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Trends in Inequality of Opportunity in health over the life cycle: the role of early-life conditions

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Abstract

This paper explores the evolution of inequality of opportunity in the prevalence of chronic diseases along the life cycle and across different birth cohorts for individuals aged 50 or older and residing in 13 European countries. We adopt an ex-ante parametric approach and rely on the dissimilarity index as our reference inequality metric. In addition to a commonly used set of circumstances, we pay particular attention to the role of adverse early-life conditions, such as the experience of harm and the quality of the relationship with parents. In order to quantify the relative importance of each circumstance, we apply the Shapley inequality decomposition method. Our results suggest that inequality of opportunity in health is not stable over the life cycle - it is generally lower at younger ages and then monotonically increases. Moreover, it varies between different birth cohorts and is generally higher for younger individuals than for older age groups. Finally, the contribution of adverse early life conditions ranges between 25% and 45%, which is comparable to the share of socio-economic circumstances but significantly higher than the relative contribution of other demographic characteristics, especially at younger ages.

Keywords: Inequality of opportunity, health, life cycle, adverse early-life conditions, decomposition.

JEL Classification: I14, D63.

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1 Introduction

Following the call for health equity by the World Health Organisation (WHO, Commission on Social Determinants of Health 2008), the reduction of health inequalities represents a crucial goal for policy makers worldwide. In the European context, the WHO promoted the Health 2020 project with the aim of supporting action by government and society in order to: "significantly improve the health and well-being of populations, reduce health inequalities, strengthen public health and ensure people-centred health systems that are universal, equitable, sustainable and of high quality".¹

Health inequality may come from different sources, not all of which are equally objectionable. Based on the theoretical approach of Roemer (1998) to equality of opportunity, there is a distinction between "legitimate" and "illegitimate" sources of inequality. While legitimate sources of disparities can be attributed to consequences of individual effort (*i.e.*, determinants within individual control), illegitimate sources of differences are related to circumstances (*i.e.*, determinants beyond individuals' responsibility) such as race, gender, ethnicity, characteristics of the neighborhood in which an individual grows, parental backgrounds and/or early-life conditions. Thus, inequality from given circumstances should be compensated while the one arising from efforts, which are mainly determined by individual choices and behavior, are morally and normatively accepted, and should be rewarded.

There are two approaches to the measurement of inequality of opportunity (IOp, henceforth): ex-ante and ex-post (Fleurbaey and Peragine, 2013; Li Donni et al., 2014; Davillas and Jones, 2020). The ex-post approach seeks equality of outcomes between individuals who exert the same level of effort, irrespective of their circumstances (Roemer, 1998; Peragine, 2002; Aaberge et al, 2011). The ex-ante approach, on the other hand, suggests that there is equality of opportunity if all individuals encounter the same set of opportunities, prior to their efforts and outcomes being realised (Ooghe et al., 2007; Bourguignon et al., 2007; Checchi and Peragine, 2010; Fleurbaey and Peragine, 2013; Davillas and Jones, 2020). Em-

¹For more details see: https://www.euro.who.int/__data/assets/pdf_file/0006/199536/Health2020-Short.pdf

pirically speaking, the ex-ante approach can be implemented using information on observed circumstances and outcomes since inequality is identified by comparing outcome distributions between different types defined in terms of circumstances. The total contribution of circumstances includes both the direct effect of circumstances on outcomes, and their indirect effect through efforts.

In this paper we adopt an ex-ante parametric approach and rely on a dissimilarity index to quantify the extent of inequality of opportunity in the prevalence of chronic diseases. Our contribution to the existing literature is twofold. First, we include, among the circumstances, a novel battery of variables (so-called *Adverse Childhood Circumstances* - ACE, henceforth) describing emotional and physical abuse in childhood, such as physical harm from parents and/or third parties, child neglect and the quality of the relationship with parents. We are particularly interested in disentangling the relative contribution of ACE to the overall IOP in the prevalence of chronic diseases both over the lifespan and in different birth cohorts. Individuals who experienced ACE are at increased odds of adverse health outcomes during life, such as premature death, diabetes, stroke, depression, fair/poor health, myocardial infarction, asthma, disability, severe obesity, mental distress, and sexually transmitted diseases (Sonu et al., 2019; Chanlongbutra et al., 2018; Campbell et al., 2016; Felitti et al., 1998.)

Second, we provide a comprehensive picture of the evolution of IOP in health during the lifespan for individuals born in different historical and economic contexts. Unlike the existing literature which focuses mainly on a limited number of case-studies, we carry out a wide cross-country analysis including 13 European countries, namely Austria, Germany, Sweden, Spain, Italy, France, Denmark, Switzerland, Belgium, Czech Republic, Slovenia, Estonia, and Croatia. The sample consists of individuals born starting from the World War II (1940-45) and the immediate post-war period (1946-51) to more recent years (1952-57; 1958-63), in which most European countries have witnessed a significant increase in individual well-being and income. In order to explore the evolution of IOP over the life cycle, within each birth cohort, we quantify inequalities of opportunity arising at different life stages, namely when individuals were 25, 30, 35, 40, 45, 50, 55, 60 and 65 years old.

In this way we are able to track changes in IOp starting from young adulthood to old age, separately for each birth cohort. For the purposes of our analysis, we use individual-level data drawn from the Survey of Health, Ageing and Retirement in Europe (SHARE). SHARE is a multidisciplinary, longitudinal survey on ageing which focuses on individuals aged 50+ and their spouses. Our analysis is based on retrospective information collected in the seventh wave of SHARELIFE, which allows us to track the health status of respondents over the life cycle, and to obtain information on an extensive set of childhood circumstances. With this information and coverage, the SHARE data set constitutes an ideal platform for the purposes of our analysis.

Looking at IOp over the life-cycle is crucial to understand how inequalities related to early- life conditions evolve over time. There is some evidence that risk factors associated with poor health and inappropriate living conditions tend to accumulate over a lifetime (see Kim and Durden, 2007). This is in line with the so-called "cumulative advantage" hypothesis, suggesting that adverse circumstances and health disadvantages accumulate as individuals age. Conversely, other studies show that IOp in health increases with age up to a limit and then inequality begins to narrow most likely due to the "age-as-leveller" hypothesis (Davillas and Jones, 2020) which suggests that unavoidable biological processes may dominate the socio-economic determinants of health when older. Moreover, the evidence of generational differences in terms of IOp is important to properly monitor trends in health disparities among individuals exposed to different economic and social conditions, such as changes in the health and welfare systems in the countries where they live (van Kippersluis et al, 2009).

Overall, our findings support the "cumulative advantage" hypothesis since IOp is shown to increase monotonically over the life cycle. Moreover, we find a significant variation of IOp between birth cohorts. Indeed, with a few exceptions, inequality seems to be generally higher for younger than older cohorts. Regarding circumstances, there is a significant heterogeneity in terms of their contribution to inequality of opportunity in health: ACE account for a significant portion of inequality (from about 25% to almost 45%) and their

contribution seems to be more pronounced at younger ages. Socio-economic conditions such as having experienced economic difficulties during childhood and parental education are also important and their contribution persists throughout life. Finally, the relative importance of demographic factors rises over the lifespan, especially for the oldest generation.

2 Related Literature

A growing body of literature has addressed the measurement of IOp in health using different approaches and focusing on different countries (i.e., Davillas and Jones (2020), Carrieri et al. 2019, Rosas Dias (2009), Fajardo-Gonzalez (2016), Jusot et al. (2010), among others). Empirical research is mainly driven by data availability. Most studies of the adult population are based on data from single countries in Europe, especially from UK while studies analysing inequalities of opportunity among children are based on low or middle-income countries and focus on children less than 5 years old.

A key issue in measuring IOp in health is the choice of the health indicator. The existing evidence comes mainly from self-assessed health (SAH) as the main input for the measurement of health inequality (e.g., Kerkhofs and Lindeboom (1995), Rosas Dias (2009), Doiron et al. 2015, Fajardo-Gonzalez (2016), Bricard et al.(2020)).² Other studies have used a more specific measure of health in adulthood, *i.e.*, the incidence of self-reported long-standing illness or disability at a specific age (Jones et al., 2012). Recently, some papers have measured inequality of opportunity in health using bio-markers instead of self-reported health indicators. Davillas and Jones (2020), for instance, use blood-based bio-markers considered relevant for specific chronic health conditions such as obesity, high blood-pressure and diabetes. In the same vein, Carrieri et al. (2019) use a composite biological measure to capture several health dimensions such as blood-pressure, inflammation, blood sugar level and cholesterol.

²Although SAH has proved effective in predicting mortality and health-care utilisation (van Doorslaer and Gerdtham, 2003), it has some limitations. An important one is reporting bias: sub-groups of the population may in fact use different thresholds when assessing their health status, even if their objective health conditions are likely the same.

Regarding the choice of circumstances, most studies deem the socio-economic background an illegitimate source of inequality in health. Davillas and Jones (2020) include in circumstances the educational attainment of individuals and their parents, parental occupation, and childhood language. They find that these characteristics explain a non-trivial part of inequality, along with age and gender. Rosas Dias (2009) measures inequality of opportunity in health in the UK, adopting an ex-post approach. He considers a large set of circumstances such as parental socio-economic status, grandparents socio-economic status, educational attainment, lifestyles and health status of parents. Other studies focus on specific circumstances such as parental occupation. For instance, Bricard et al. (2020) stress the importance of the father's occupation as a childhood circumstance. They use data from the 1958 National Child Development Study which records individual health status at different ages over the lifespan. At all ages, they find that individuals born to a "professional", "senior manager or technician" father report a better health status and have a lower mortality rate than individuals born to manual workers and individuals without a father at birth. Both studies (i.e., Bricard et al.(2020), and Rosas Dias (2009)) quantify IOp over the lifespan using UK data, and look at the health status of individuals at different ages. Conversely, Yan et al.(2020) quantify IOp in health in China focusing on the health status of elderly Chinese respondents. Childhood conditions include a large set of information on demographic factors, parent's health and health behaviors, family socio-economic status, relationship with parents (if parents ever hit the respondent), and self-reported health when respondents were children. By using the Shapley value decomposition approach, they show that childhood circumstances may explain up to 23 percent of health inequality in old age among multiple health outcomes (cognitive health, mental health, physical health, etc.)

Only few studies measure inequality of opportunity in health using a cross-country perspective. Bricard et al. (2013) measure and compare inequality of opportunity in health in different European countries using data from the Retrospective Survey of SHARELIFE, which focuses on life histories of European people aged 50 and over in 2008/2009. In particular, the paper investigates whether the correlation between effort (lifestyles) and cir-

cumstances (social conditions in childhood, parents' longevity and parents' health-related behaviors) differ from one country to another. Their findings suggest that inequalities of opportunity in health are mainly driven by social background affecting adult health directly, and so would require policies compensating for poorer initial conditions. In another interesting study, Jusot et al. (2010) use data from the same survey (SHARELIFE) to quantify inequality of opportunity in health in a set of European countries. They focus on health status in adulthood (self-assessed health), and show the existence of inequalities of opportunity in health among different European countries related to circumstances. In particular, inequalities of opportunity in health are particularly marked in Mediterranean and Germanic countries while in the Nordic countries they appear as less pronounced. Both studies assess inequality of opportunity in health focusing on the health status of respondents in adulthood (aged 50 or older).

3 Data and Methodology

Individual-level data employed in this study are drawn from the Survey of Health, Ageing and Retirement in Europe (SHARE). SHARE is a multidisciplinary longitudinal survey on ageing which focuses on individuals aged 50+ and their spouses. The survey contains both regular and retrospective waves (SHARELIFE). The regular rounds collect information on the individuals' current situation, such as health, working situation, social network/relations, accommodation, economic situation/assets, behavioral risks, and expectations. In addition, two survey rounds add retrospective information on multiple dimensions of the respondents' past (health, health care, accommodation, working career, household situation and performance at school during childhood, number of children, childbearing for women, emotional experiences in early life, relationship with parents, adverse childhood experiences, etc.).

What makes SHARE data particularly suited for the purposes of our analysis is the ability to link the information on the respondents' current situation to retrospective childhood/adulthood data. First, using retrospective data enables us to track the health status of respondents over the lifespan. We create a set of variables describing the number of chronic

conditions an individual has reported suffering from at different ages (*i.e.*, 25, 30, 35, 40, 45, 50, 55, 60, 65). The chronic conditions considered are the following: heart problems, high blood pressure, high cholesterol, stroke, diabetes, lung disease, asthma, arthritis, osteoporosis, cancer, ulcer, Parkinson's disease, Alzheimer's disease, psychological problems, and kidney disease. We then generate a dummy indicator assigning value 1 whether an individual reports suffering from at least one chronic condition listed above.³

Second, retrospective data allows us to consider an extensive set of childhood circumstances. We are particularly interested in disentangling inequalities by means of a specific set of early-life conditions called "*Adverse Childhood Circumstances*". The retrospective SHARELIFE component of the survey asks respondents to report information on exposure to child neglect and childhood physical abuse, either from mother, father or third parties. More precisely, the questionnaire asks the following questions:

1. How often did your mother/your father push, grab, shove, throw something at you, slap or hit you? 1. Often 2. Sometimes 3. Rarely 4. Never.
2. How often did anybody else physically harm you in any way? 1. Often 2. Sometimes 3. Rarely 4. Never.;
3. How much did your mother/your father (or the woman/man that raised you) understand your problems and worries? 1. A lot 2. Some 3. A little 4. Not at all.
4. How would you rate the relationship with your mother/your father (or the woman/man that raised you)? 1. Excellent 2. Very good 3. Good 4. Fair 5. Poor.

We consider that an individual experienced physical abuse from either the mother or the father during childhood if s/he answers "1. Often" or "2. Sometimes" to question 1. We treat question 2 in the same manner to capture physical harm from other persons. A situation of "child neglect" corresponds to answers "3. A little" or "4. Not at all" to question

³In addition, we also compare the number of chronic diseases with the median prevalence of comorbidities at the country - cohort level and for each life-stage by means of a binary variable with value 1 if the number of diseases declared by individuals is higher than or equal to the median of their generation at each specific age, and zero otherwise. Results are set out in Section 4.3.

3. The relationship with mother/father in childhood is rated 1, i.e.,problematic/negative, if the respondent answers "4. Fair" or "5. Poor" to the last question. Both "child neglect" and relationship variables describe the quality of parent-child relationships. Since they are highly correlated, we opt for including only one, namely the rating of the relationship with parents.⁴

Among the circumstances, we also include gender, absence of a parent, financial hardship during childhood, parental education, household size, and health status when the respondent was ten years old. Concerning childhood health, the following self-assessed health (SAH, henceforth) status question was asked: "Would you say that your health during your childhood was in general excellent, very good, good, fair, or poor?". SAH was therefore measured on a five-point scale from "excellent" (score 5) to "poor" (score 1) and treated as an ordered categorical variable. It was dichotomized into a binary variable with value 1 if individuals declare that their health during childhood was fair or poor, and 0 otherwise. As for the parental financial condition, the respondents were asked whether their family was fairly well off financially, about average or poor. We use a binary variable with a value of 1 assigned to individuals reporting early-life financial hardship. Finally, the highest level of parental education establishes whether one or both parents hold a tertiary degree (as defined by ISCED-97).

3.1 Sample and Cohorts

Regarding the analysis of IOp over the generations, we consider four contiguous 6-year cohorts of individuals born from World War II (1940-45) and the immediate post-war period (1946-51) to more recent years (1952-57; 1958-63). As a robustness check we also consider alternative specifications of cohorts defined at a 5-year (1941-45; 1946-50; 1951-55; 1956-60), 6-year (1939-44; 1945-50; 1951-56; 1957-62) and 10-year intervals (1935-44; 1945-54; 1955-1964). Even though the year of birth of the respondents in SHARE spans from the 1920s

⁴Results do not vary substantially when the other dummy variable indicating a situation of "child neglect" is included in the model.

to 1970s, the choice of cohort partitions was mainly driven by two concerns, namely the requirement of a balanced distribution of individuals between cohorts and overall country coverage. The trade-off between these two objectives was significantly influenced by data availability.

In order to increase the total number of observations and to guarantee a meaningful comparison of IOP between generations and during the life cycle, we consider a panel of individuals interviewed starting from wave 4 and also present in wave 7. For eight countries that joined SHARE only in 2017 (Lithuania, Bulgaria, Cyprus, Finland, Latvia, Malta, Romania and Slovakia) together with Hungary (which participated in waves 1 and 7) and the Netherlands (not present in wave 7), we do not have information on parental backgrounds (collected in waves 5 and 6 but not in wave 7), and a further three countries were excluded due to insufficient data coverage (Greece, Poland and Portugal), while Israel was not considered because of the particularities of the sample composition (more than 55% of foreign-born respondents). In order to produce meaningful and comparable evidence on the evolution of IOP over time, we also had to assure a satisfactory balance between all the birth cohorts considered in terms of data coverage and composition. In some cases (Luxembourg) this was not possible. As a consequence, Luxembourg was excluded from the analysis. Our final sample covers 13 European countries for a total of 92,960 individuals (6-year cohorts) for which the information on the prevalence of chronic diseases was collected in 2017 (wave 7).⁵ Table 1 shows the distribution of individuals across countries and cohorts (6-year partition) in the sample used as a baseline specification.⁶

⁵In the case of a 10-year cohort partition, the number of individuals increases to 106,282.

⁶The interpretation of the results related to the youngest cohort in Sweden require some caution since the cohort balance requirement is only partially satisfied.

Table 1: Number of observations by country and cohort

Country	1940-45	1946-51	1952-57	1958-63
Austria	2356	2475	2230	1496
Germany	1612	2270	2277	2719
Sweden	1794	1879	1486	720
Spain	1957	2245	2426	1895
Italy	1493	1890	2088	2196
France	1133	1825	2012	1674
Denmark	828	1165	1477	2307
Switzerland	1342	1468	1819	1164
Belgium	1359	2091	2771	3020
Czech Republic	2765	3556	2947	1293
Slovenia	2225	2934	3162	1708
Estonia	3920	4317	4096	2661
Croatia	862	1193	1338	1224

Notes: Author's processing of SHARE data, waves 4-7 .

Birth cohorts considered in the analysis were exposed to different socio-economic and historical conditions. Unlike for younger cohorts (born after 1950), the older generations (late 1930s and 1940s) include individuals born immediately before, during or after World War II. Experience with the war and the financial hardship immediately afterwards may have had important effects on outcomes later in life (Kesternich et al., 2014). First, the war caused severe hunger crises which led to many casualties, and may have had long-term effects on the health status of survivors. Second, older cohorts may have been exposed to negative events such as dispossession, persecution and migration related to the war. Dispossession was often associated with persecution and resulted in the geographic displacement of populations. All these exogenous circumstances led to severe economic and emotional insecurity, which in turn could have prevented individuals from achieving good health during their lives.

3.2 Empirical strategy and inequality metric

In order to quantify the extent of inequality of opportunity across the life cycle and between cohorts, we estimate a set of country-cohort level regressions for each specific age at which

the prevalence of chronic diseases is recorded. Thus, we obtain a point estimate of inequality of opportunity at different stages of the life cycle, separately for each birth cohort. More precisely, we estimate the following reduced-form model:

$$y_i = \alpha + \beta \mathbf{CI}_i + \epsilon_i \quad (1)$$

where y_i is a dummy variable that equals 1 if an individual i reports suffering from at least one chronic disease, and 0 otherwise, and CI is a vector of circumstances. Coefficients β reflect the total contribution of circumstances and include both the direct effect of circumstances on outcomes, and their indirect effect through efforts. We then generate a counterfactual distribution $\{y\}$ where y is replaced with its predicted value \hat{y} . Since the predicted outcomes are the same for all individuals with identical circumstances (Ferreira and Gignoux, 2011), we can estimate the absolute IOp by means of an inequality metric applied to the distribution of the predicted values, \hat{D} .

As a reference inequality metric, we calculate a dissimilarity index. This index can be defined as a measure proportional to the absolute distance between the distribution of circumstances among those with high outcomes (*i.e.*, not suffering from any chronic disease) and the distribution among those with low outcomes (suffering from at least one chronic disease). Following Paes de Barros et al. (2008) and Fajardo-Gonzalez (2016), a consistent estimator for the dissimilarity index for dichotomous outcomes is given by:

$$\hat{D} = \frac{1}{2\bar{y}} \sum_{i=1}^n l_i |\hat{y}_i - \bar{y}| \quad (2)$$

where \hat{y}_i is the predicted probability of suffering from one or more chronic disease for individuals of type (circumstance group) $i = 1, \dots, n$, while $\bar{y} = \sum_{i=1}^n l_i \hat{y}_i$ stands for the estimated conditional probability with $l_i = 1/n$ denoting sampling weights.

The index \hat{D} can be interpreted as the minimum fraction of healthy individuals (*i.e.*, those with no chronic diseases) that needs to be redistributed across circumstance groups

in order to achieve equal opportunity (*i.e.*, when an equal proportion of people with some chronic conditions are found in all circumstance groups). The index ranges from 0 to 1 and takes the value zero when opportunities are spread evenly throughout the population (Fajardo-Gonzalez, 2016).

3.3 Decomposition of the dissimilarity index

The ex-ante parametric approach presented so far provided us with a point estimate of absolute inequality of opportunity in the prevalence of chronic diseases at different stages of the life cycle. In order to better understand the phenomenon of interest and its evolution over time, we decompose inequality of opportunity in a given country and for different cohorts by estimating the relative importance of each circumstance using the Shapley value. Hence, we are able to divide inequality of opportunity into its components and attribute a part of total IOp to each circumstance. While interpreting the results, it is important to bear in mind that the results obtained *cannot* be interpreted as causal but they represent a proxy of the relative importance of each circumstance. As suggested by Ferreira and Gignoux (2014), the process of decomposition may suffer from multicollinearity since most of the circumstances are often correlated. It is important to note, however, that the presence of multicollinearity does not influence the precision of the calculated inequality of opportunity measures.

The relative contribution of a circumstance is given by the average change in inequality of opportunity when this circumstance is added to the model over all possible inclusion sequences. If we denote with CI the entire set of N circumstances arranged in some order $CI \in \{1, \dots, c, \dots, N\}$, and with $S \subset CI$ any randomly selected subset of M circumstances, then the marginal contribution of any circumstance $c \in S$ to the value of the dissimilarity index $\hat{D}(S \setminus \{c\})$ is defined by $\hat{D}(S) - \hat{D}(S \setminus \{c\})$. The probability distribution over S is given by the product of the probability that a circumstance c is in the S^{th} place (which is simply equal to $1/N$) and the probability that $S \setminus \{c\}$ actually occurs when we randomly select $M - 1$ circumstances from the population $CI \setminus \{c\}$. This probability is simply given by $(N - M)!(M - 1)!/(N - 1)!$. The relative contribution of any circumstance $c \in CI$ to the

value of \hat{D} is given by:

$$RC_c(CI, \hat{D}) = \frac{\sum_{S \subset CI, c \in S} \frac{(N-M)!(M-1)!}{(N-1)!} [\hat{D}(S) - \hat{D}(S \setminus \{c\})]}{\hat{D}(CI)} \quad (3)$$

with $\sum RC_c(\cdot) = 1, c = 1, \dots, N$.

4 Results

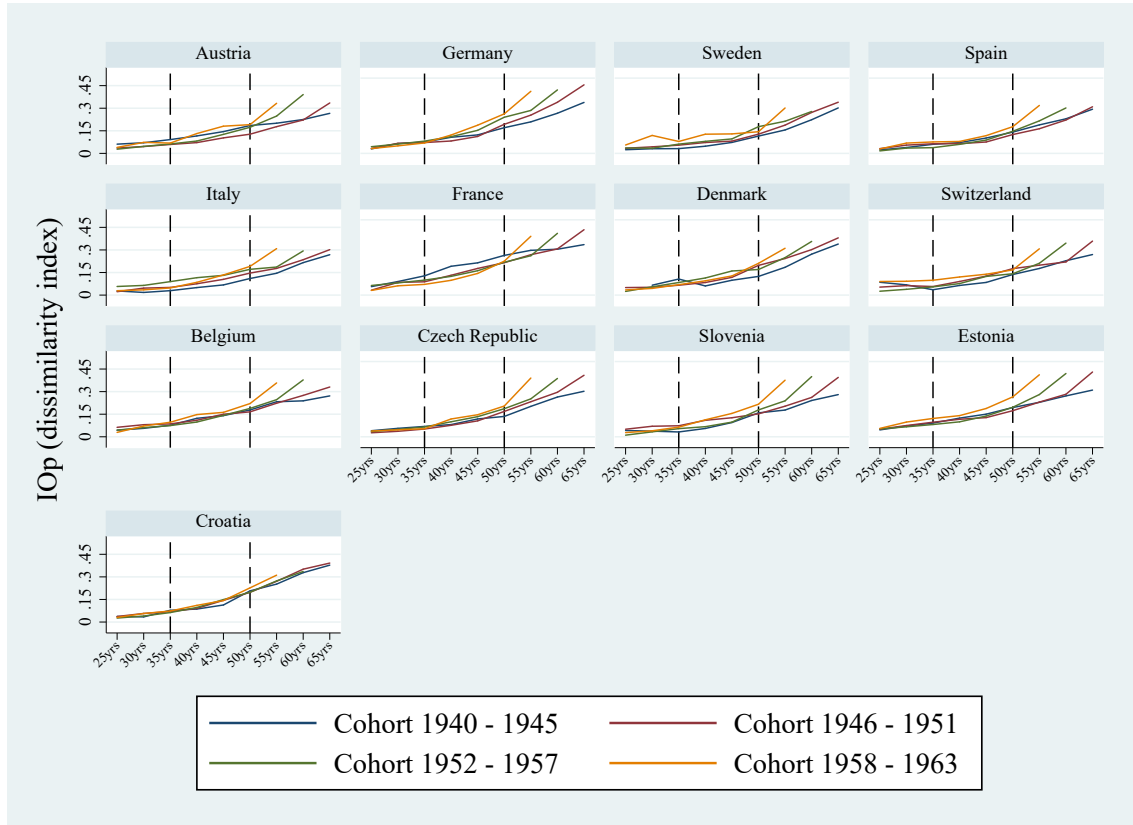
4.1 Evolution of inequality of opportunity in health over time and throughout the life cycle

Figure 1 and Table 2 (in the Appendix) show IOp in health over the lifespan for each of the four cohorts considered. The levels of absolute inequality of opportunity are calculated at different ages over the lifespan, namely when the individuals were 25, 30, 35, 40, 45, 50, 55, 60 and 65 years old. For the age of 65, the point estimates are shown only for the two oldest cohorts since the sub-sample of individuals born after 1952 and aged 65 at the time of the interview was too small to produce reliable estimates.

Regarding the evolution of IOp over the life cycle, in most countries we observe a gradual rise in inequality of opportunity with increasing age. One explanation for such a pattern may lie in the so-called "cumulative advantage" hypothesis according to which adverse circumstances and health disadvantages accumulate as individuals age (Davillas and Jones, 2020; Kim and Durden, 2007). This finding suggests a more significant role of circumstances in health as people age: small differences early in life can widen in the course of a lifetime, leading to accumulating health disadvantages later in life.

Interestingly, inequality of opportunity tends to be more pronounced for younger cohorts than for older age groups, in particular for a subset of countries like Italy, Sweden, Germany, Spain, Czech Republic, Estonia and Slovenia. Generally, the divergence of IOp between cohorts is more pronounced after the age of 50 in almost all countries considered.

Figure 1: IOP in the prevalence of chronic diseases over the life cycle, by country and cohort



Notes: The value for IOP for Denmark for the oldest cohort (1940-45) at the age of 25 was excluded due to the insufficient prevalence of chronic diseases in the population.

There are two possible explanations for this pattern. The first is related to the distribution of parental socio-economic conditions during the respondents' childhood. Indeed, during the period of the Second World War and in the years immediately following the war, large portions of the population experienced similar circumstances in terms of financial hardship and precarious economic conditions. This regularity resulted in lower overall inequality, both in absolute terms and regarding opportunities. In such a context, countries with initially higher levels of development were also relatively more unequal in terms of outcomes and opportunities.

During the *Golden Age of Capitalism* from 1950 to 1969, however, the social and economic situation started to evolve and several European countries experienced a period of economic

expansion at different speeds. Southern European countries like Italy and Spain, along with Germany, registered the fastest growth rates worldwide (between 5.5% and 6.5%).⁷ The widely documented evidence underlying the inverted "U" shape relationship between economic development and inequality (Kuznets curve) resulted in more asymmetric exposure to adverse conditions between social groups, making some individuals initially more disadvantaged than others. Since parental socio-economic conditions are inherited and are beyond an individual's control, higher overall inequality may have been accompanied by a greater disparity in opportunities.

In support of this conjecture, Figures 2 and 3 show the correlation between IOp in health for two different birth cohorts, and the average GDP measured over the same period. The choice of the cohorts (both at a 6-year and a 10-year interval) overlaps with the periods prior to (1940-45; 1935-44) and during the post-war economic expansion (1958-63; 1955-64). There is a positive relationship between IOp and GDP starting from the beginning of the *Golden Age of Capitalism* early in life (age 40) while the relationship tends to become less clear (flat or slightly negative) at the age of 60. The fact that the link between opportunities and development weakens with age is not surprising, since at later life stages the individuals are more affected by other factors, such as experience, life-style, improved medical care and their overall economic well-being which is assumed to increase with age.

Another potential explanation for higher levels of inequality among younger generations may be related to mortality, which might reduce the magnitude of IOp across different birth cohorts, emphasizing the gap between old and young generations. Indeed, individuals experiencing poorer initial conditions may die prematurely, and there may be a selection bias since the oldest cohorts in the sample include individuals with better health prospects and, hence, with longer life expectancy (Bricard et al., 2020).

⁷For more details see: <https://www.statista.com/statistics/730758/western-europe-economic-manufacturing-output-growth-golden-age/>.

Figure 2: IOp in the prevalence of chronic diseases over the life cycle, and average GDP at birth - age 40.

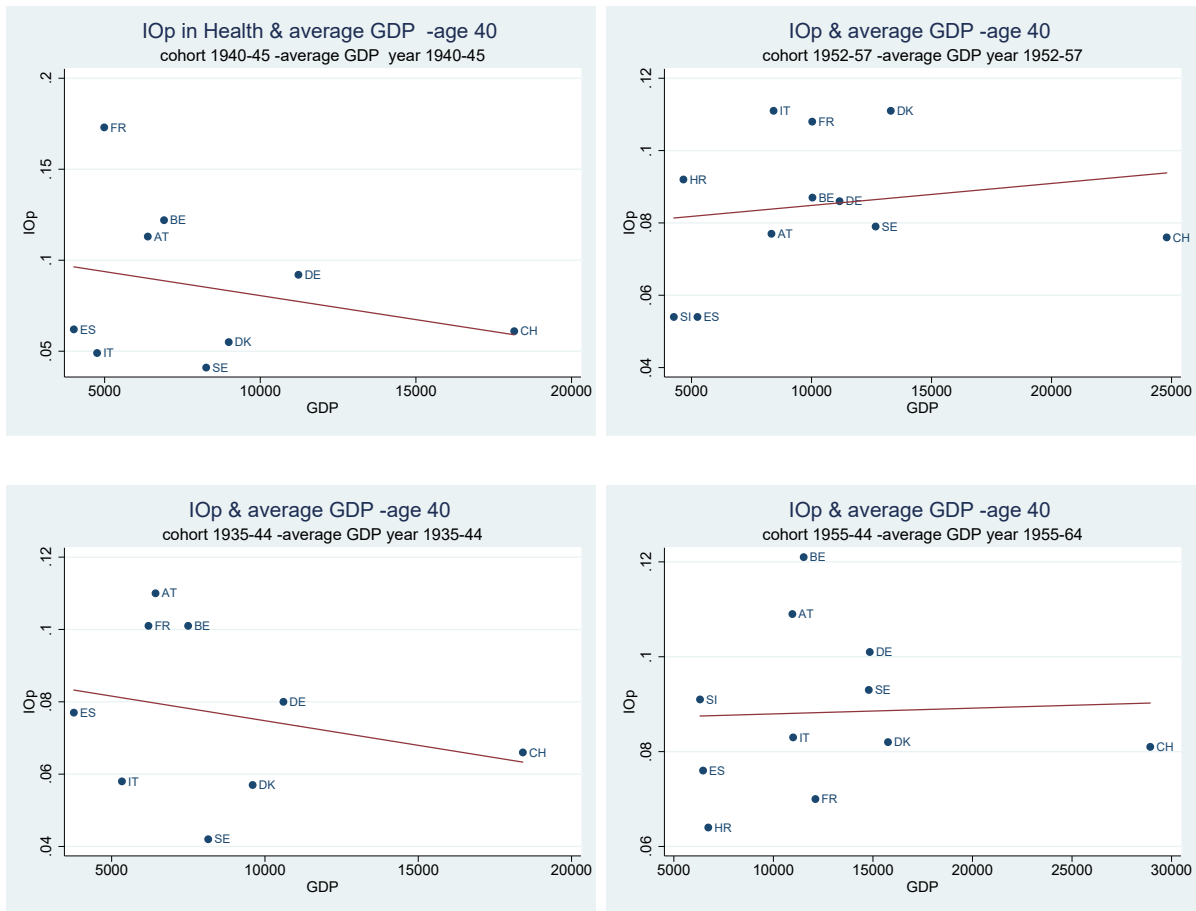
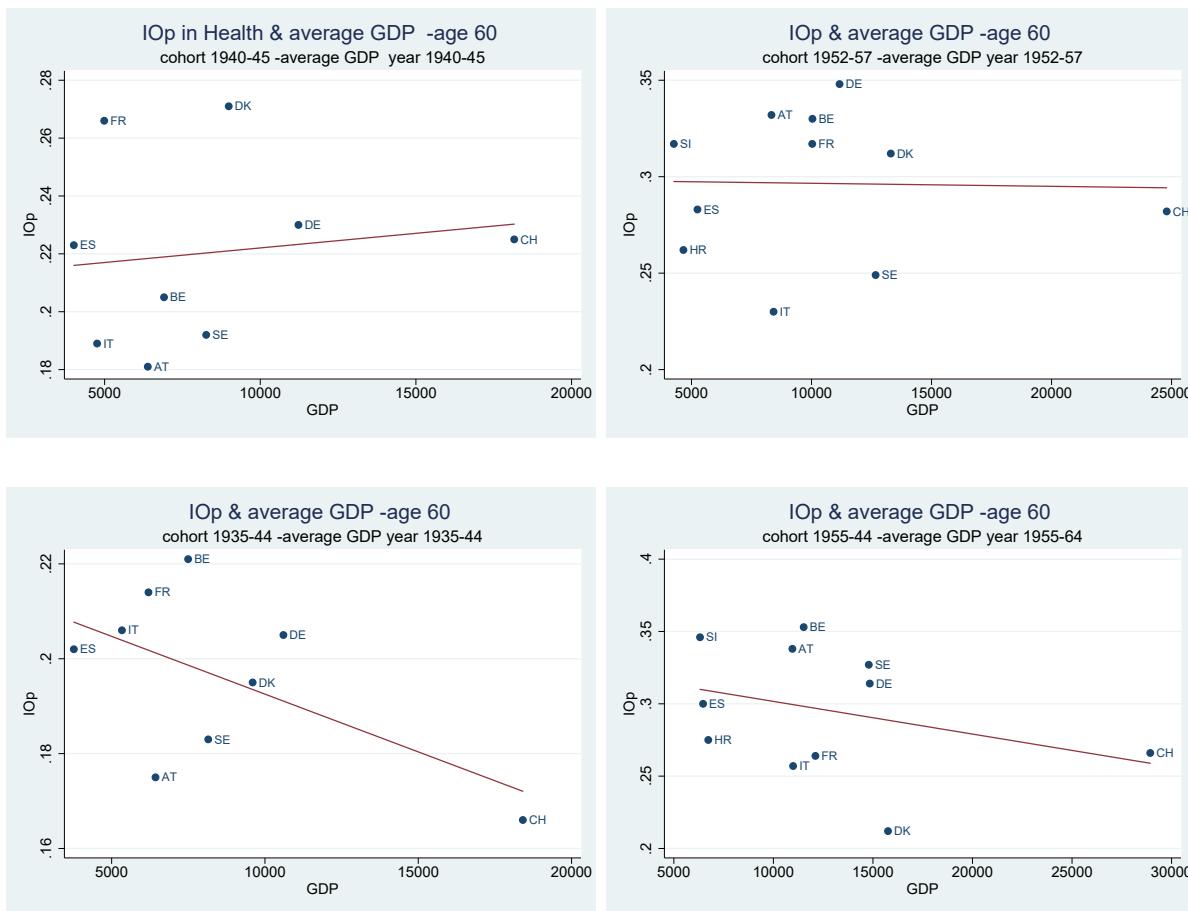


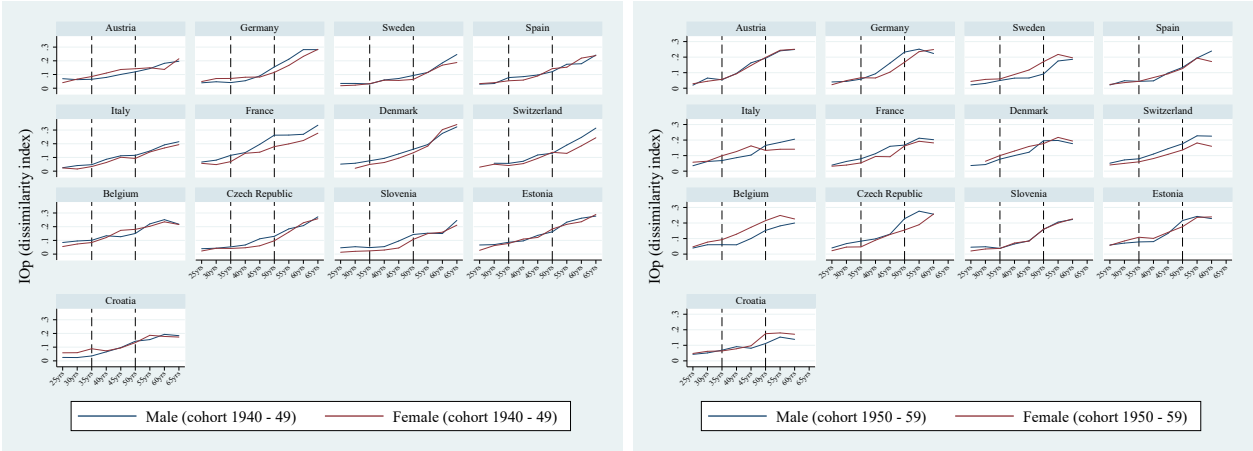
Figure 3: IOp in the prevalence of chronic diseases over the life cycle, and average GDP at birth - age 60.



An interesting picture emerges when we look at differences in IOp between males and females. Figure 4 shows the evolution of IOp over the life cycle separately for men and women born in two different historical contexts, namely during and immediately after World War II (cohort 1), and in the 50s (cohort 2). We were not able to carry out the analysis by gender for four different cohorts as in Figure 1 because the sample coverage was not sufficient to produce reliable estimates of inequality of opportunity separately for males and females. There is an evident gender gap in most countries: among individuals belonging to older age groups, IOp is generally higher for men than for women, while for younger cohorts we observe reversal

of the trend with women experiencing more unfairness than men. This gender based switch in IOp is particularly pronounced in Sweden, Denmark, Belgium and Italy (up to 45). Once again, this discrepancy may be due to social and economic development during the post-war period, in particular in terms of women’s empowerment. Overall, women born after 1950 experienced different socio-economic conditions than women born earlier. In particular, different female participation rates are linked to societal changes in the orientation towards paid employment. The higher rates of labor force participation experienced by younger cohorts may be related to increased education or a drop in fertility (Euwals et al., 2011). As a consequence, improvements of the socio-economic status of specific sub-groups of women may have exacerbated inequalities in health between different generations.

Figure 4: IOp in the prevalence of chronic diseases over the life cycle, by cohort and gender



4.2 Decomposition of IOp: the role of ACE

Together with the evolution of inequality of opportunity over time documented in the previous section, one of the main objectives of this research is to quantify the relative contribution of parent-child relationship variables, and other demographic and socio-economic circumstances, to disparities in the prevalence of chronic diseases.⁸ Figure 5 shows the average

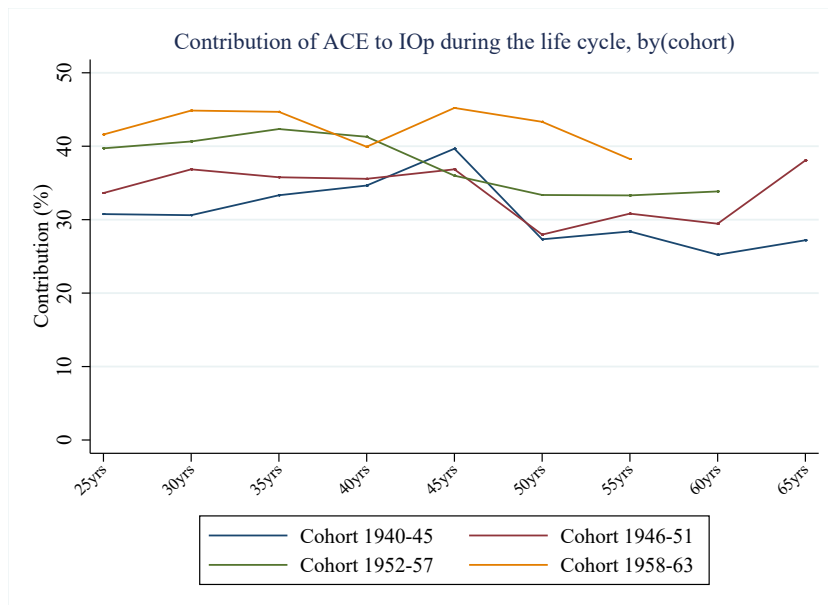
⁸In this section we report the average contribution of ACE (harm from parents, harm from others, and relationship with parents) and socio-economic circumstances (parental education, financial hardship, health

contribution of ACE at each stage of the life cycle, by cohort. This novel set of circumstances represents an important source of inequality of opportunity over the lifespan for all cohorts considered. Indeed, the relative contribution of ACE ranges (roughly) between 25% and 45% on average, with a gradually decreasing trend over the life cycle.

Interestingly, ACE appear relatively more important for younger cohorts (1952-57; 1958-63), and especially in young adulthood. The contribution of ACE for the youngest generation is on average 10 percentage points higher than for the oldest cohort. From the age of 45 IOp follows a decreasing trend while remaining approximately at the same distance with respect to older generations. One possible explanation may be related to differences in reporting physical and emotional abuse across cohorts. It may be that changes in norms and attitudes over time about how parents bring up their children mean that what was considered simply strict parenting in one era is deemed abuse in another. For example, commonly held views of what constitutes physical abuse during the war might have changed in the post-war period (Attanasio et al., 2020).

in childhood, household size, and absence of a parent) at the aggregate level. In the appendix we report the average contributions of each single circumstance separately.

Figure 5: Relative contribution of ACE (%) over the life cycle, by cohort (cross-country average)



It is also worth noting that the relative importance of ACE decreases over the life cycle for all generations except for the immediate post-war cohort. Compared to the evidence emerging from Figure 1, a more pronounced increase in inequality of opportunity after the age of 45 is not followed by an equivalent increase in the contribution of ACE; instead, older life stages see socio-economic factors gaining more importance at the expenses of ACE (Figure 6). This is not surprising since the effects of early life conditions may fade later in life while other health-related factors, presumably more persistent and dependent on parental socio-economic backgrounds,⁹ may win the race in determining the magnitude of IOp. When individuals are younger, the influence of childhood conditions is stronger, not necessarily because of the shorter time between their occurrence and chronic disease but because some other circumstances may gain relevance in middle or old-age. Indeed, the evidence in Figures 6 and 7 confirms the interplay between ACE and other circumstances

⁹There is an extensive literature which shows a persistent relationship between the socio-economic status of parents and the socio-economic outcomes of their children as adults (for a detailed review, see Blanden, 2013).

- the relative importance of gender gradually decreases up to the age of 40 for all birth cohorts and then rises by 10 to 15 percentage points at the age of 60. This is a very interesting result that highlights significant unfairness in the distribution of opportunities of good health outcomes for women.

Overall, the fraction of inequality that can be attributed to ACE is significant. The impact of early life circumstances related to the parent-child relationship is comparable to the share of socio-economic circumstances such as financial hardship, parental education, household size and the absence of a parent, while it significantly exceeds the impact of gender, especially in young adulthood.

Figure 6: Relative contribution of socio-economic conditions (%) over the life cycle, by cohort (cross-country average)

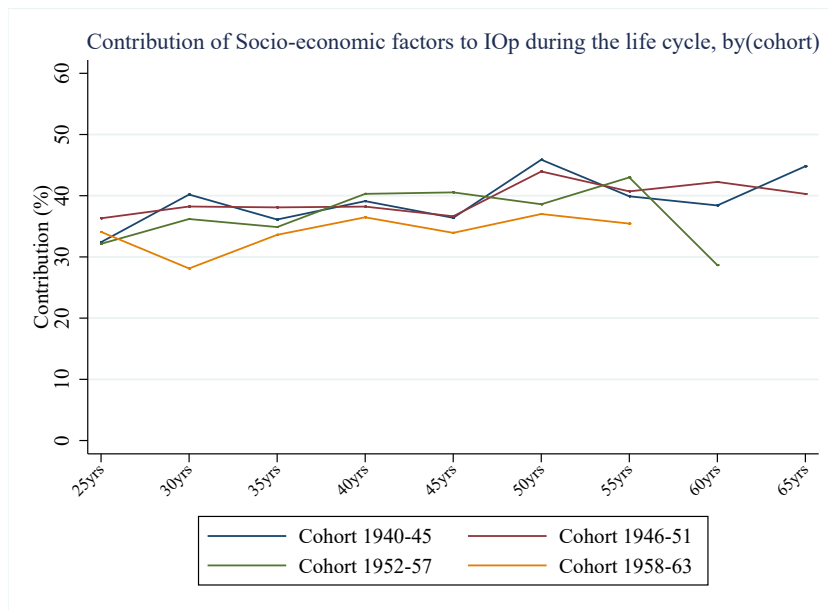
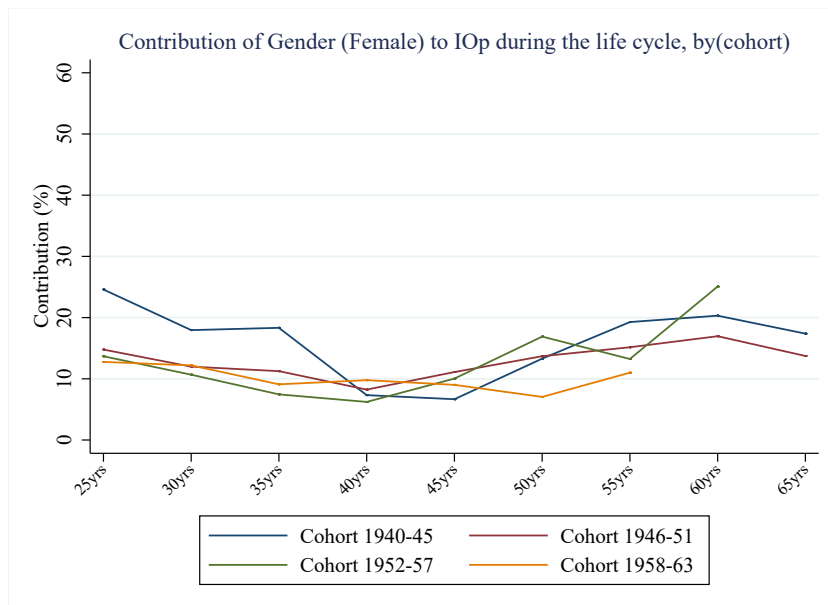


Figure 7: Relative contribution of gender (%) over the life cycle, by cohort (cross-country average)



In spite of the relatively clear patterns of contributions across the lifespan and cohorts, significant heterogeneity exists between countries. Figures 8 - 11 provide a more detailed insight into the relative importance of ACE along with the other circumstances, separately for each country and for each birth cohort. For the sake of space and clarity, we focus on four instead of nine distinct ages, namely 30, 40, 50, and 60. For the age of 60, we were able to measure contributions only for three consecutive cohorts (*i.e.*, 1940-45, 1946-51 and 1952-57). To offer a more precise picture of the relative importance of each ACE component, we split the category into two parts, namely "harm" (including both the harm from parents and third parties) and "relationship". On the other side, we continue to consider socio-economic circumstances as an aggregate category. By comparing the contributions at each life-stage between different birth cohorts enables us to retrieve useful information on the evolution of the relative importance of each circumstance (or groups of circumstances) over the generations at different ages.

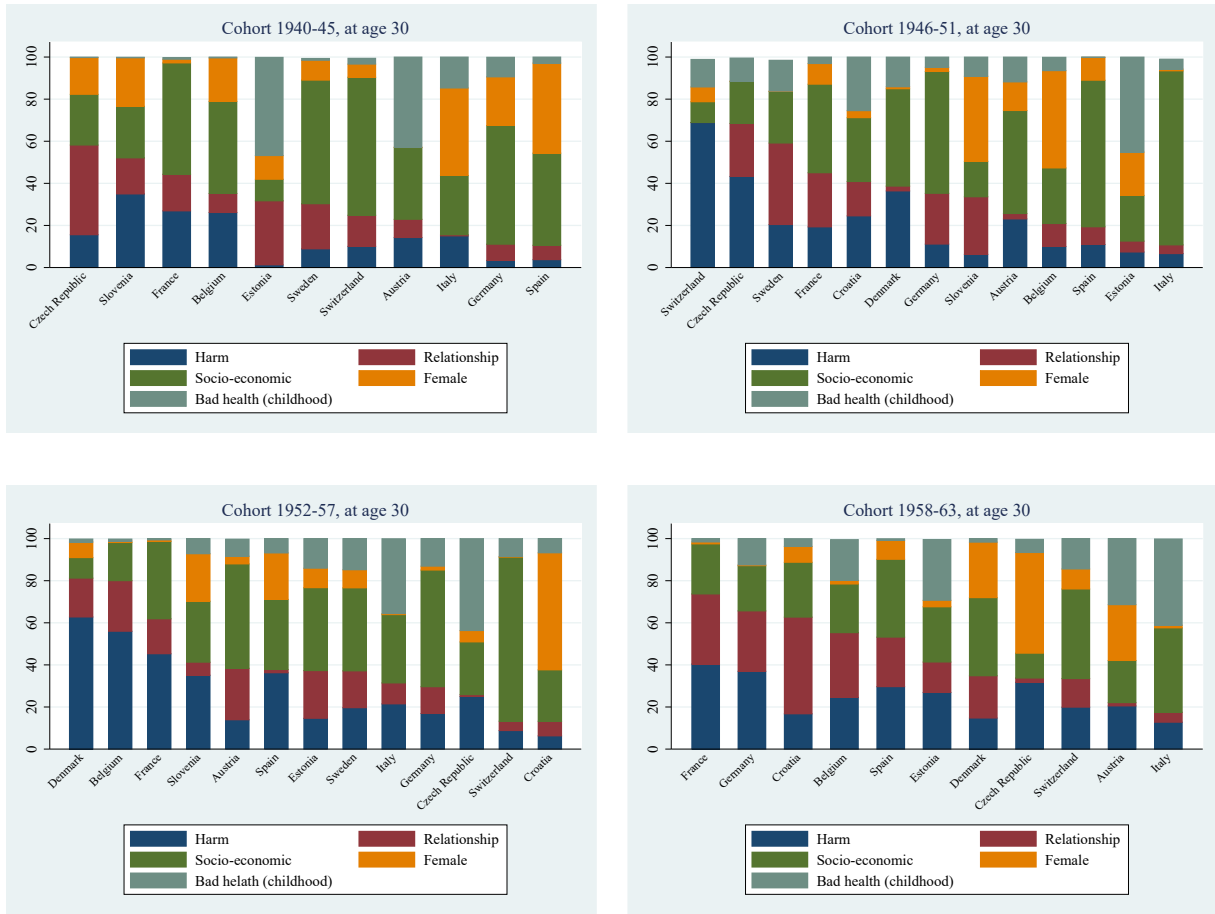
Overall, southern and south-eastern European countries such as Italy, Spain, and Croatia

feature lower contributions of ACE while the relative importance of socio-economic conditions remains high, both in young adulthood (age 40) and later in life (age 50 and age 60). This evidence confirms the important role played by economic and social conditions during childhood in shaping individual opportunities for health later in life. The largest contributions of ACE are found in northern and some central European countries. The gap between countries at the upper and the lower bound is particularly pronounced for younger cohorts. Interestingly, cohorts where ACE is less important are offset by a higher incidence of socio-economic conditions and less by gender and adverse health conditions in early life.

Compared to adverse early life conditions, poor health conditions in childhood account for a smaller portion of IOp, especially in older cohorts (1940-45; 1946-51) and at later stages in life (at the age of 60), and the relative contribution is also rather negligible for younger individuals. An interesting finding emerges comparing the relative importance of ACE, socio-economic conditions in early life and bad health conditions in childhood: countries with a higher contribution of ACE are also those where bad health is relatively less important compared to other countries characterized by lower contributions of ACE.

Finally, the gender component accounts for a larger portion of inequality of opportunity at older ages (*i.e.*, when individuals are aged 60). This evidence seems to hold for all cohorts examined. As in the case of socio-economic conditions and bad health, being female is more important for IOp in countries where the contribution of ACE is relatively lower.

Figure 8: Relative contribution of circumstances (%) at age 30, by country and cohort



Notes: Contributions for Denmark and Croatia for the youngest and oldest cohorts (1940-45; 1958-63) were excluded due to an insufficient number of observations (less than 500).

Figure 9: Relative contribution of circumstances (%) at age 40, by country and cohort

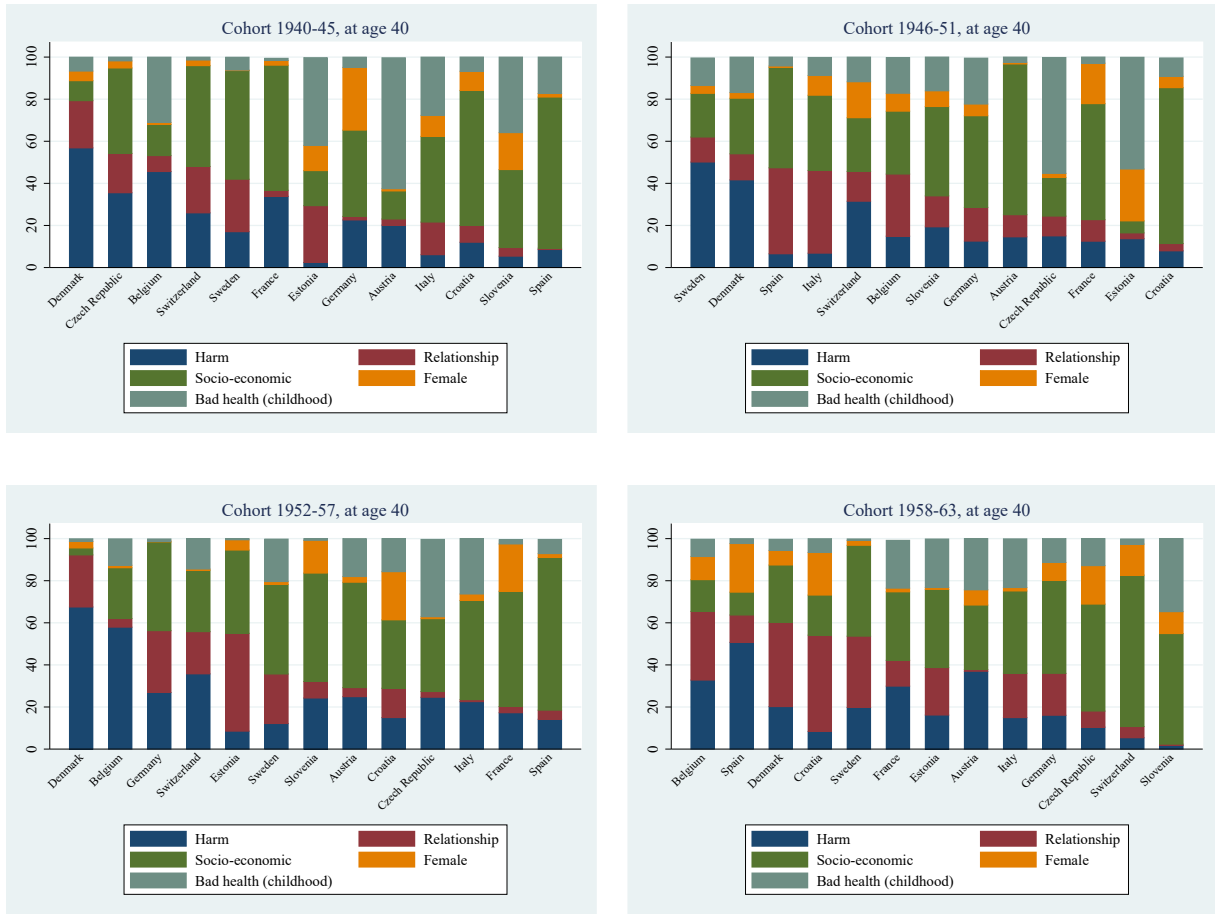


Figure 10: Relative contribution of circumstances (%) at age 50, by country and cohort

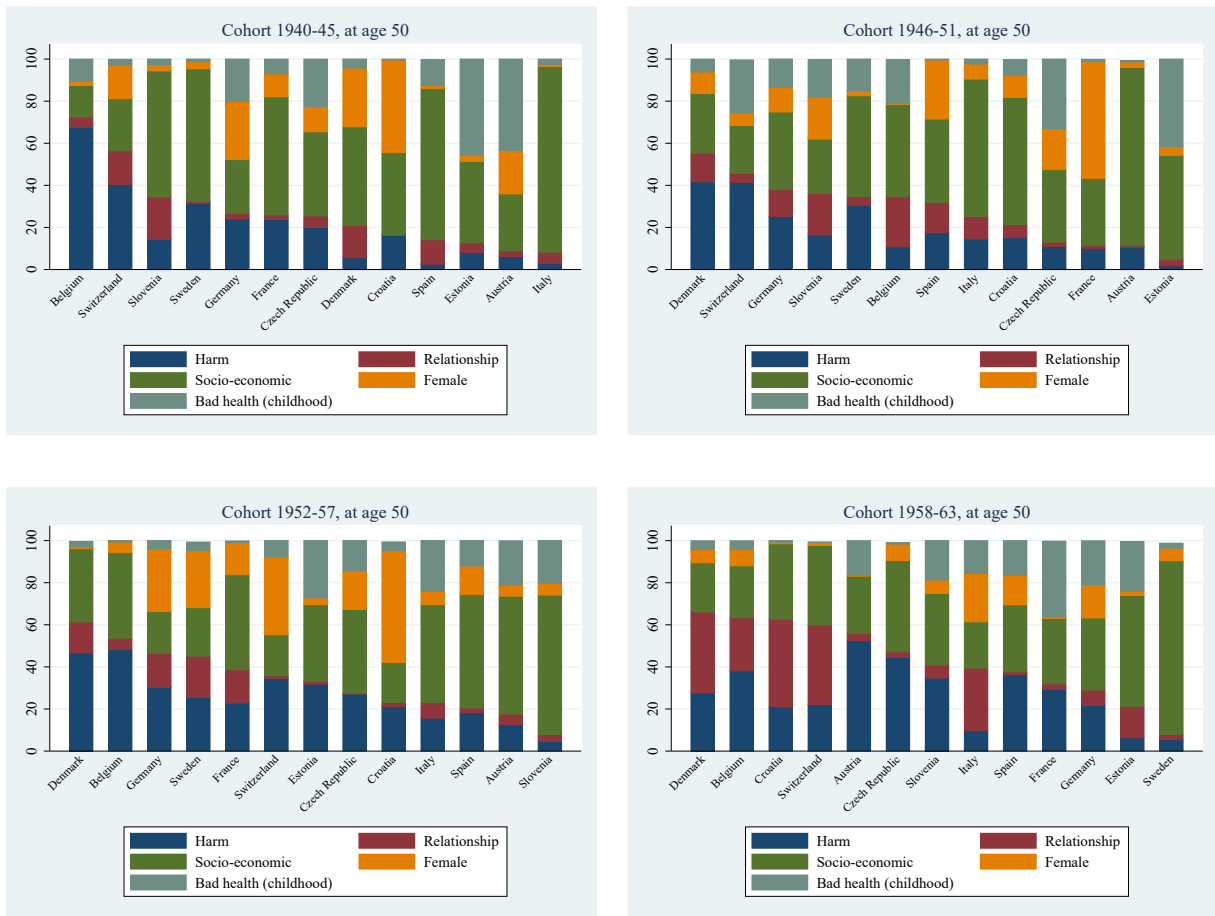
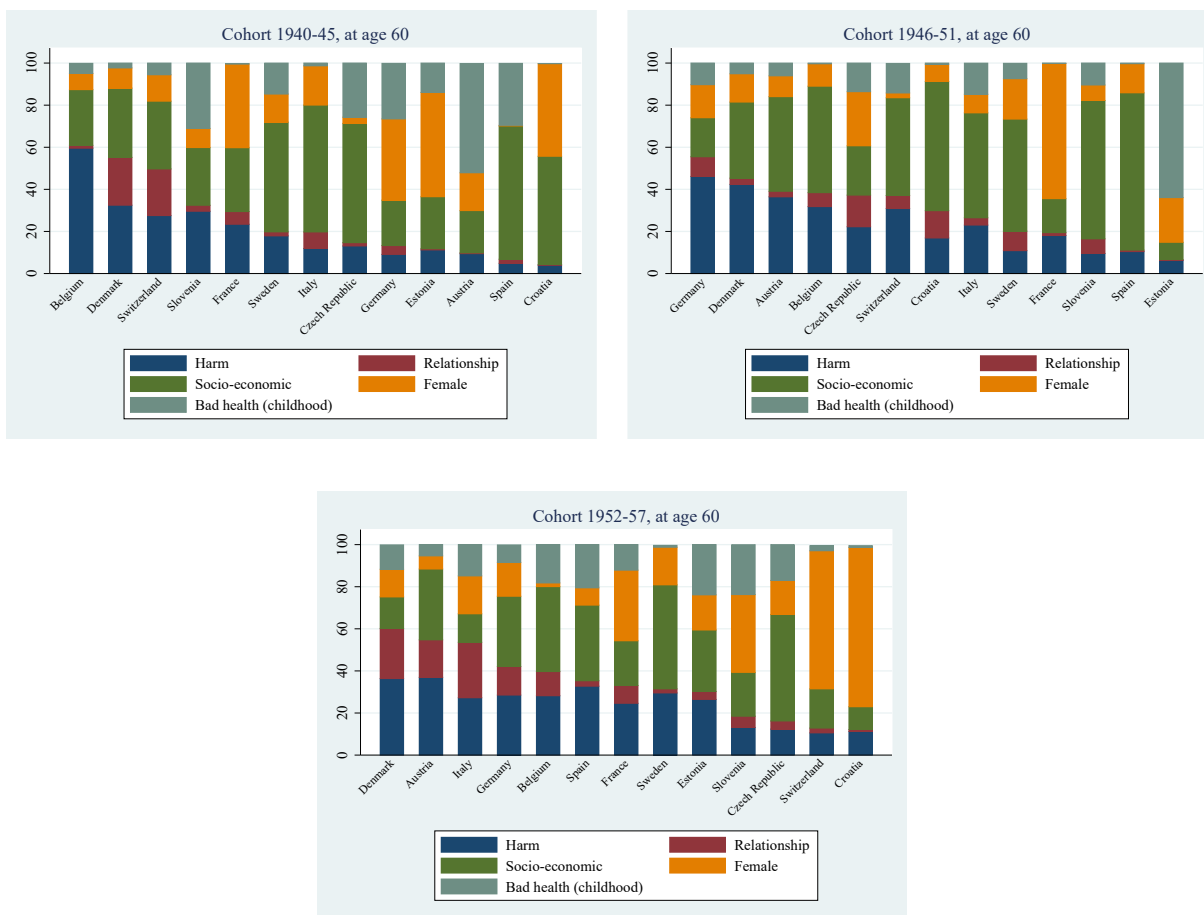


Figure 11: Relative contribution of circumstances (%) at age 60, by country and cohort



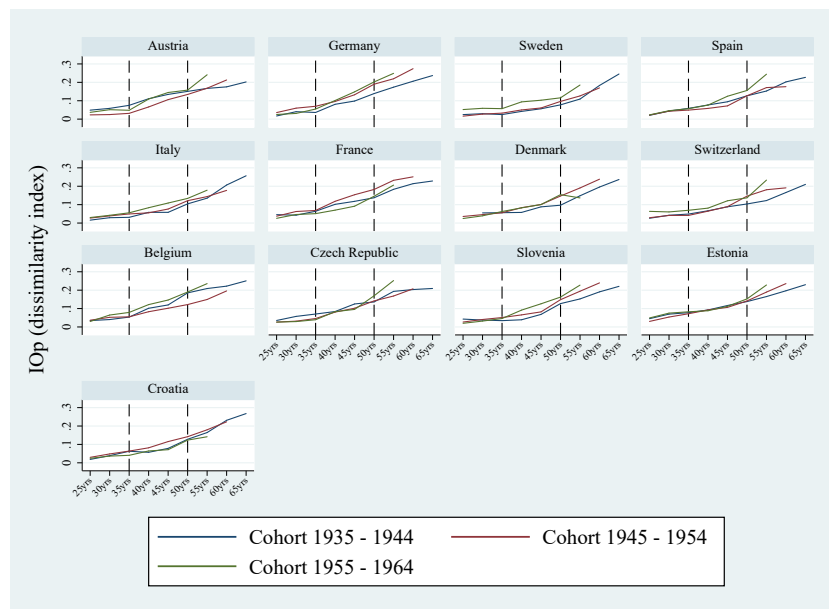
4.3 Sensitivity Analysis

The validity of our results is tested via a set of robustness checks. We concentrate on the measurement of absolute IOp in health across the lifespan, by country and cohort while, for the sake of space, we do not report the decomposition results, which are available from the authors upon request.

First, in order to test whether our results are sensitive to cohort partitions, we re-run the model by considering alternative cohort specifications, *i.e.*, four cohorts at a 5-year interval (1941-45; 1946-50; 1951-55; 1956-60), four cohorts at a 6-year interval (1939-44;

1945-50; 1951-56; 1957-62) and three cohorts at a 10-year interval (1935-44; 1945-54; 1955-64). These partitions consider individuals born in different historical periods which share similar economic and social characteristics. Overall, results from the two different cohort specifications are in line with those from the baseline model. Below, we set out the results from the cohort partition at a 10-year interval.¹⁰ As shown in Figure 12, IOp trends increase with age for each cohort and in most of the countries considered the youngest cohort (1955-64) exhibits higher IOp than older cohorts. This evidence is particularly pronounced in Germany, Sweden, Spain, Italy, Sweden, Spain, Italy and Belgium.

Figure 12: IOp in the prevalence of chronic diseases over the life cycle, 10-year cohorts.

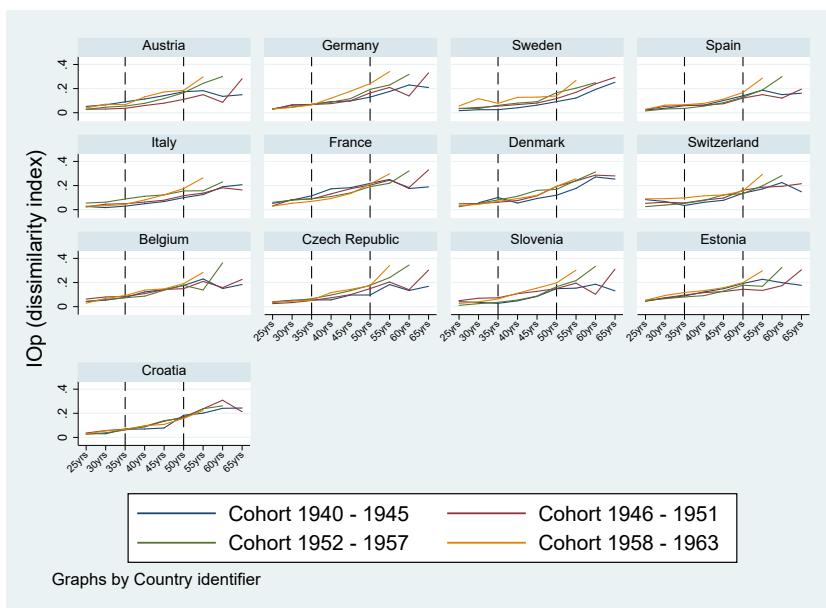


Second, in order to test the sensitivity of our results to the choice of the health outcome, we replicate the analysis using an alternative health indicator. Specifically, we create a dummy indicator with value 1 whether the number of chronic conditions reported by individuals is higher than or equal to the median of their cohort at each specific age, and zero otherwise. Compared to the previous indicator (which has value 1 whether respondents report suffering from at least one chronic condition at different life-stages), this variable

¹⁰Results from partitions at 5 and 6-year intervals are available from the authors on request.

provides additional information since it compares the health status of a specific individual with the overall health situation of his/her peers, *i.e.*, individuals who are (i) of the same age and (ii) who were born in the same country and cohort. Figure 13 shows the results. In general, trends in IOp in different countries are very similar to those observed in the baseline specification (Figure 1): IOp in health increases with age, and is more pronounced in the youngest generation (1955-64).

Figure 13: IOp in the prevalence of chronic diseases compared to the country-cohort median, over the life cycle.



5 Conclusions

This paper investigates the evolution of inequality of opportunity in the incidence of chronic diseases over the lifespan and across different birth cohorts for individuals aged 50 or older in 13 European countries. We adopt an ex-ante parametric approach and rely on the dissimilarity index as our reference inequality metric. In addition to a commonly used set of circumstances, we pay particular attention to the role of adverse childhood events, such as the experience of harm and the quality of the relationship with parents.

Our results provide general evidence of the lasting effects of childhood circumstances on health at different ages, from young adulthood to old age. More in detail, we show that IOP in health is not stable over the life-cycle but generally lower at younger ages and subsequently tending to increase monotonically. Moreover, inequalities seem to be more pronounced for younger cohorts than for older age groups in most of the countries considered.

Regarding circumstances, we find a significant heterogeneity in terms of their contribution to inequality of opportunity in health: ACE account for a significant portion of inequality (from about 25% to 45%), especially at younger ages, while the relative contribution of demographic characteristics (gender) is less pronounced, in particular in mid adulthood (from 30 to 50). Socio-economic conditions such as economic difficulties during childhood and parental education are important sources of IOP, and their contribution remains relatively stable over the lifetime (from about 28% to 45%). It is worth noting that, in general, the impact of early life circumstances related to the parent-child relationship is comparable to that of socio-economic circumstances, while it significantly exceeds the importance of gender, especially in young adulthood.

Our findings may have important policy implications. ACE are serious issues since they can importantly contribute to the formation of IOP in health throughout life in the same manner as socio-economic circumstances, with a significant cost not only at individual but also at societal level. In light of this, policy interventions aimed at reducing these inequalities should first identify disadvantaged individuals, who may be considered less responsible for the outcomes observed than better placed individuals, and target them with specific programs such as economic support for families, family-friendly work policies or educational campaigns.

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Appendix

Table 2: IOp in the prevalence of chronic diseases, by country, cohort and age group

Country	Life stage (age)	1940-45	1946-51	1952-57	1958-63
Austria	25	.0614803	.035819	.0279615	.0397593
Austria	30	.0708922	.0457407	.0463308	.0732028
Austria	35	.0918894	.0592973	.0625994	.0686885
Austria	40	.1160707	.0717639	.0821391	.1317686
Austria	45	.1448768	.1032128	.1263438	.1809272
Austria	50	.1849913	.1275574	.1735472	.1909532
Austria	55	.2006231	.1778383	.2479091	.3326637
Austria	60	.2251328	.2219474	.3907391	
Austria	65	.2660039	.3350151		
Germany	25	.0300062	.0326195	.0445559	.032104
Germany	30	.0652804	.0670926	.0620964	.0501935
Germany	35	.075401	.0720681	.0814126	.0695016
Germany	40	.107205	.0824393	.1110538	.1219651
Germany	45	.1228252	.112533	.1532892	.1873664
Germany	50	.1706375	.1932314	.2400737	.2625044
Germany	55	.2096425	.2542581	.2853375	.412461
Germany	60	.2668061	.3397786	.4216197	
Germany	65	.3385945	.4552948		
Sweden	25	.0245796	.0340447	.0361126	.055879
Sweden	30	.0309785	.0434683	.0346659	.1194565
Sweden	35	.0318499	.0548574	.061583	.0794089
Sweden	40	.0477284	.0722786	.0801152	.1277206
Sweden	45	.0728796	.0817522	.0963669	.1295563
Sweden	50	.1151998	.1278055	.1774733	.1439963
Sweden	55	.1555292	.1877775	.2135128	.3015913
Sweden	60	.2236428	.272218	.2784075	
Sweden	65	.3020231	.3398685		
Spain	25	.023266	.0318427	.0167256	.0295283
Spain	30	.039036	.0551059	.0352966	.0684762
Spain	35	.0604456	.0640698	.0382323	.0762959
Spain	40	.071734	.0646293	.0602982	.079267
Spain	45	.1021494	.0758715	.0884173	.1179607
Spain	50	.1414962	.1252121	.1469062	.1775316
Spain	55	.1892865	.1639707	.2160558	.3184715
Spain	60	.2297564	.2218828	.3018196	
Spain	65	.2936708	.3095288		

Country	Life stage (age)	1940-45	1946-51	1952-57	1958-63
Italy	25	.0277109	.0227887	.0573858	.0293953
Italy	30	.0177586	.0464707	.064255	.0349087
Italy	35	.0295211	.0510421	.089638	.0475966
Italy	40	.0499703	.0753183	.1156267	.0849364
Italy	45	.0676751	.1045864	.1311857	.1338557
Italy	50	.1103632	.14625	.1713721	.1908893
Italy	55	.1451461	.1773782	.1863512	.3086983
Italy	60	.2158229	.2351428	.293417	
Italy	65	.2682876	.3020203		
France	25	.0563776	.032665	.0639138	.0312296
France	30	.0899759	.0846154	.08101	.061761
France	35	.1279031	.088377	.0996127	.0711569
France	40	.1915336	.1316207	.1243424	.0982572
France	45	.2143198	.1771381	.1619972	.1439798
France	50	.2638	.2153989	.2180648	.2252218
France	55	.2975185	.2681907	.2614114	.3907643
France	60	.3046786	.3067903	.410328	
France	65	.3352931	.4341418		
Denmark	25	.4897959	.0499071	.0244641	.034365
Denmark	30	.0657903	.0520815	.0548344	.0446593
Denmark	35	.1068431	.0656656	.083575	.0693388
Denmark	40	.0609014	.0836735	.1138241	.0949921
Denmark	45	.0987157	.1180325	.1602059	.127271
Denmark	50	.1240613	.1973079	.1701895	.2109534
Denmark	55	.184664	.2429627	.2489906	.3110278
Denmark	60	.2720809	.3022081	.3565243	
Denmark	65	.3392461	.3801562		
Switzerland	25	.0853079	.0530975	.0256691	.090252
Switzerland	30	.0682274	.0628389	.0383861	.0920137
Switzerland	35	.0357372	.0569925	.0546232	.0986982
Switzerland	40	.0641384	.0904459	.0766078	.120307
Switzerland	45	.0841028	.1261846	.1242649	.1388781
Switzerland	50	.136852	.1760206	.1417221	.1673335
Switzerland	55	.1769369	.1987337	.2113534	.3073176
Switzerland	60	.2282246	.2202003	.3452505	
Switzerland	65	.2693245	.3586688		

Country	Life stage (age)	1940-45	1946-51	1952-57	1958-63
Belgium	25	.0439197	.0629519	.0445419	.0293996
Belgium	30	.0562984	.0805043	.0609225	.0718225
Belgium	35	.0764239	.0855586	.0745042	.0967526
Belgium	40	.1229588	.1097834	.0982376	.1476284
Belgium	45	.1408122	.149845	.1420581	.1624833
Belgium	50	.1784688	.1657111	.1886083	.220912
Belgium	55	.2327964	.2231876	.2467517	.3577627
Belgium	60	.2388602	.2749009	.3778084	
Belgium	65	.2716444	.3308335		
Czech Republic	25	.040456	.0267197	.0346475	.0383482
Czech Republic	30	.0561398	.0367359	.0492144	.0462804
Czech Republic	35	.0690027	.0516463	.0652579	.0536776
Czech Republic	40	.0810774	.0763787	.0997435	.118398
Czech Republic	45	.1185207	.1059439	.1339351	.1466027
Czech Republic	50	.1352987	.1686349	.1866791	.2044112
Czech Republic	55	.2022296	.2329953	.2521623	.3902428
Czech Republic	60	.2640058	.2959386	.3875879	
Czech Republic	65	.3025705	.4087274		
Slovenia	25	.0418885	.0502741	.0109843	.0278599
Slovenia	30	.0375763	.0700576	.0328191	.039942
Slovenia	35	.0321465	.0733918	.0542182	.0641983
Slovenia	40	.0554329	.1095697	.067176	.1129111
Slovenia	45	.0947656	.1265776	.0973105	.1552235
Slovenia	50	.158956	.152579	.1786693	.2162947
Slovenia	55	.1776513	.2033389	.2389041	.375991
Slovenia	60	.2413909	.2618763	.4000743	
Slovenia	65	.2804586	.3946575		
Estonia	25	.0458201	.0508474	.0522948	.055831
Estonia	30	.071757	.0749357	.0662406	.0979355
Estonia	35	.0911433	.0969171	.0815938	.1220112
Estonia	40	.1243734	.1166101	.0994357	.1406821
Estonia	45	.1504194	.1275851	.1378538	.1880966
Estonia	50	.194434	.1734401	.1959654	.2652466
Estonia	55	.2291003	.2304365	.2805864	.4120203
Estonia	60	.2717029	.2825159	.4204348	
Estonia	65	.3103417	.4303541		

Country	Life stage (age)	1940-45	1946-51	1952-57	1958-63
Croatia	25	.037413	.0368683	.0265388	.0307786
Croatia	30	.034333	.0571612	.04027	.0567498
Croatia	35	.078405	.0693117	.0629928	.0733164
Croatia	40	.0862577	.0908647	.0969709	.1107978
Croatia	45	.1133395	.1443275	.1493549	.1428021
Croatia	50	.2070621	.1974129	.1983126	.22708
Croatia	55	.252012	.2706959	.2733095	.3114606
Croatia	60	.3281065	.3512276	.3360557	
Croatia	65	.3779794	.3917651		

Notes: Author's processing of SHARE data, waves 4-7.

Figure 14: Relative contribution of circumstances (%) over the life-cycle, by cohort (cross-country average)

