age 21-25	(0.245)	(0.278)	(0.279)	(0.269)	(0.325)	(0.266)	(0.332)	(0.253)	(0.279)
GDP Fluc.	0.147	-0.082	-0.565*	0.512**	-0.051	-0.529*	-0.333	0.194	-0.137
Age 26-30	(0.232)	(0.260)	(0.293)	(0.221)	(0.262)	(0.267)	(0.266)	(0.208)	(0.265)
Observations	55,211	55,271	55,221	55,278	55,212	55,198	55,248	55,067	55,375
R-squared	0.199	0.172	0.209	0.153	0.186	0.192	0.210	0.171	0.173

Notes: The data in the first nine columns are from the European Household Community Panel, from 1994-2001. The regressions are the same as the column 10 in Table 4 in the paper. Standard errors clustered by country-cohort cells are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table D9: Early Life Economic Conditions, Health, and Cognition, SHARE

Data source	SHARE				ECHP	
	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Self-rated health	Verbal fluency (0-100)	Numeracy (1-5)	Words recall (0-20)	Working now (Yes = 1)	Tenure in years (among working people)
Mean	3.14	19.7	3.34	8.82	0.56	10.0
Economic Conditions in Earlier Life						
GDP fluc -1-0	-0.0385	-0.113	0.00564	-0.0443	0.028*	0.106
	(0.0362)	(0.246)	(0.0358)	(0.0980)	(0.017)	(0.357)
GDP fluc 1-5	-0.151**	0.233	-0.0140	0.204	-0.016	2.900***
	(0.0704)	(0.473)	(0.0718)	(0.208)	(0.036)	(0.758)
GDP fluc 6-10	-0.272**	-0.248	0.146	0.233	0.009	4.770***
	(0.109)	(0.715)	(0.123)	(0.360)	(0.050)	(1.102)
GDP fluc 11-15	-0.414***	0.837	0.298*	0.675	-0.040	7.373***
	(0.152)	(0.978)	(0.172)	(0.474)	(0.062)	(1.558)
GDP fluc 16-20	-0.430**	0.621	0.460**	0.640	0.045	10.426***
	(0.174)	(1.141)	(0.205)	(0.535)	(0.086)	(2.038)
GDP fluc 21-25	-0.357**	1.356	0.380*	0.561	0.026	9.221***
	(0.168)	(1.098)	(0.208)	(0.546)	(0.094)	(1.977)
GDP fluc 26-30	-0.474***	2.015*	0.525**	0.785	-0.106	3.716**
	(0.172)	(1.123)	(0.212)	(0.536)	(0.081)	(1.849)
Observations						
Total	185,236	180,560	120,316	181,080	601,643	356,771
Individuals	104,332	102,431	100,559	102,697	120,115	84560
Country-cohort	923	931	923	932	585	584
R^2	0.186	0.257	0.200	0.263	0.276	0.256

Notes: The data in the first four columns are from the SHARE, and the sample in the rest two columns are composed of those aged between 30 and 65 in ECHP. All regressions control for country-gender-year, country-age-gender, and gender-birth cohort fixed effects. Standard errors clustered by country-cohort cells are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

References

Bank, World, "World development indicators," *World Bank*, 2015.

Baxter, Marianne and Robert G. King, "Measuring Business Cycles: Approximate Band-Pass Filters For Economic Time Series," *The Review of Economics and Statistics*, November 1999, *81* (4), 575–593.

Cutler, David M, Wei Huang, and Adriana Lleras-Muney, "When does education matter? The protective effect of education for cohorts graduating in bad times," *Social Science & Medicine*, 2015, *127*, 63–73.

Donkelaar, Aaron Van, Randall V Martin, Michael Brauer, N Christina Hsu, Ralph A Kahn, Robert C Levy, Alexei Lyapustin, Andrew M Sayer, and David M Winker, "Global Estimates of Fine Particulate Matter using a Combined Geophysical-Statistical Method with Information from Satellites, Models, and Monitors," *Environmental science & technology*, 2016, *50* (7), 3762–3772.

Hodrick, Robert J and Edward C Prescott, "Postwar US business cycles: an empirical investigation," *Journal of Money, credit, and Banking*, 1997, pp. 1–16.

Khan, Hashmat, Christopher R. Knittel, Konstantinos Metaxoglou, and Maya Papineau, "Carbon Emissions and Business Cycles," Working Paper 22294, National Bureau of Economic Research May 2016.

Layard, P Richard G, Stephen J Nickell, and Richard Jackman, *Unemployment: macroeconomic performance and the labour market*, Oxford University Press on Demand, 2005.

Lleras-Muney, Adriana and Flavien Moreau, "The Shape of Mortality: Implications for Economic Analysis," *Working Paper*, 2016.

Mitchell, Brian, *International historical statistics: Europe 1750-1993*, Springer, 1998.

Ruhm, Christopher J, "Are Recessions Good for Your Health?," *The Quarterly Journal of Economics*, 2000, *115* (2), 617–650.

van den Berg, Gerard J, Maarten Lindeboom, and France Portrait, "Economic conditions early in life and individual mortality," *The American Economic Review*, 2006, pp. 290–302.