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Inequality of Opportunity in Health and Cognitive Abilities: The Case of Chile*

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Abstract

This paper studies inequality of opportunity in health in Chile. Following Roemer's approach to equality of opportunity, we separate the effect of circumstances and efforts -healthy behaviors- on self-assessed health. In addition to parental and family background, our set of circumstances includes a proxy of numeracy skills. We find that circumstances explain nearly 40 percent of the variance of health outcomes, four times the contribution of efforts. More than one third of the contribution of circumstances is due to numeracy skills, similar to the contribution of parental education. Parents' longevity is also important but its contribution is smaller. The overall influence of circumstances on inequality is substantial, ranging from 62 to more than 90 percent depending on the inequality index used. Overall, we find that health inequality is higher in Chile than in European countries and the contribution of unequal opportunities to inequality is at least as large. Our results also highlight the importance of cognitive ability on health inequality.

Keywords. Equality of opportunity, health, cognitive skills, numeracy, Gini index.
JEL Classification: D63, I14.

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1 Introduction

There seems to be significant agreement on the notion that access to better health should not depend on social, ethnic or family background.[1] Following Roemer (1998), the equality opportunity literature has emphasized that inequalities resulting from circumstances such as family or parental background, that is, factors that are not associated with individual efforts, are ethically unjustifiable. This paper contributes to the equality of opportunity literature by studying health outcomes in Chile, a highly unequal country. We study the role of individual family and parental background on current health inequality. Special attention is given to the role of cognitive abilities.

The recent body of research on inequality of opportunities in health has mainly focused in data from European countries (Trannoy et al., 2010; Bricard et al., 2014). This paper takes advantage of a unique dataset from a longitudinal household survey in Chile, a country that has reached relatively high average standards of living with persistent inequality. In 2009, at the time of the survey used in this paper and in the wake of entering the OECD, Chile's per capita income reached 16,000 U.S. dollars (PPP) and life expectancy was 78.8.[2] The country's Gini coefficient is 0.52 , the highest in the OECD (OECD, 2014) and right around the average in Latin America, the most unequal region in the world. Recent estimates show that income inequality at top is extremely high: the share of total income of the top 1 percent is almost 24 percent (Fairfield and Jorratt, 2014), compared to an average of 7 percent in nordic countries (Atkinson et al., 2011).

Importantly, the country has a dual health system: a subsidized public provider covers roughly 80 percent of the population, including the poorest segments, coexists with a private system that is only affordable to upper-middle and high-income households.[3] Figure 1 illustrates health inequalities across a sample of countries by showing the prevalence of "less than good" self-assessed health (SAH) for high and low education individuals in each country. Chile has one of the lowest levels of prevalence of less than good self-assessed health (SAH) for people with higher education and the largest SAH gap between people with high and low education.

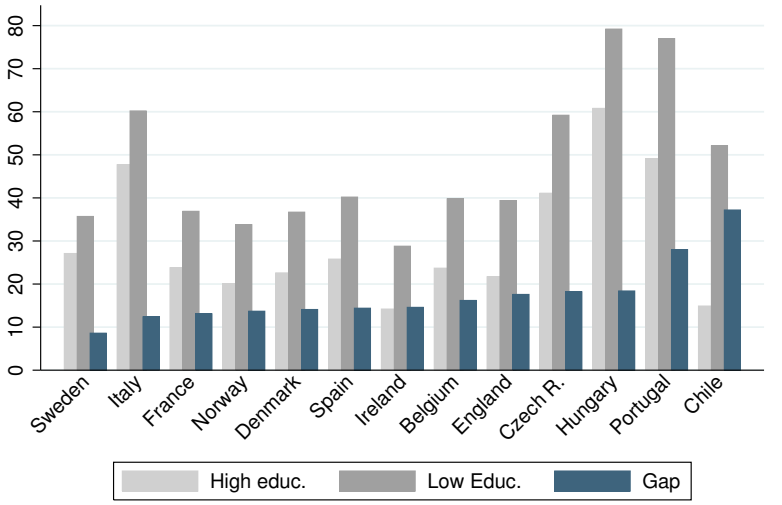
The methods we use to assess inequality of opportunity in health outcomes have three steps. First, the analyst defines health measures, and the circumstances and efforts that affect them. Our health measure is SAH, a self-reported ordered variable that can take six values, from very poor to excellent. We distinguish two categories of factors that influence health outcomes: circumstances

[1] For example, in 32 out of 33 middle-to-high-income democracies considered in the 2009 round of International Social Survey Program, a majority of the respondents consider that it is unjust/incorrect (as opposed to just/correct) that higher income individuals can buy better heath care than people with lower incomes.

[2] In 2009, the average income per capita in the OECD was 33,851 dollars while life expectancy was 79.3 years.

[3] Since 2006, the country gradually introduced universal coverage for an expanding list of medical conditions. However, the public system remains severely underfunded, and the expenditure per patient in the private system is roughly five times higher than in the public system. Recent work by Vasquez et al. (2013) shows that the reform has gradually reduced disparities in access to treatment, but they remain large.

Figure 1: Prevalence of "Less Than Good" Health According to Educational Achievement



Source: European data by Kunst & Roskam (2007). All european data is for 2000 with exception of Portugal, with 1999 data. Chilean data added by the authors using CASEN 2000 data for comparability.

and efforts. For Roemer (2008), circumstances are "attributes of a person's environment for which he should not be held responsible", while efforts are a choice variable for which the individual is accountable. In line with previous papers, the set of circumstances considered includes variables that capture parental and family background -parents education, parents occupation, and the household composition when individual was raised- and a measure of parents's longevity. The effort variables considered are smoking, sports activity and body mass, all associated with health-related behaviors. Importantly, following Trannoy et al. (2010), since circumstances affect investments in health, to capture the overall impact of circumstances we consider *relative efforts* by removing the effect that circumstances have on efforts.

In a recent paper, Wagstaff and Kanbur (2015) provide an important philosophical and practical critique of the application of this method. A specific concern they raise is that the definition of the set of circumstances associated with unjustifiable inequality is not trivial and may have strong policy implications. For example, some authors (Paes de Barros et al., 2009) do not consider innate talents as part of this set, thus justifying inequalities that arise from individual endowments for which the individual is not responsible. Others, including Roemer and Wagstaff and Kanbur, argue that innate talents must be considered as circumstances. This paper shares the latter point of view.

Indeed, a novelty of the paper is to introduce a proxy of innate cognitive ability as an additional circumstance. Specifically, we take advantage of questions in the survey aimed at measuring basic numeracy skills and compute a score based the number of correct questions. Since the performance

in these questions depends not only on innate abilities but also on investments (e.g. education), we compute a residual score that controls for background circumstances, gender and age.

The second step of the method is to estimate a ordered logit model that predicts the probability that SAH is above a given threshold as a function of circumstances, demographics -gender and age- and efforts.[4] The predicted probabilities are used as our health outcomes.

The third step is a decomposition of inequality aimed to quantify the contribution of circumstances on the inequality of health outcomes. We consider two different approaches for this final step. First, following Jusot et al. (2013), we provide linear decomposition of the variance of health outcomes into three terms: circumstances, demographics and relative efforts. This exercise amounts to ask what part of the actual individual differences in health are explained by variation in each of these factors. We find that roughly 50 percent of the variance is explained by demographics, 40 percent by circumstances and only 10 percent by efforts. Next, we decompose the variance component of circumstances to isolate the explanatory power of each individual component. More than one third of the contribution of circumstances is due to cognitive skills, and this contribution is similar to the contribution of parental education. Parents' longevity is also important but its contribution is smaller.

The second approach, is based on comparing two distributions of health outcomes: the actual distribution and a counterfactual distribution (Roemer, 2002; Lefranc et al., 2009; Trannoy et al., 2010). The counterfactual distribution is computed using the predicted outcomes but, instead of using the actual circumstances of each individual, all circumstances are set equal to the best possible circumstance. The overall influence of circumstances on inequality measures is substantial, ranging from 62 to more than 90 percent depending on the inequality index used. The most relevant circumstances are the parents' educational level, followed by our cognitive ability measure and parents' longevity.

This paper contributes to the literature on health inequality in two dimensions. First, there is a growing literature showing the importance of cognitive measures on financial and health decisions.[5] At the same time, recent work has shown that education differences play a major role in explaining inequalities in SAH (Cutler and Lleras-Muney, 2010; Conti et al., 2010; Cutler et al., 2014; Brunello et al., 2015). Our paper aims to address the role of (innate) cognitive abilities on health inequality. Specifically, we find that our cognitive measure explains between 13 and 16 percent of the variance in our health outcomes and contributes significantly to inequality for all of the inequality indexes considered.

[4] For robustness, we use two thresholds, "good" and "very good".

[5] See Banks et al. (2010), and Banks and Oldfield (2007) for savings, Cole et al. (2011) for financial participation. Research studying the role of cognition and numeracy skills on health care includes Chan and Elbel (2012) on suplemental Medicare enrollment, Cavanaugh et al. (2008) on self-managed diabetes treatment, Peters et al. (2007) on the assessment of health risks, among others.

Second, most of the work that estimates inequality of opportunity in health uses European and American data. Some recent exceptions are Jusot et al. (2014) and Brunori et al. (2013). Studying a country like Chile, with middle-to-high income but large social disparities, shows that health inequality is higher than what previous studies have found for European countries and also that the impact circumstances on inequality is at least as large (Trannoy et al., 2010; Jusot et al., 2013).

The rest of the paper is organized as follows. Section 2 gives an explanation on the methodology and the estimations. Section 3 accounts for the data used. Section 4 shows the results, some robustness checks and extensions and section 5, concludes.

2 Data

Our main data source is the Chilean Social Protection Survey (SPS; Encuesta de Protección Social). The SPS is a longitudinal household survey that aims to characterize the social protection and the labor market conditions in Chile for adult individuals.[6] The panel of 14,463 individuals includes rich information on income, wealth, health, sociodemographic characteristics, personal history, and cognitive skills. The sample is representative of the Chilean population of individuals of age 18 and older. We use information from all four rounds of the SPS panel, (2002, 2004, 2006 and 2009). The health, demographic, cognitive and effort variables used in this paper are from the 2009 round.

Some of the surveys used in the literature on inequality of opportunities in health (e.g. SHARE survey for Europe) are restricted individuals aged 50 and older, while others consider the entire adult population.[7] In this paper, all estimations consider the subsample of individuals aged 30 and over (12,408 individuals). After eliminating observations with missing data, the sample reduces to 10,934 individuals.

We describe the main variables used and our measure of cognitive ability in some detail.

[6] A more detailed description of the SPS can be found at http://www.proteccionsocial.cl. The survey is administered by the Ministry of Labor and was designed by the Centre of Microdata at University of Chile in collaboration with researchers of the University of Pennsylvania.

[7] Trannoy et al. (2010) considers individuals over 50 years old. In our case, this reduces the sample by half. Still, as discussed in section 4.2, if we restrict to the subsample of individuals aged 50 and older our results remain qualitatively unchanged.

Table I: Descriptive Statistics

Variables	Mean	SD	Min	Max	Variables	Mean	SD	Min	Max
Self Assesed Health (SAH)	3.66	0.93	1	6	*Parent's literacy*				
Demographics					Father reads	0.85	0.35	0	1
Age	51.08	13.61	30	108	Doesn't know/answer (father)	0.00	0.06	0	1
Gender (Female)	0.46	0.50	0	1	Mother reads	0.82	0.38	0	1
Numeracy Score					Doesn't know/answer (mother)	0.00	0.05	0	1
Number of correct answers	1.36	1.16	0	3	*Employment: Mother*				
Circumstances					Unemployed	0.57	0.49	0	1
Household Composition: Mother					Unstable	0.09	0.29	0	1
Lived with mother	0.95	0.23	0	1	Stable	0.32	0.47	0	1
Lived with foster or step mother	0.02	0.13	0	1	Doesn't know/answer	0.02	0.14	0	1
Other	0.04	0.19	0	1	*Employment: Father*				
Doesn't know/answer	0.00	0.03	0	1	Unemployed	0.02	0.16	0	1
Household Composition: Father					Unstable	0.13	0.33	0	1
Lived with father	0.93	0.26	0	1	Stable	0.83	0.38	0	1
Lived with foster or step father	0.04	0.19	0	1	Doesn't know/answer	0.02	0.14	0	1
Other	0.04	0.19	0	1	*Household Comparison*				
Doesn't know/answer	0.00	0.04	0	1	Much better	0.13	0.33	0	1
Alive parents					Better	0.47	0.50	0	1
Father alive	0.47	0.50	0	1	Same	0.28	0.45	0	1
Doesn't know/answer (father)	0.00	0.05	0	1	Worse	0.12	0.32	0	1
Mother alive	0.63	0.48	0	1	Much Worse	0.01	0.10	0	1
Doesn't know/answer (mother)	0.00	0.04	0	1	Doesn't know/answer	0.00	0.04	0	1
Schooling: Mother					**Efforts**				
None	0.16	0.37	0	1	Normal BMI	0.35	0.48	0	1
Primary school	0.60	0.49	0	1	Smokes	0.29	0.46	0	1
High school	0.07	0.25	0	1	Practices sports	0.29	0.45	0	1
Higher education	0.02	0.14	0	1					
Doesn't know/answer	0.15	0.36	0	1					
Schooling: Father									
None	0.14	0.34	0	1					
Primary school	0.57	0.50	0	1					
High school	0.07	0.26	0	1					
Higher education	0.04	0.20	0	1					
Doesn't know/answer	0.18	0.38	0	1					

2.1 Background Circumstances and Effort Measures

In line with the literature, we use self-assessed health (SAH) as our health measure. SAH is based on the answer to the question "How is your health in general?". In the SPS, there are six possible SAH responses -very poor, poor, average, good, very good and excellent. Thus, SAH is an ordered variable that reflects the perception of an individual on her/his own health. Previous research has shown that SAH is highly predictive of objective measures of health (Idler and Benyamini, 1997; Latham and Peek, 2012). If SAH is coded from 1 to 6, where 1 stands for very poor, 2 for poor, and so on, the mean response is 3.66 and the standard deviation is 0.93.

Following Roemer (1998), we partition the factors affecting health outcomes between circumstances and efforts. The set of circumstances considered is defined by theoretical considerations and data limitations. For example, Trannoy et al. (2010) considers a number of parental characteristics: occupation, education levels, longevity (relative to life expectancy), and whether parents are alive or not at the time of the survey.[8] In this paper, we distinguish between *background circumstances* that are associated with parental and family information, and innate cognitive abilities discussed shortly.

The set of *background circumstances* follows the previous literature and is given by:

- Household composition when growing up;
- Indicator of parents' currently alive;
- Subjective socioeconomic comparison between their current and their family household when growing up;
- Parents' working status when growing up;
- Parents' literacy indicator;
- Parents' occupation; and
- Parents' schooling level.

The effort variables considered by other papers vary widely. In line with Jusot et al. (2013), who use smoking, obesity, and vegetable consumption we also identify health-related efforts with health behaviors. Our smoking and obesity variables coincide with theirs. Instead of vegetable consumption, unavailable in our survey, we use a measure of sports activity. Specifically, we define indicators that identify if the individual currently smokes, if her/his Body Mass Index (BMI) is within normal range,[9] and if she/he practices sports at least one time during the year.

[8] Jusot et al. (2013) use other parental information including the SAH of parents, adverse life situations and financial situation faced by them. Recent work by Jusot et al. (2014) on Indonesia, considers family religion, and languages spoken.

[9] BMI is within normal range if it is between 18.5 and 24.9.

2.2 A Measure of Numeracy Skills

A growing literature has emphasized the role of education and cognition in explaining health inequalities (Cutler and Lleras-Muney, 2012; Cutler et al., 2014). The channels identified include protective behaviors following an adverse shock (e.g. poor labor market), the ability to follow a medical treatment adequately, and a positive association with health-promoting behaviors.

In principle, it is unclear whether cognitive skills should be identified as a circumstance or an effort. To the extent that cognitive skills result from investments for which the individual is responsible -much like education- they could be considered an effort. Instead, if they reflect mostly innate abilities or a lucky draw of genetic inheritance, it seems more akin to consider them a circumstance. One might accept that cognitive skills have a little bit of both. Ultimately, different measures may capture different aspects of this variable.

There are few databases that combine health, sociodemographic and personal history information with measures of cognitive ability. We take advantage of a module on financial literacy in the SPS survey. Specifically, the first three questions of the module aim to identify basic numeracy skills. The questions are the following:

- If the possibility of contracting an illness is 10 percent, how many out of 1000 people would contract the illness?
- If 5 people have the winning number in a lottery and the price is two million pesos, how much would each one receive?
- Suppose that you have $100 in a saving account and the interest rate for the savings is 2% per annum. If you leave the money in the account for 5 years, how much will you have at the end of the fifth year?

These are the exact same questions used by Lusardi and Mitchell (2006) to study the role of cognitive skills in financial decisions. A similar set of questions is used by Banks and Oldfield (2007) and Banks et al. (2010) to address the importance of numeracy abilities on retirement saving decisions.[10]

For each individual, we calculate a *Numeracy Score* by counting the number of correct answers.[11] Thus, this variable can take one of four values: 0, 1, 2, or 3. The average score in the sample is 1.36 and the standard deviation is 1.16.

We discuss two potential concerns with our proxy of cognitive skills. First, since our instrument considers just three numeracy questions, our measure could be inaccurate. We elaborate on this

[10] These papers use answers to five questions in the 2002 English Longitudinal Study of Ageing. See also Steel et al. (2003).

[11] For robustness, we tried alternative combinations of the performance in these questions. For example, we defined an indicator taking the value 1 is k questions are answered correctly and zero, otherwise, with $k = 1, 2$, or 3. The qualitative nature of the results presented hereafter remains unchanged if these variables are used.

shortly. Second, even assuming that few questions might be quite informative, performance in knowledge tests is systematically influenced by a number of other factors including educational level, socioeconomic background, or age. We try to deal with the latter problem by considering the component of the numeracy score that is orthogonal to circumstances and demographics. In particular, we estimate the following OLS equation

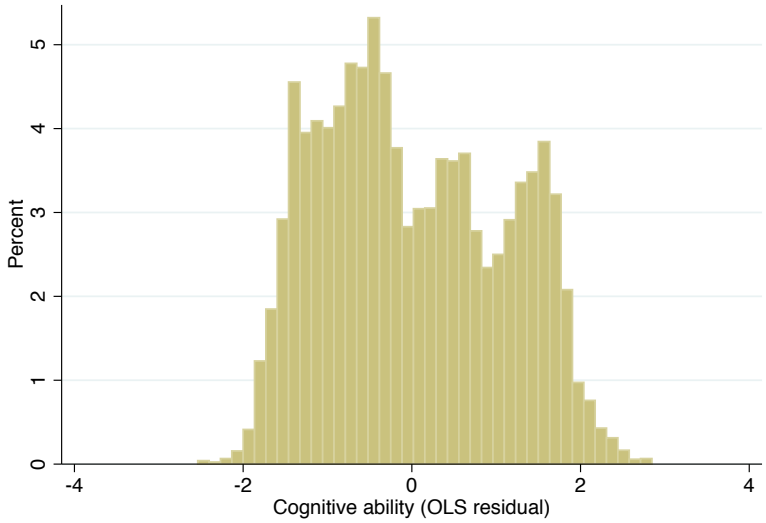
$$Numeracy\ Score_i = \alpha_Q + \beta_Q C_i + \gamma_Q X_i + q_i \tag{1}$$

where C_i is a vector that with all the circumstance variables defined above and X_i is a vector a demographic characteristics that includes a gender dummy and age. The predicted residual is

$$Q_i = Numeracy\ Score_i - \hat{\alpha}_Q - \hat{\beta}_Q C_i - \hat{\gamma}_Q X_i.$$

The residual numeracy score Q_i controls for a number of individual variables that could affect numeracy skills directly or indirectly (for example, this could include education investments that affect numeracy skills and are influenced by circumstances, cohort and gender effects). In particular, this measure would capture innate cognitive skills and, possibly, other personal traits that predict cognition not captured by demographics, family and socioeconomic background. The distribution of the residual numeracy score Q_i is illustrated by figure 2.

Figure 2: Distribution of Cognitive Ability



Source: Author's calculations on SPS.

We now elaborate on the informativeness of the measure. We have no direct way of measuring the

informativeness of measure. This would require comparing our measure with a validated numeracy skills tests in a large sample.[12] However, we can explore the extent to which our proxy Q_i variable correlates with other variables that influenced by cognitive skills. Table II shows the bivariate relationship between our numeracy skills proxy and a number of variables for individuals between 30 and 59 years of age.[13]

Table II: Descriptive Statistics Across Numeracy Skills Quintiles

Quintile	SAH	Sex	Age	Schooling	Income	Smokes	Normal BMI	Sports	Numeracy score
		(% female)	(Years)	(Years)	(Thousands)	(%)	(%)	(%)	(Correct answers)
1	3.66	45.0	44.1	9.4	230.0	37.5	34.0	31.8	0.02
2	3.64	44.7	44.7	9.4	226.5	34.3	33.9	32.4	0.64
3	3.81	40.8	44.1	10.7	296.1	36.9	37.5	39.9	1.47
4	3.9	45.8	43.2	12.0	418.3	35.3	35.0	37.8	2.35
5	3.95	42.9	44.1	12.0	346.0	35.8	36.5	28.6	2.98
Total	3.79	43.8	44.0	10.7	309.0	36.0	35.4	34.1	1.48

Note: Table includes individuals between the ages of 30 and 59.

The average number of correct answers for individuals the quintiles 1 through 5 of our residual numeracy score are, respectively, 0.02, 0.64, 1.47, 2.35 and 2.98. That is, each quintile of the residual score captures individuals with a distinct numeracy performance. We also see that income and education level increase monotonically as we move to higher quintiles of our measure Q_i. These correlations seem in line with the evidence that shows a positive correlation between cognitive skills and income.[14] An agnostic interpretation of our innate numeracy skills proxy is simply that, it is highly predictive of income and educational attainment after controlling for a large set of individual characteristics.

We can also observe a drop in the percentage of individual who smoke regularly as we move from the lowest quintile of Q_i to the second quintile. The relationship with smoking, obesity (BMI) and sports activity is not robust. Moreover, in our data Q_i is nearly uncorrelated with the space generated by the effort variables.[15]

[12] In a recent paper, Weller et al. (2013) do exactly this. They show that and abbreviated test of eight questions in the same vein as the one used here are enough to predict numeracy skills accurately.

[13] In Chile, women's retirement age is 60.

[14] In the Appendix, we show the estimation of a Mincer equation, that controls for a large list of income determinants. We find that our numeracy skills proxy is positively and strongly associated with income (see table **??**). Similarly, we also find a strong relationship between our numeracy skill measure and schooling years after controlling for the same independent variables.

[15] Specifically, we ran an OLS of Q_i on the effort variables and calculated the residual, call it Q_i^-. By construction, Q_i^- is orthogonal to the effort variables. The correlation between Q_i and Q_i^- is 0.99.

3 Measuring Inequality of Opportunity

As noted by Roemer (1998), efforts can be influenced by circumstances. Specifically, socioeconomic and family background influence health-related behaviors. Since we are interested both in the direct effect of circumstances on outcomes and the indirect effect through efforts, in line with Trannoy et al. (2010), we consider a measure of *relative effort* rather than absolute effort that captures the component of efforts orthogonal to circumstances. In concrete, we run a separate regression (probit model) for each effort against a circumstances vector and other control variables. Let E_i be a binary effort variable, which, in our case, can be an indicator of frequent smoking, obesity or frequent sport activity. If E_i^* denotes the latent variable associated to the effort variable E_i, we assume the linear relationship

$$E_i^* = \alpha_E + \beta_E X_i + \gamma_E \, C_i + u_i, \tag{2}$$

where X_i is a vector of demographic controls that includes a gender dummy and age, known to strongly influence health; C_i is the vector of background circumstances and u_i is a normal error term. Using this equation, we define relative effort as the predicted generalized residuals from the probit estimation as $\tilde{E}_i = E(\hat{u}_i | E_i^* = 1)$. This quantity represents the component of effort that is not explained by individual circumstances. By construction, relative effort is uncorrelated with the vector of circumstances.

Let H_i denote our SAH measure for individual i. We estimate the following equation using an ordered logit model:

$$H_i = \alpha + \beta X_i + \gamma \, C_i + \delta \tilde{E}_i + \theta_2 Q_i^2 + \cdots + \theta_5 Q_i^5 + v_i, \tag{3}$$

where, again, X_i is a vector of individual demographics and C_i is the vector of circumstance variables. The variable Q_i^k is an indicator that takes the value 1 if the residual numeracy score is in quintile k. The coefficients γ and θ represents the total effect of circumstances on health.

Using the estimates of the health equation (3), we can compute the predicted probabilities $\hat{Pr}(SAH = l | \tilde{C}, \tilde{Q}, \tilde{E}, \tilde{X})$ of each one of the six SAH levels as a function of circumstances $\tilde{C}$, cognitive skills $\tilde{Q}$, relative efforts $\tilde{E}$ and demographics $\tilde{X}$. Hereafter, for ease of notation, we omit the dependence on $\tilde{E}$ and $\tilde{X}$ as we are interested in the explanatory power of background circumstances and (innate) cognitive abilities. Following the literature, we focus on two health outcomes, the predicted probability of having a $SAH = \textit{Very Good}$ or $\textit{Excellent}$,

$$\Phi(\tilde{C}, \tilde{Q}) = \hat{Pr}(SAH = \textit{Very Good} \, | \tilde{C}, \tilde{Q}) + \hat{Pr}(SAH = \textit{Excellent} \, | \tilde{C}, \tilde{Q})$$

and the predicted probability of having a $SAH = Good$, *Very Good* or *Excellent*, that is,

$$\Phi^{+}(\tilde{C}, \tilde{Q}) = \hat{Pr}(SAH = Good|\tilde{C}, \tilde{Q}) + \Phi(\tilde{C}, \tilde{Q}).$$

Table III summarizes the estimation of probit model for the efforts' equation (2), the OLS for the numeracy score decomposition (1) and the health equation (3). Tables VIII and IX in the appendix present detailed versions of these estimates that include the coefficients of all controls.

Table III: The Impact of Circumstances on Numeracy Scores, Efforts and SAH

VARIABLES	(1) Sports	(2) Smoking	(3) BMI	(4) Numeracy	(5) SAH
Father alive	-0.00	-0.02	-0.01	0.07**	1.21***
	(0.01)	(0.01)	(0.01)	(0.03)	(0.07)
Mother alive	0.05***	0.03*	0.03*	0.14***	1.21***
	(0.02)	(0.02)	(0.02)	(0.04)	(0.08)
Household comparison: Much better	0.06***	-0.04**	-0.05***	0.19***	1.36***
	(0.02)	(0.02)	(0.02)	(0.05)	(0.11)
Household comparison: Better	0.04***	-0.01	-0.02	0.03	1.00
	(0.01)	(0.01)	(0.01)	(0.03)	(0.06)
Household comparison: Worse	-0.01	0.08***	0.01	0.01	0.81**
	(0.02)	(0.02)	(0.02)	(0.05)	(0.07)
Household comparison: Much Worse	0.00	0.05	-0.03	0.05	0.51***
	(0.05)	(0.05)	(0.05)	(0.12)	(0.12)
Father schooling: Higher ed.	0.08	-0.06	0.08	0.57***	2.09***
	(0.05)	(0.04)	(0.05)	(0.11)	(0.43)
Father schooling: High school	0.00	-0.06*	0.05	0.19**	1.07
	(0.04)	(0.04)	(0.04)	(0.09)	(0.17)
Father schooling: Primary school	-0.01	-0.08**	0.03	0.15*	1.00
	(0.03)	(0.03)	(0.03)	(0.07)	(0.13)
Mother schooling: Higher ed.	0.06	0.00	-0.03	0.40***	1.69**
	(0.06)	(0.06)	(0.05)	(0.14)	(0.38)
Mother schooling: High school	0.02	0.05	-0.00	0.32***	1.52**
	(0.04)	(0.04)	(0.04)	(0.09)	(0.25)
Mother schooling: Primary school	-0.00	0.03	-0.04	0.24***	1.26*
	(0.03)	(0.03)	(0.03)	(0.07)	(0.17)
Cognitive effort - 2nd quintile					1.08
					(0.09)
Cognitive effort - 3rd quintile					1.41***
					(0.11)
Cognitive effort - 4th quintile					1.60***
					(0.13)
Cognitive effort - 5th quintile					2.25***
					(0.18)
Constant				-0.07	
				(0.12)	
Observations	10,934	10,934	10,934	10,934	10,934
Pseudo R-squared	0.0494	0.0528	0.0132		0.0776
Adjusted R-squared				0.12	

Note: Marginal effects for probit estimations; Standard errors in parentheses
$*$ ($p < 0.05$), $**$ ($p < 0.01$), $***$ ($p < 0.001$)

4 Results

Using the estimates of the previous section, we provide two types of measures of inequality of opportunity. First, we estimate the contribution of circumstance variables to the overall variation of health outcomes. The second approach is a counterfactual analysis that identifies the drop in inequality that would occur if all individuals had the same circumstances, the best ones.

4.1 Variance Decomposition

A natural measure of inequality across individuals is the variance of the outcome of interest, in this case, the predicted probability of having "very good" or "excelent" SAH (see Jusot et al. (2013), Jusot et al. (2014), and Roemer and Trannoy (2015)). The variance allows for a direct linear decomposition of each of the circumstances and efforts' components.[16]

Let $\hat{P}_i = \Phi(C_i, Q_i)$ be the predicted probability that SAH is "very good" or "excellent" for individual i with circumstances C_i and our measure of residual numeracy skills Q_i. For short, let $Z_i = (C_i, Q_i^2, Q_i^3, Q_i^4, Q_i^5)$ be a vector that includes background circumstances and the numeracy skills quintile dummies. A linear variance decomposition is based on the following OLS:

$$\hat{P}_i = \beta_v X_i + \gamma_v Z_i + \delta_v \tilde{E}_i + \eta_i. \tag{4}$$

This estimation yields the following variance decomposition:

$$Var(\hat{P}_i) = cov(\hat{P}_i, \hat{\beta}_v X_i) + cov(\hat{P}_i, \hat{\gamma}_v Z_i) + cov(\hat{P}_i, \hat{\delta}_v \tilde{E}_i) + cov(\hat{P}_i, \hat{\eta}_i) \tag{5}$$

Based on this decomposition, we can define a relative measure of inequality of opportunities in health as the variance component related to circumstances normalized by the overall variance:

$$IO^{Var} = cov(\hat{P}_i, \hat{\gamma}_v Z_i)/Var(\hat{P}_i).$$

Using the same methodology for the variance of a particular component (e.g. $Var(\gamma_v Z_i)$), we determine the contribution of each specific circumstance to overall inequality of opportunity.

Unlike the methodology we present next, this methodology does not require to equalize circumstances across individuals as it does not measure the decrease in overall inequality when inequality of opportunity has been removed. Instead, the variance decomposition allows us to quantify how much of the actual inequality is due to each component.

[16] See Bricard et al. (2014) for a discussion of additional properties.

Table IV shows the result for the variance decomposition for our two predicted probabilities, Φ and Φ^+ (having a "very good" or "excellent' SAH, or a better than "good" SAH, respectively). Consistent with previous studies, the most important variables in predicting health are demographics: age and gender explain 42 percent of overall inequality. For outcome Φ, circumstances explain 38.8 percent while (relative) efforts explain 9.3 percent of the overall variance. The contribution of these variables to the variance of outcome Φ^+ are similar, 39.8 percent and 11.2 percent, respectively. As show in Table X in the Appendix, our confidence intervals imply that the contribution of demographic variables and circumstances are not statistically different. Overall, our results are remarkably similar to those obtained by Jusot et al. (2013) using French data. They find that the contribution of demographics, circumstances and efforts to are respectively 48.4, 46.4, and 6.1 percent, with confidence intervals that overlap those estimated herein for each of these variables. [17]

If we look at the contribution of specific circumstances, parents' education and our measure of cognitive abilities prove to be the most relevant, followed by the indicator of whether parents are alive or not -a more direct health circumstance. For outcome Φ, both parent's education level amount to 39.4 percent of the contribution of circumstances while (residual) numeracy skills explain 33.4 percent. For outcome Φ^+, these numbers are 22.3 and 38.7 percent, respectively. Given the confidence intervals, we cannot reject that the contribution of parents' education and numeracy skills are equal.

[17] See Table III in their paper. They consider three different specifications of the effort/circumstance decomposition that yield statistically identical results (our corresponds what they refer as Roemer's scenario).

Table IV: Variance Decomposition: Contribution to Health Inequality

	$\Phi = \hat{Pr}(SAH = vg, e)$		$\Phi^+ = \hat{Pr}(SAH = g, vg, e)$	
Demographics	42.2		51.1	
Circumstances	38.8		39.8	
Household Composition		2.1		4.0
Alive Parents		13.6		17.7
Parents Read		2.0		5.2
Parents Work Status		2.0		3.4
Household Comparison		7.0		8.8
Mother's Education		27.4		11.8
Father's Education		12.0		10.5
Numeracy skills		33.9		38.7
Relative efforts	11.2		9.3	
Practices sports		97.2		97.1
Smokes		1.1		1.6
Normal BMI		1.7		1.3
Residual	7.7		-0.2	

Note: g=good, vg=very good, e=excellent.

4.2 Counterfactual Approach

We now measure inequality of opportunity in health following the methodology developed by Trannoy et al. (2010). This analysis is based on the comparing the actual distribution of outcomes with one of counterfactual outcomes.

The counterfactual outcomes are computed using the predicted probabilities that arise from equalizing one or more circumstances across individuals, and fixing these values to the highest possible level in each category. For example, if we want to study the impact of being raised by both parents instead of a foster family, we determine a new vector of circumstances in which all individuals were raised by both parents and predict a new distribution where all the other circumstances remain constant.[18]

Estimating the contribution of unequal circumstances on inequality depends two choices, health outcomes and the inequality index. Different health outcomes could be influenced by circumstances in various different ways. Similarly, the inequality index chosen may be more or less sensitive to changes in the distribution of health outcomes. As before, for robustness we consider two health measures Φ and Φ^+. In addition, we consider three different inequality indexes, the Gini, Theil and the Atkinson indexes.[19]

[18] For each circumstance, we make a new prediction changing each of the distinct circumstances and assigning the best category to all the individuals, defined as the one with the highest coefficient. If a circumstance is a categorical variable, one category is set as a reference category. If all coefficients are negative (or below 1 for odd ratios), the best circumstance is the reference category.

[19] The Theil index is equivalent to the Atkinson index with an income aversion parameter of 1. The Atkinson index reported in this paper has an income aversion parameter of 2, which gives greater importance to the lower portion of the distribution.

For any distribution of health outcomes F, denote the corresponding index of inequality by $\Sigma(F)$. Here Σ is either the Gini, Theil or Atkinson index. If we define $C = \{c_1, \ldots, c_m\}$ as the set of circumstances, the impact of modifying the subset of circumstances $J \subset C$ on inequality is given by:

$$IO^{cf}(\Sigma, J) = 1 - \frac{\Sigma(\tilde{F}_J)}{\Sigma(F)} \tag{6}$$

where F is the health distribution considering the actual circumstances and $\tilde{F}_J$ represents the distribution associated with the counterfactual health outcomes (those with modified circumstances). Hence, $IO^{cf}(\Sigma, J)$ takes values between 0 and 1 and represents the part of total inequality of the distribution of health explained by circumstances included in J. If $J = \{c_j\}$ for a single circumstance $c_j \in C$ then $IO^{cf}(\Sigma, c_j)$ measures the inequality of opportunity associated to this particular circumstance. If $J = C$ then $IO^{cf}(\Sigma, C)$ represents the impact of all circumstances on total health inequality. In other words, it measures the inequality of opportunity associated with the differences in the circumstances of set C.

Tables V and VI show the impact of the different circumstances on the three inequality indexes. Each table shows the level of inequality, $\Sigma(\tilde{F}_j)$, for each counterfactual distribution $\tilde{F}_j$ and the percentage difference between this and actual inequality, $IO^{cf}(\Sigma, c_j)$.

Table V: The Impact of Circumstances on Inequality using Φ

	Gini	Impact(%)	Theil	Impact(%)	Atkinson(2)	Impact(%)
Actual Circumstances	41.4	.	27.6	.	46.3	.
Household Composition	39.1	5.5	24.4	11.7	43.9	5.2
Alive Parents	37.5	9.4	22.5	18.5	38.1	17.7
Parents Read	40.8	1.5	26.8	3.1	44.8	3.2
Parents Work Status	41.1	0.5	27.3	1.2	45.9	0.8
Household Comparison	39.5	4.6	24.9	9.7	43.0	7.0
Mother's Education	38.5	6.9	23.6	14.5	41.7	9.9
Father's Education	35.6	13.9	20.0	27.6	37.7	18.5
Cognitive Variables	36.9	10.9	21.6	21.6	38.7	16.4
Best Circumstances	15.7	62.0	3.8	86.3	7.8	83.2

Note: Φ represents the predicted probability of having very good or excellent SAH.
Column 1 is the Gini coefficient, column 3 is the Theil index and column 5 is the Atkinson index with an inequality aversion of 2.

From table V and table VI, the overall contribution of circumstances to inequality is between of 62.1 percent (Gini with Φ) and 99.0 percent (Atkinson Index with Φ^+). Hence, the set of circumstances considered explains most of the gaps in adult health -as measured by SAH- for Chile. The literature on equality of opportunities traditionally assumes that these estimate as a lower bound of the contribution of circumstances to inequality.[20] In sum, this approach confirms that

[20]This is due to the residual nature of relative efforts, where anything that is not explained by circumstances is considered an effort, including actual efforts, non-observed circumstances and luck (Trannoy et al., 2010).

Table VI: The Impact of Circumstances on Inequality using Φ^+

	Gini	Impact(%)	Theil	Impact(%)	Atkinson(2)	Impact(%)
Actual Circumstances	18.8	.	5.7	.	13.3	.
Household Composition	15.0	20.4	3.7	34.9	9.2	30.4
Alive Parents	15.4	18.1	3.8	33.6	8.5	36.2
Parents Read	18.2	3.5	5.3	7.3	12.2	8.6
Parents Work Status	18.5	1.6	5.5	3.2	12.9	3.0
Household Comparison	15.8	15.9	4.1	28.7	9.4	28.9
Mother's Education	15.5	17.9	3.9	31.7	9.1	31.7
Father's Education	11.9	36.8	2.4	58.5	5.5	58.6
Cognitive Variables	13.6	27.8	3.0	47.1	7.0	47.1
Best Circumstances	2.0	89.5	0.1	98.9	0.1	99.1

Note: Φ^+ represents the predicted probability of having good, very good or excellent SAH. Column 1 is the Gini coefficient, column 3 is the Theil index and column 5 is the Atkinson index with an inequality aversion of 2.

inequality of opportunity in health in Chile is substantial.

Regarding the impact of specific circumstances, the three circumstances with the greatest impact on inequality are the level of education of the mother, whether parents are alive and cognitive abilities.[21]

Table VII: The Contribution of Cognitive Variables to Inequality for Different Age Groups

	Φ				Φ^+			
	30+ years		50+ years		30+ years		50+ years	
	Gini	Impact(%)	Gini	Impact(%)	Gini	Impact(%)	Gini	Impact(%)
Actual Circumstances	41.4	.	33.6	.	18.8	.	19.1	.
Cognitive Variables	36.9	10.9	27	19.8	13.6	27.8	12.9	32.6
Best Circumstances	15.7	62	9.4	72.1	2	89.5	1.4	92.8
Best w/o cognitive	21.3	48.5	16.2	51.8	3.5	81.6	3.1	83.9

Note: *Best w/o cognitive* considers the counterfactual distribution of outcomes when all circumstances are set equal to the best possible value except for cognitive variables. Φ represents the predicted probability of having very good or excellent health; Φ^+ includes good health as well.

Depending on the health measure and inequality index used, mother's education explains between 7 percent and 32 percent of inequality. This impact is partially due to the fact that the level education of the mother influences the health-related efforts, such as practicing sports regularly, which directly impacts health. The fact that one's parents are alive accounts between 9.4 percent and 36.6 percent of total inequality. Since we control for age, this variable captures parent's longevity. This suggests that direct intergenerational health transmission is also important. Our measures of cognitive abilities capture a circumstance that has not been included in previous papers. It accounts for between 10.6 percent and 46.6 percent of inequality.

[21] As seen in table III these three circumstances have a positive and statistically significant effect on health and in most of the effort equation estimates.

A comparison with previous work is not straightforward due to data limitations. Specifically, while our method follows Trannoy et al. (2010), the background circumstances in their survey are not exactly the same. However, the background circumstances we use span similar information -education, socioeconomic and longevity variables. For comparability, we need restrict our sample to individuals in the same age range, i.e., those aged 50 and over. Perhaps more problematic, their SAH original variable has five rather than the six categories in our data, and their health outcome is the probability that SAH is in their two highest categories -good or very good, i.e., better than regular. Lets call this outcome ρ. Our results consider two health outcomes, Φ for SAH in our two top categories -very good and excellent- and Φ^+ for the three top categories -good, very good and excellent, i.e., all those above regular. It seems safe to assume that the overall inequality obtained for the distribution of Φ^+ with actual circumstances is a lower bound of what would be obtained for ρ, while the inequality for Φ is an upper bound.

For France, Trannoy et al. (2010) estimate a Gini of 15.5 and Gini for the counterfactual distribution of 6.6, implying that contribution of background circumstances to inequality of 57.3 percent. Columns 2 and 4 table on VII, show the Gini for actual circumstances and the contribution to inequality of background circumstances (i.e., excluding cognitive variables) for individuals aged 50 and above in our sample. For outcome Φ the Gini is 33.6 and the contribution of background circumstances is 51.8 percent. For outcome Φ^+ the respective numbers are 19.1 and 83.9 percent. The Gini for the actual distribution is higher in Chile for both outcomes. At the same time, inequality of opportunity explains a similar or higher percentage of inequality in Chile. The same qualitative conclusions hold for the Theil and Atkinson indexes.

Table VII shows two additional facts. First, by comparing the contribution of all circumstances to inequality with that of background circumstances only (i.e., excluding cognitive variables), we conclude that additional contribution of cognitive variables is substantial: 20.3 additional percentage points for Φ and 8.9 additional percentage points for Φ^+. Second, regardless of the health outcome used, the contribution of cognitive variables to health inequality is considerably larger in the sample of older individuals.

5 Conclusion

This paper quantifies the contribution of parental and family background and cognitive abilities on health inequality in Chile. Our health outcome is the predicted probability of having SAH above a certain threshold. A linear decomposition of the variance of our health outcome yields that circumstances explain nearly 40 percent of the variance, four times the contribution of efforts. The remainder is explained by gender and age. More than one third of the contribution of circumstances

is due to numeracy skills. Parental education explain between 22 and 39 percent. The contribution of parents' longevity is also important.

Comparing the inequality of the actual distribution with the one of a counterfactual outcome that equalizes circumstances across individuals, also shows the significance of unequal circumstances on health inequalities. We find that circumstances explain between 62 percent and 90 percent of inequality as measured by the GINI index. The most important circumstances are parental education, cognitive skills and parental longevity. Combined, the latter account for almost 90 percent of the total contribution of circumstances. The contribution of cognitive abilities is larger for older individuals.

Relative to studies on unequal opportunities in health for European countries, we find that inequality is higher in Chile. Our results suggest that the contribution of unequal opportunities to inequality is at least as large. Further comparative studies are needed to improve our understanding the role of different circumstances across countries.

An important finding of this paper is the significant role of cognitive abilities in explaining inequalities in health. Future research should shed light on the robustness of these finding, the mechanisms that underlie this relationship and the impact of education and health policies aimed at reducing health disparities that arise from cognitive differences.

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Appendix

Table VIII: Circumstance Relevance on Absolute Efforts and Numeracy Skills

	Sports	Smoking	BMI	Numeracy
	Probit	Probit	Probit	OLS
Age 30 to 34	0.33***	0.59***	-0.12***	0.68***
	(0.06)	(0.05)	(0.04)	(0.10)
Age 35 to 39	0.28***	0.56***	-0.13***	0.51***
	(0.06)	(0.05)	(0.04)	(0.10)
Age 40 to 44	0.25***	0.54***	-0.16***	0.48***
	(0.06)	(0.05)	(0.03)	(0.10)
Age 45 to 49	0.19***	0.54***	-0.18***	0.49***
	(0.06)	(0.05)	(0.03)	(0.09)
Age 50 to 54	0.18***	0.54***	-0.17***	0.52***
	(0.06)	(0.05)	(0.03)	(0.09)
Age 55 to 59	0.17***	0.49***	-0.16***	0.50***
	(0.06)	(0.06)	(0.03)	(0.10)
Age 60 to 64	0.12*	0.40***	-0.17***	0.45***
	(0.06)	(0.06)	(0.03)	(0.10)
Age 65 to 69	0.14**	0.35***	-0.13***	0.37***
	(0.07)	(0.07)	(0.04)	(0.10)
Age 70 to 74	0.04	0.31***	-0.13***	0.20*
	(0.07)	(0.09)	(0.04)	(0.12)
Age 75 to 79	0.09	0.17*	-0.08*	0.03
	(0.07)	(0.09)	(0.05)	(0.11)
Gender (Female)	0.04***	0.04***	0.02*	0.12***
	(0.01)	(0.01)	(0.01)	(0.03)
Maternity: Parent	-0.01	-0.04	0.04	0.03
	(0.05)	(0.05)	(0.04)	(0.11)
Maternity: Other	-0.04	-0.08	0.06	-0.12
	(0.06)	(0.05)	(0.07)	(0.15)
Paternity: Parent	0.11***	-0.03	-0.01	0.11
	(0.04)	(0.04)	(0.04)	(0.11)
Paternity: Other	0.10	0.03	-0.05	-0.01
	(0.06)	(0.05)	(0.05)	(0.13)
Father alive	-0.00	-0.02	-0.01	0.07**
	(0.01)	(0.01)	(0.01)	(0.03)
Mother alive	0.05***	0.03*	0.03*	0.14***
	(0.02)	(0.02)	(0.02)	(0.04)
Mother reads	0.06**	-0.02	0.06**	0.11*
	(0.02)	(0.03)	(0.03)	(0.07)
Father reads	0.06**	0.08***	-0.01	0.10
	(0.03)	(0.03)	(0.03)	(0.07)
Mother employment: Unemployed	-0.01	-0.04*	-0.01	0.06
	(0.02)	(0.02)	(0.02)	(0.05)
Mother employment: Stable	-0.02	-0.01	-0.03	0.14***
	(0.02)	(0.02)	(0.02)	(0.05)
Father employment: Unemployed	0.00	-0.00	-0.02	-0.15*
	(0.04)	(0.04)	(0.04)	(0.08)
Father employment: Stable	0.00	0.02	-0.01	0.05
	(0.02)	(0.02)	(0.02)	(0.04)
Household comparison: Much better	0.06***	-0.04**	-0.05***	0.19***
	(0.02)	(0.02)	(0.02)	(0.05)
Household comparison: Better	0.04***	-0.01	-0.02	0.03
	(0.01)	(0.01)	(0.01)	(0.03)
Household comparison: Worse	-0.01	0.08***	0.01	0.01
	(0.02)	(0.02)	(0.02)	(0.05)
Household comparison: Much Worse	0.00	0.05	-0.03	0.05
	(0.05)	(0.05)	(0.05)	(0.12)
Father schooling: Higher ed.	0.08	-0.06	0.08	0.57***
	(0.05)	(0.04)	(0.05)	(0.11)
Father schooling: High school	0.00	-0.06*	0.05	0.19**
	(0.04)	(0.04)	(0.04)	(0.09)
Father schooling: Primary school	-0.01	-0.08**	0.03	0.15*
	(0.03)	(0.03)	(0.03)	(0.07)
Mother schooling: Higher ed.	0.06	0.00	-0.03	0.40***

	(0.06)	(0.06)	(0.05)	(0.14)
Mother schooling: High school	0.02	0.05	-0.00	0.32***
	(0.04)	(0.04)	(0.04)	(0.09)
Mother schooling: Primary school	-0.00	0.03	-0.04	0.24***
	(0.03)	(0.03)	(0.03)	(0.07)
Relative effort: Sports				0.17***
				(0.02)
Relative effort: Smoking				0.01
				(0.02)
Relative effort: BMI				-0.04**
				(0.02)
Constant				-0.07
				(0.12)
Observations	10,934	10,934	10,934	10,934
Other control variables	Yes	Yes	Yes	Yes
Observations	10,934	10,934	10,934	10,934

Marginal effects for probit estimations; Standard errors in parentheses.
Doesn't know and doesn't answer categories omitted.
$*$ ($p < 0.05$), $**$ ($p < 0.01$), $***$ ($p < 0.001$)

Table IX: Decomposition of SAH: Circumstances, Absolute and Relative Efforts

	(1) Circumstances	(2) Sports & Smoking	(3) BMI	(4) Numeracy	(5) All eforts
Self-Assesed Health					
Age 30 to 34	6.389***	5.326***	5.366***	4.666***	6.730***
	(1.226)	(1.044)	(1.051)	(0.912)	(1.309)
Age 35 to 39	4.696***	4.060***	4.091***	3.685***	4.864***
	(0.874)	(0.769)	(0.775)	(0.697)	(0.919)
Age 40 to 44	3.763***	3.307***	3.341***	3.032***	3.934***
	(0.678)	(0.607)	(0.614)	(0.555)	(0.722)
Age 45 to 49	3.073***	2.804***	2.834***	2.548***	3.179***
	(0.550)	(0.510)	(0.516)	(0.462)	(0.579)
Age 50 to 54	2.129***	1.929***	1.949***	1.729***	2.169***
	(0.378)	(0.348)	(0.352)	(0.312)	(0.392)
Age 55 to 59	1.750***	1.603***	1.619***	1.443**	1.770***
	(0.315)	(0.292)	(0.295)	(0.262)	(0.323)
Age 60 to 64	1.635***	1.541**	1.557**	1.408*	1.685***
	(0.307)	(0.292)	(0.296)	(0.267)	(0.322)
Age 65 to 69	1.658**	1.543**	1.553**	1.400	1.651**
	(0.342)	(0.322)	(0.325)	(0.291)	(0.344)
Age 70 to 74	1.387	1.345	1.354	1.284	1.377
	(0.289)	(0.290)	(0.293)	(0.279)	(0.301)
Age 75 to 79	1.197	1.143	1.150	1.133	1.183
	(0.287)	(0.278)	(0.281)	(0.274)	(0.288)
Gender (Female)	1.193***	1.157***	1.156***	1.124**	1.198***
	(0.0594)	(0.0577)	(0.0577)	(0.0563)	(0.0598)
Maternity: Parent	0.910	0.919	0.918	0.902	0.885
	(0.190)	(0.199)	(0.199)	(0.200)	(0.195)
Maternity: Other	1.325	1.367	1.364	1.396	1.338
	(0.363)	(0.385)	(0.384)	(0.396)	(0.378)
Paternity: Parent	1.263	1.192	1.193	1.180	1.289
	(0.243)	(0.235)	(0.235)	(0.238)	(0.258)
Paternity: Other	0.838	0.800	0.802	0.819	0.851
	(0.187)	(0.182)	(0.182)	(0.188)	(0.194)
Father alive	1.207***	1.209***	1.209***	1.188***	1.209***
	(0.0726)	(0.0725)	(0.0725)	(0.0709)	(0.0719)
Mother alive	1.209***	1.174**	1.172**	1.140*	1.209***
	(0.0805)	(0.0788)	(0.0788)	(0.0769)	(0.0814)
Mother reads	1.144	1.105	1.102	1.077	1.134
	(0.136)	(0.131)	(0.131)	(0.126)	(0.132)
Father reads: NA	0.594	0.598	0.597	0.590	0.587
	(0.295)	(0.308)	(0.308)	(0.291)	(0.292)
Father reads	0.990	0.946	0.948	0.924	0.982
	(0.121)	(0.118)	(0.118)	(0.113)	(0.121)
Mother employment: Unemployed	1.008	1.009	1.009	0.993	0.999
	(0.0852)	(0.0848)	(0.0848)	(0.0832)	(0.0840)
Mother employment: Stable	1.020	1.022	1.023	0.985	1.007
	(0.0903)	(0.0899)	(0.0900)	(0.0867)	(0.0889)
Father employment: Unemployed	1.014	1.009	1.011	1.049	1.024
	(0.156)	(0.156)	(0.156)	(0.163)	(0.158)
Father employment: Stable	1.221***	1.214***	1.215***	1.203***	1.220***
	(0.0823)	(0.0812)	(0.0813)	(0.0804)	(0.0816)
Household comparison: Much better	1.357***	1.312***	1.316***	1.253***	1.355***
	(0.112)	(0.108)	(0.109)	(0.104)	(0.112)
Household comparison: Better	0.994	0.969	0.971	0.966	0.999
	(0.0595)	(0.0586)	(0.0589)	(0.0591)	(0.0608)
Household comparison: Worse	0.816**	0.814**	0.814**	0.805**	0.810**

	(0.0745)	(0.0746)	(0.0747)	(0.0745)	(0.0747)
Household comparison: Much Worse	0.525***	0.523***	0.525***	0.517***	0.510***
	(0.125)	(0.120)	(0.121)	(0.122)	(0.120)
Father schooling: Higher ed.	2.037***	1.968***	1.957***	1.713***	2.090***
	(0.407)	(0.401)	(0.400)	(0.350)	(0.426)
Father schooling: High school	1.070	1.076	1.074	1.027	1.068
	(0.173)	(0.176)	(0.176)	(0.166)	(0.173)
Father schooling: Primary school	1.001	1.013	1.011	0.977	0.999
	(0.133)	(0.137)	(0.136)	(0.129)	(0.133)
Mother schooling: Higher ed.	1.650**	1.621**	1.625**	1.460*	1.689**
	(0.375)	(0.369)	(0.370)	(0.330)	(0.384)
Mother schooling: High school	1.475**	1.477**	1.480**	1.370*	1.521**
	(0.249)	(0.249)	(0.249)	(0.230)	(0.255)
Mother schooling: Primary school	1.258*	1.262*	1.265*	1.190	1.257*
	(0.168)	(0.168)	(0.169)	(0.157)	(0.166)
Absolute effort: Sports		1.886***	1.885***	1.763***	
		(0.103)	(0.103)	(0.0972)	
Absolute effort: Smoking		1.089	1.085	1.084	
		(0.0602)	(0.0601)	(0.0609)	
Absolute effort: BMI			1.052	1.069	
			(0.0552)	(0.0562)	
Numeracy Score				1.302***	
				(0.0301)	
Relative effort: Sports					1.467***
					(0.0487)
Relative effort: Smoking					1.048
					(0.0358)
Relative effort: BMI					1.041
					(0.0335)
Cognitive effort - 2nd quintile					1.079
					(0.0887)
Cognitive effort - 3rd quintile					1.408***
					(0.110)
Cognitive effort - 4th quintile					1.595***
					(0.129)
Cognitive effort - 5th quintile					2.253***
					(0.177)
Observations	10934	10934	10934	10934	10934

Exponentiated coefficients; Standard errors in parentheses
Doesn't know and doesn't answer categories omitted.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table X: Decomposition of inequalities in health according to the three sources, circumstances, effort and demographics (Benchmark case bootstrapped with 1,000 replications using percentiles methods)

	Φ			Φ^+		
	Coeff.	Confidence Interval		Coeff.	Confidence Interval	
Demographics	42.22	34.92	48.38	51.15	43.64	58.07
Circumstances	38.80	32.27	46.64	39.76	33.07	47.03
Household Composition	2.08	0.52	6.14	3.97	1.38	9.10
Alive Parents	13.64	5.94	21.43	17.71	8.03	26.37
Parents Read	2.02	-1.28	7.05	5.17	-1.52	14.95
Parent's Work Status	1.96	0.58	6.38	3.36	1.34	7.97
Household Comparison	6.96	3.13	13.16	8.80	4.51	14.85
Mother's Education	27.42	12.36	41.79	11.78	4.24	20.40
Father's Education	11.99	3.13	25.52	10.48	1.31	21.54
Cognitive Variables	33.94	21.81	44.82	38.72	27.98	46.65
Relative efforts	11.24	7.65	15.44	9.26	6.38	12.33
Sports	97.24	88.37	99.74	97.09	87.65	99.77
Smoking	1.07	0.00	7.55	1.63	0.00	8.50
BMI	1.69	0.00	9.14	1.29	-0.01	8.20
Residual	7.74	6.10	9.89	-0.17	-1.04	1.58

Note: Φ represents the predicted probability of having very good or excellent SAH. Φ^+ includes good health as well.

Table XI: The Impact of Circumstances on Inequality using Φ for people aged 50 and over

	Gini	Impact(%)	Theil	Impact(%)	Atkinson(2)	Impact(%)
Actual Circumstances	33.6	.	18.4	.	30.9	.
Household Composition	32.3	4.0	16.8	8.5	34.9	-13.1
Alive Parents	30.7	8.8	15.4	16.2	25.7	16.9
Parents Read	33.0	2.0	17.6	4.0	29.2	5.4
Parent's Work Status	33.2	1.3	17.9	2.8	30.2	2.2
Household Comparison	31.9	5.2	16.5	10.5	27.9	9.6
Mother's Education	30.1	10.4	14.5	20.9	25.9	16.1
Father's Education	30.2	10.2	14.5	21.1	26.2	15.2
Cognitive Variables	27.0	19.8	11.8	36.0	22.0	28.8
Best Circumstances	9.4	72.1	1.4	92.4	2.7	91.2

Note: Φ represents the predicted probability of having very good or excellent SAH.
Column 1 is the Gini coefficient, column 3 is the Theil index and column 5 is the Atkinson index with an inequality aversion of 2.

Table XII: The Impact of Circumstances on Inequality using Φ^+ for people aged 50 and over

	Gini	Impact(%)	Theil	Impact(%)	Atkinson(2)	Impact(%)
Actual Circumstances	19.1	.	5.7	.	12.4	.
Household Composition	16.2	15.4	4.2	27.2	13.5	-9.3
Alive Parents	15.6	18.7	3.8	34.0	8.0	35.6
Parents Read	18.0	5.8	5.0	11.6	10.7	13.6
Parent's Work Status	18.7	2.3	5.4	4.6	11.8	4.3
Household Comparison	16.4	14.1	4.2	26.3	9.2	25.2
Mother's Education	13.8	27.9	3.0	47.2	6.8	45.1
Father's Education	13.2	31.0	2.8	51.6	6.2	49.6
Cognitive Variables	12.9	32.6	2.7	53.1	6.2	50.1
Best Circumstances	1.4	92.8	0.0	99.5	0.1	99.5

Note: Φ^+ represents the predicted probability of having good, very good or excellent SAH.
Column 1 is the Gini coefficient, column 3 is the Theil index and column 5 is the Atkinson index with an inequality aversion of 2.