Human capital formation in the OECD: exploring the role of welfare state composition

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Abstract

Social expenditure has the potential to foster human capital accumulation and, in this way, increase economic growth and make the distribution of income less unequal. A disaggregated analysis of the effects of specific types of social spending on human capital formation may help the design of more effective social policies that result in more inclusive societies and promote economic growth. The role of different social policy interventions may vary according to the type of human capital, educational or health human capital. We employ a fixed effects model with Driscoll–Kraay standard errors to evaluate the response of both types of human capital to changes in the size and composition of social spending in a sample of 37 OECD countries observed over the period 1985-2018. Our findings reveal that the composition of social spending from the perspective of its distribution across the nine social policy areas defined by the OECD influences health human capital formation. Old age spending also matters to educational human capital, but the results for spending on education question the efficiency in the use of the resources devoted to the schooling system. These findings have implications for social policy design in the aftermath of the COVID-19 crisis period with its direct impact on health human capital formation but also because it is eroding the ability of the education system to promote human capital accumulation.

Keywords: Social Expenditure, Human Capital, Education, Health, OECD

JEL Classification: H19, H53, I28, I38, P50

This research received financial support from COMPETE 2020, Portugal 2020 and the European Union [POCI-01-0145-FEDER-029365]; and from the *Fundação para a Ciência e Tecnologia I.P./MCTES* through national funds (PIDDAC) [PTDC/EGE-ECO/29365/2017].

1. Introduction

Economic growth has been shown to depend crucially upon the process of accumulation of human capital as it determines the availability of a fundamental input for production and productivity growth (see e.g. Nelson and Phelps (1966); Lucas (1988); Romer (1990); Mankiw, Romer, and Weil (1992); Benhabib and Spiegel (2005); Tsai, Hung, and Harriott (2010); E. Hanushek and Woessmann (2011); Benos and Zotou (2014); Bayraktar-Sağlam (2016); Silva, Simões, and Andrade (2018); D. E. Bloom, Kuhn, and Prettner (2018)). Additionally, human capital is seen as relevant for distributional issues and poverty alleviation (Abdullah, Doucouliagos, and Manning (2015); Roser and Cuaresma (2016); Bhattacharjee, Shin, Subramanian, and Swaminathan (2017); Lee and Lee (2018); Sehrawat and Singh (2019)), which in turn can also influence long run macroeconomic performance (P. Aghion, Caroli, and García-Peñalosa (1999); Dominicis, Florax, and De Groot (2008); Berg, Ostry, Tsangarides, and Yakhshilikov (2018); Tridico and Paternesi Meloni (2018)). Understanding how such process takes place is thus essential to explain what makes countries grow and improve the standards of living of their citizens as well as promoting social inclusion.

As far as determinants of human capital formation are concerned, public spending has received some attention (see e.g. Baldacci, Guin-Siu, and Mello (2003); Baldacci, Clements, Gupta, and Cui (2008); Akinkugbe and Mohanoe (2009); Fayissa and Traian (2013); Vegas and Coffin (2015); Dissou, Didic, and Yakautsava (2016); OECD (2017); Del Boca, Monfardini, and See (2018); Rahman, Khanam, and Rahman (2018); Singh and Shastri (2020)) as human capital externalities (see e.g. Lucas (1988); Romer (1990); Daron Acemoglu and Angrist (2001); Dee (2004); Jones (2005); Ciccone and Peri (2006); Lochner (2011); Winters (2013)) justify the need for state interventions that promote the accumulation of human capital. An important model of state intervention that can promote the formation of human capital is the welfare state, through different policy interventions: directly through public spending on education and health but also indirectly through other social policy areas such as family related benefits, housing or active labour market policies. Overall it is possible to find arguments supporting the influence on the process of human capital formation of all the nine social policy areas identified in the OECD Social Expenditures database – Old age, Survivors, Incapacity-related benefits, Health, Family, Active labour market policies (ALMPs), Unemployment, Housing, and Other social policy areas (OECD (2019)). A disaggregated analysis of the effects of specific types of social spending on human capital formation might thus have important implications for the design of more effective social policies that result in more inclusive societies and promote economic growth.

This paper covers the formation of two types of human capital: educational and health human capital. The formation of educational and health human capital is influenced by numerous factors, with public expenditure potentially playing a key role since it constitutes a measure of monetary efforts to increase the level of human capital at the national level, likely affecting the overall quantity and quality of schooling and the health status of the population and in this way contributing to the accumulation of human capital. We examine the role of different types of social spending in the formation of both types of human capital. The main research questions this paper addresses are the following: (1) What are the roles of different types of social spending in the process of human capital formation? (2) Does the role of different social policy interventions vary according to the type of human capital, educational or health human capital? To answer the former research questions, we focus on OECD economies since for these group of countries we have comparable disaggregated data on social expenditures, starting as far back as 1985 and for a reasonable number of countries. The empirical model takes

as dependent variable a measure of human capital, based on the schooling levels or the health status of the population or both, and as explanatory variables of interest public social expenditure and its composition. In addition, a set of control variables composed of potential drivers of human capital formation selected according to previous literature is also considered. We employ a fixed effects model with Driscoll–Kraay standard errors to evaluate the response of both types of human capital to changes in the size and composition of social spending in a sample of 37 OECD countries observed over the period 1985-2018.

This paper contributes to the clarification of the existence (or lack of) of linkages between social expenditure and human capital formation. We take a step back and look at the process of human capital formation from a broader perspective by providing a macro description of its association with social policy. By identifying broad patterns for the link between social policy and human capital formation we aim also to pave the way to more disaggregated studies (e.g. at the individual level) that enable a deeper understanding of the process of human capital accumulation and thus help to define more accurate policy interventions. Our contribution is thus essentially descriptive in nature not aiming at providing a detailed explanation of the linkages found but by taking stock of the former it can help a countries to benefit the most from its social policy.

With respect to previous works, that usually consider only one human capital dimension, we investigate the accumulation of the two most important and often studied forms of human capital, educational and health human capital. Our work also differs and builds upon previous research since our focus is not exclusively on total public social spending, nor on particular components of social spending taken in isolation but instead we take into account all the comparable social policy areas from the OECD Social Expenditure Database (SOCX), OECD (2019), plus education. The world health crisis stemming from the new SARS-CoV-2 virus raises deep concerns about the health status but also education levels of the world population at large and especially future adults but quick and strong social policy responses have been fundamental in containing the devastating social and economic outcomes of the pandemic, Cook and Ulriksen (2021), Pereirinha and Pereira (2021). A disaggregated analysis of the effects of specific types of social spending on human capital formation may aid in the design of more effective social policies that alleviate the former consequences of the pandemic and result in more inclusive societies as well as boosting economic growth.

The remainder of the paper is set out as follows: Section 2 gives an overview of the literature. Section 3 provides information on the dataset and describes the empirical methodology. Section 4 presents and discusses the results and Section 5 concludes.

2. Literature overview

The economic role of human capital has been a key research issue since at least the 1960s when Theodore Schultz and Gary Becker introduced the concept (Schultz (1961); Becker (1964)). From the 1980s onwards it also started raising a lot of interest at the macroeconomic level, especially within economic growth theory, both from an exogenous and from an endogenous growth perspective (Lucas (1988); Mankiw et al. (1992); Romer (1990)). In this study we examine the formation of two types of human capital: educational and health human capital.

The OECD (2001) defines human capital as the knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic

well-being. Within this broad definition that encompasses quite varied sources of human capital (education, training, experience, health care, family background, etc.), two have been the object of extensive research, education and health. For instance, the importance of these two types of human capital is recognized by the World Bank in its recent Human Capital Project (World_Bank (2018))[1] that includes the computation of a human capital index based exclusively on education and health data. This index is designed to capture the amount of human capital a child born today could expect to attain by age 18 with information divided into three components, survival (measured using the under-5 mortality rate), expected years of learning-adjusted school (expected years of schooling and test scores) and health (the rate of stunting of children under age 5 and the adult survival rate).

From the perspective of assessing its importance for long run macroeconomic performance, educational human capital is most often measured using information on participation in formal education, e.g. school enrolment rates, percentage of the population that has attained a certain level of schooling or average years of schooling of the population/workforce (see e.g.Barro and Lee (2013), De La Fuente and Doménech (2000) and Cohen and Soto (2007)). More recently, the issue of the quality of education received has been incorporated in measures of educational human capital mostly using the (comparable) results from international assessment tests such as those administered by the Program for International Student Assessment (PISA) of the OECD, although with much more limited data availability (see e.g. E. A. Hanushek and Woessmann (2012)). Angrist, Djankov, Goldberg, and Patrinos (2019) compute an educational human capital measure for 164 countries and territories population from 2000 to 2017 that takes into account learning, based on the results from achievement tests. The authors find that learning is highly associated with growth and show that it accounts for up to a third of cross-country income differences. In a meta-regression analysis of the effects of education on economic growth using data from 56 empirical studies corresponding to 979 estimated coefficients, Benos and Zotou (2014) conclude for the existence of substantial publication bias towards finding a positive link betwixt education and growth and also that the results depend to a large extent on the specific design of different studies.

As far as health human capital is concerned, the interest in this input as a growth determinant is more recent but has already been investigated in a few applied studies (Bhargava, Jamison, Lau, and Murray (2001); D. Bloom, Canning, and Sevilla (2004); Daron Acemoglu and Johnson (2007); Weil (2007); Lorentzen, McMillan, and Wacziarg (2008); (Cervellati & Sunde, 2011); Cooray (2013); Hansen and Lønstrup (2015); Silva et al. (2018)). D. E. Bloom et al. (2018) carry out a comprehensive review of the empirical literature on health and economic growth identifying also different measures of health human capital, such as life expectancy, mortality rates, morbidity rates, children's and women's health, and health at older ages. According to the authors, these different dimensions of health may reveal different economic effects, although overall the positive correlation between health and economic growth seems to be well-established. In any case, the mechanisms at work vary. For the specific case of developed countries, the role of health as a driver of economic growth is less consensual due to concerns with the excessive focus in the elderly that can result in a diminished labour force and lower productivity as well as an excessively important (less productive) health sector. According to the authors a lot of research dampens these concerns, e.g. because higher life

[1] See https://www.worldbank.org/en/publication/human-capital

expectancy raises aggregate savings, or due to the fact that increases in healthy life span translate into the elderly's higher labour force participation.

In this study we investigate human capital formation at an aggregate level. Research into the determinants of educational and health human capital formation at an aggregate level includes Baldacci et al. (2008) that build on a previous work focusing on health human capital, Baldacci et al. (2003). The main aim in Baldacci et al. (2008) is to a examine the role of social spending for economic growth in a sample of 120 developing countries from 1975 to 2000, highlighting its indirect influence through human capital accumulation, both in terms of education and in terms of health. For this latter purpose, the authors estimate what they call an education equation and a health equation. The dependent variable in the education human capital formation regression, the education equation, is the composite primary and secondary school enrolment rate and the explanatory variables are school age population, the income level, health capital, a quality of schooling indicator, education spending, poor governance a gender equality. The dependent variable in the health human capital formation regression, the health equation, is the under-5 child mortality rate and the explanatory variables are the income level, gender equality, urbanization, poor governance and health spending. Overall, the different explanatory variables are statistically significant and present the expected signs. Specifically, for the case of social spending in education and in health, the authors conclude that there is a time lag between increases in education spending and the effects on educational human capital and growth, while the impact of health spending is immediate. Additionally, the positive effects of both education and health spending are strongly influenced by the quality of governance. One of the goals in Égert, Botev, and Turner (2020) is to investigate the effect of education policies on human capital for a sample of 28 European and OECD countries over the period 1970-2014. Human capital is measured using data on mean years of schooling and realistic rates of return to education. The evidence found shows that an increase in spending on education and life expectancy translates into more human capital, while the results for the rate of urbanisation is less robust across specifications. By interacting the former core drivers of human capital with what the authors call policy drivers (pre-primary education; student-teacher ratio; school autonomy; age of first tracking; barriers to funding to students in tertiary education; university autonomy), they conclude that the results "(…)can be interpreted in terms of cost effectiveness as they are obtained as interactions with public spending on education: any given increase in public spending will have a greater effect on human capital if for instance more children attend pre-primary education and if tracking in secondary education starts at an older age." (p. 7)

We build especially on Baldacci et al. (2008) and Égert et al. (2020) to investigate the impact of the composition of social spending on educational and health human capital introducing the necessary adaptations in the models specifications in order to accommodate the differences relative to our sample of OECD countries. These are explained in the methodology and data section.

3. Methodology and data

We investigate how various components of government spending affect the different measures of human capital relying on an empirical model inspired by recent literature, Égert, Botev, and Turner (2019), Klomp and de Haan (2013), Baldacci et al. (2008) and Baldacci et al. (2003). Equation (1) gives the baseline model specification:

$$HC_{it} = \alpha + \beta_1 SocExp_{i,t-1} + \theta' X_{it-1} + \vartheta_i + \varepsilon_{it} \quad (1)$$

where HC is the human capital measure in country *i* at time *t*; *SocExp* is the set of social spending indicators; X denotes the vector of control variables and ϑ_i, and $\varepsilon_{i,}$ represent country fixed-effects, and the error term, respectively. The dataset includes thirty-seven OECD countries over the period 1985-2018.

We measure human capital, HC using three different proxies related to education, to the health status of the population and a composite human capital index that considers both education and health indicators.

Educational human capital is proxied by the quantity of education received, more specifically as average years of schooling taken mostly from the Barro and Lee education dataset (Barro and Lee (2013)), and also from Goujon et al. (2016), Cohen, Leker, and Centre for Economic Policy Research (Great Britain) (2014) and de la Fuente and Doménech (2015). This proxy is widely used as a measure of human capital in empirical growth studies. For some recent examples see e.g. Gutiérrez-Romero (2021), Matousek and Tzeremes (2021), Ouedraogo, Sourouema, and Sawadogo (2021), Zergawu, Walle, and Giménez-Gómez (2020). The set of data sources combined provide consistent and reliable education data across countries. However, the information is provided at 5-year intervals, which results in a low number of observations, while we use annual data. To obtain yearly values for our variable we imputed the missing data using the approach suggested by J. Honaker, King, and Blackwell (2011). This approach assumes a missingness matrix where every variable is linearly estimated with information obtained from the other variables in the database. The approach combines the classic Expectation-Maximization algorithm (EM), from Dempster, Laird, and Rubin (1977), with the a bootstrap method resulting in EMB (Expectation-Maximization with Bootstrap). For more details see James Honaker and King (2010).

The health human capital proxy used refers to life expectancy at birth obtained from the OECD database. The health status of the population has been measured using different proxies usually grouped into measures of the lack of health (negative indicators) and indicators of the existence of health (positive indicators). The latter involves concepts of wellness and quality of life and life expectancy at birth is included in this group of measures. Life expectancy has been widely used as a proxy for health human capital that confirm the importance of the former for economic growth, see e.g. Arora (2001), Philippe Aghion, Howitt, and Murtin (2011), Cervellati and Sunde (2011), D. E. Bloom, Canning, and Fink (2014), D. E. Bloom et al. (2018).

We also build a human capital index (HCI) using the methodology proposed by Kraay (2018) that suggests the use of adult and children survival rates and years of schooling adjusted for learning to compute a more thorough measure of human capital that covers three human capital dimensions: 1. Child Survival; 2. School; 3. Health. This human capital index intends to capture the expected contribution to production of a child born today as a future worker, taking into account the current education and health conditions in his/her country of origin. The human capital index is computed as:

$$HCI = p \times e^{\phi(s \times l - s^*)} \times e^{\gamma(z - z^*)} \qquad (2)$$

where p is the probability of child survival; ϕ is the return to education; s is average years of schooling; s^* is a benchmark for years of schooling and l is a learning (quality of education) measure obtained from different assessment programs including PISA (Programme for International Student Assessment), PIRLS (Progress in International Reading Literacy Study), TIMSS (Trends in International Mathematics and Science Study) and PIAAC (Programme for the International Assessment of Adult Competencies). Since these organizations have different

assessment scales we harmonized the data by applying the anchoring method, see Duarte, Santos, Simões, and Andrade (2021) for details. To obtain enough observations for further examination we also had to impute missing values. In the health component, γ represents returns to health, z is the survival rate from age 15 to 60 and z^* is the benchmark value for the survival rate.

SocExp is the measure of welfare effort corresponding to public social expenditure, total and according to spending categories, as a percentage of GDP, retrieved from the OECD Social Expenditures database, SOCX (OECD (2019)) and also public expenditure on education from the World Development Indicators (WDI). We expect that higher welfare effort, overall and corresponding to the different welfare programs promotes de accumulation of human capital. We thus expect to obtain a positive association not only between public health and education expenditure and human capital availability but also with the remaining spending categories, old age pensions, survivors' pensions, incapacity and family related benefits, active labour market policies, unemployment benefits, housing and other social policy areas. For instance, old age pensions, survivors pensions, incapacity related benefits and unemployment benefits may depend on the level of wages. Since higher levels of human capital increase productivity and thus wages, the former will constitute an incentive to invest more in human capital and guarantee an income in old age, incapacity or unemployment similar to the one received while working. Family related benefits allow children the means to participate in the education system and have access to better health conditions and adults to invest further in human capital instead of staying at home looking after the elderly or children.

The vector *X* includes a set of control variables selected based on previous literature on human capital formation, see e.g., Baldacci et al. (2003), Baldacci et al. (2008), Rezapour, Mousavi, Lotfi, Soleimani Movahed, and Alipour (2019), Égert et al. (2020). Overall, we control for economic conditions (log of real GDP per capita, *lgdppc*), the existence of surrounding conditions that promote the accumulation of human capital (log of urbanization, *lurban*), learning environment conditions (student-to-teacher ratio, *pupteacher*), integration in world markets (globalisation index, *kofgi*) and socio-demographic structure (total dependency ratio, *depratio*). We expect that a higher level of income per capita, *lgdppc*, results in higher levels of human capital since it provides individuals and countries with more resources to invest in education and health, as well as raising the demand for these services, Baldacci et al. (2003); Baldacci et al. (2008)). Urbanisation, *lurban*, is expected to promote human capital accumulation because in cities there is a higher concentration and demand for skilled workers that provides incentives and facilitates looking for and finding jobs that require higher levels of human capital, E. L. Glaeser (1999) and E. Glaeser and Maré (2001). The student-to-teacher ratio, *pupteacher*, controls for teaching/schools conditions that promote and facilitate learning and a higher number of students per teacher is thus expected to hamper the quantity and quality of the education received, Baldacci et al. (2003). Higher global integration, *kofgi*, is expected to result in higher levels of human capital because it increases competitiveness in the world markets or the attractiveness of domestic economies in the eyes of multinational companies, but also because individuals aspire to the social conditions available in the more advanced countries or because governments sign treaties that promote better living conditions (Mzee (2012) and Popa, Reczey, and Quansah (2015)). Finally, the ratio between non-working age population and working age population, *depratio,* controls for demand of human capital components such as health and education since, for example, a lower ratio means more working age population who can support better pensions and health systems Simon, Belyakov, and Feichtinger (2012). Table 1 describes the variables and data sources. Table 2 presents summary statistics.

Table 1: Variables and sources

Variable	Description	Unit	Source
Edu	Mean years of schooling	Years	Barro and Lee (2013), Goujon et al. (2016), Cohen et al. (2014); de la Fuente and Doménech (2015).
LExp	Life expectancy at birth	Years	OECD database
HCI	Human capital index that combines three different components: Child Survival, School and Health	Index	Own calculations.
SocExp_Tot	Total public social expenditure	% GDP	OECD Social Expenditure Database (SOCX)
SocExp_Tot_nohp	Total public social expenditure excluding health expenditure	% GDP	SOCX
SocExp_Hp	Public expenditure on Health	% GDP	SOCX
SocExp_Edu	Government expenditure on education	% GDP	World Development Indicators (WDI)
SocExp_ALMP	Public expenditure on Active labour market policies	% GDP	SOCX
SocExp_Fam	Public expenditure on Family	% GDP	SOCX
SocExp_Hou	Public expenditure on Housing	% GDP	SOCX
SocExp_Inc	Public expenditure on Incapacity-related benefits	% GDP	SOCX
SocExp_Old	Public expenditure on Old age	% GDP	SOCX
SocExp_Unem	Public expenditure on Unemployment	% GDP	SOCX
SocExp_Surv	Public expenditure on Survivors	% GDP	SOCX
SocExp_Oth	Public expenditure on Other social policy areas	% GDP	SOCX
gdppc	Real GDP at constant 2017 national prices, per capita	Millions of 2017 US$, per capita	Penn World Table (PWT 10.0)
urban	Population living in urban areas as a share of total population	Percentage	World Development Indicators (WDI)
pupteacher	Number of students per teacher	Number	World Development Indicators (WDI)
kofgi	Overall globalization index	0-100	KOF
depratio	Total dependency ratio (population<20 years old & 65+ over population aged 20-64)	Percentage	OECD Population Statistics

Table 2: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
EDU	1,258	10.67	1.68	4.65	13.94
LExp	1,240	77.24	3.67	62.10	84.20
HCI	1,174	59.92	7.72	35.52	78.81
SocExp_Tot	1,124	18.66	6.24	0	33.70
SocExp_Tot_nohp	1,096	13.53	5.17	0	27.50
SocExp_Hp	1,115	5.07	1.63	0	8.86
SocExp_Edu	877	5.06	1.23	0	8.56
SocExp_ALMP	1,101	0.51	0.44	0	2.68
SocExp_Fam	1,099	1.87	1.01	0	4.39
SocExp_Hou	1,051	0.32	0.33	0	1.72
SocExp_Inc	1,099	2.18	1.25	0	5.90
SocExp_Old	1,099	6.44	2.82	0	14.50
SocExp_Unem	1,058	0.91	0.82	0	4.64
SocExp_Surv	1,099	0.92	0.76	0	3.03
SocExp_Oth	1,095	0.47	0.48	0	3.61
gdppc	1,228	33909.64	15952.80	6981.53	92910.38
urban	1,258	75.05	11.09	45.30	98.00
pupteacher	778	16.87	6.34	8.14	39.93
kofgi	1,220	74.72	11.16	41.65	90.98
depratio	1,258	50.96	6.26	36.21	85.47

Notes: summary statistics computed for the dataset after with imputed values.

Although we include several control variables, to address one of the problems that afflict panel data models, omitted-variable bias that can result in endogeneity in the form of potential correlation between the regressors and the error term and thus inconsistent estimates, we use the fixed-effects method to estimate our empirical model described by equation (1), including country-specific characteristics that possibly determine the behaviour of inequality but remain constant over time (ϑ_i). Endogeneity may also exist due reverse causality as social expenditure (and other control variables) may also be influenced by human capital. To overcome to some extent this problem we considered the values of the explanatory variables lagged one period. Thus, we assume that human capital in the current period does not influence the explanatory variables in the previous period. Additionally, since considering fixed effects alone cannot correct for cross-sectional and time dependence, essential conditions to minimize the error term and make statistical inference valid, we also apply the correction proposed by Driscoll and Kraay (1998) that consists in recalculating the standard errors assuming the error structure to be heteroskedastic, autocorrelated up to some lag and possibly correlated between groups/panels, Hoechle (2007), making standard errors robust to general forms of cross-sectional and time dependence.

4. Results

In what follows we present and discuss the results of the estimation of equation (1) using different dependent variables, i.e. different ways of measuring human capital formation (Tables 3-5). We first consider total public social spending as an explanatory variable to account for the effect of the size of social expenditure on human capital formation. Since this variable is taken from the OECD SOCX and includes health spending, in the specifications that consider both total social expenditure and health expenditure as explanatory variables (columns 4 and 7 in Tables 3-5) total social expenditure excludes health spending. The first three columns in Tables 3-5 present the results of introducing social spending variables one at a time; columns 4 to 6 introduce two by two combinations of social spending variables; and column 7 includes all social spending variables at the same time.

Table 3 presents the results of the estimation of the equation (1) considering educational human capital as the dependent variable. The results point to a positive association between total public social spending and average years of schooling but the respective estimated coefficient is only statistically significant when total social expenditure is introduced alone (not with other measures of public social spending). The estimated coefficient for public spending on education is never statistically significant. On the contrary, the estimated coefficient for public spending on health is always positive and in some cases statistically significant. According to these findings, it is possible to conclude that for OECD countries the impact of total public social spending and public health spending are more important for the formation of educational human capital than public education spending. This indicates that creating an appropriate overall social and health support net through social and health spending provides an incentive for families to keep their children in formal education. In other words, guaranteeing better social and health conditions surrounding the schooling environment seems to produce a more important impact on educational human capital than direct financing of the education system. It could also be an indication of the lack of efficiency in spending the resources available to schools. As for the control variables, the pupil-teacher ratio has always a negative and statistically significant impact on educational human capital confirming that a good learning environment requires that teachers can concentrate on the specific needs of their students, which can only happen in small classes. On the contrary, real GDP per capita exerts a negative influence, contrary to predictions. The other control variables that, in some cases, reveal an association with educational human capital are urbanisation and globalisation, with the evidence found suggesting that they constitute a disincentive to investing in education, contradicting also our initial expectations. The association between the dependency ratio and educational human capital and is not statistically different from zero.

Table 3: Results for the educational human capital regression

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Total spending	0.352**			0.180	0.340		0.190
	(0.162)			(0.118)	(0.278)		(0.190)
Education spending			-0.047		-0.155	-0.207	-0.240
			(0.172)		(0.270)	(0.264)	(0.286)
Health spending		0.287**		0.159		0.347*	0.270
		(0.106)		(0.108)		(0.202)	(0.161)
lgdppc	-0.685***	-0.787***	-0.675***	-0.716***	-0.667***	-0.769***	-0.698***
	(0.171)	(0.146)	(0.175)	(0.155)	(0.228)	(0.208)	(0.221)
lurban	-0.819*	-0.504	-1.100*	-0.630	-1.463**	-1.276**	-1.278**
	(0.443)	(0.364)	(0.627)	(0.407)	(0.551)	(0.515)	(0.533)
pupteacher	-0.045***	-0.043***	-0.032**	-0.045***	-0.053***	-0.046***	-0.051***
	(0.010)	(0.009)	(0.013)	(0.009)	(0.013)	(0.011)	(0.013)
kofgi	-0.022***	-0.013**	-0.007	-0.017**	-0.015*	-0.007	-0.011
	(0.008)	(0.006)	(0.005)	(0.008)	(0.008)	(0.004)	(0.008)
depratio	-0.001	-0.004	-0.009	-0.003	0.000	0.000	0.001
	(0.006)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)
Observations	698	702	609	693	567	570	562
Number of groups	37	37	37	37	37	37	37
P-value for joint F-test	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Within R-squared	0.821	0.823	0.816	0.820	0.801	0.808	0.802

Notes: All regressions include time dummies. The explanatory variables are introduced in logs. Columns 1-3 include spending variables one at a time; columns 4-6 include spending variables introduced in combinations of two; column 7 includes all spending variables simultaneously. Total spending does not include health spending in the regressions when the two variables are introduced together (columns 4 and 7). Standard errors in parentheses calculated using the Driscoll and Kraay (1998) methodology to account for heteroscedasticity and autocorrelation. * p<0.10, ** p<0.05, *** p<0.01

According to the results for the health human capital regression presented in Table 4, total public social spending presents a positive and statistically significant association with health human capital in all specifications, with the exception of column (7) when it is not statistically significant. Contrary to expectations, education spending presents a negative and statistically significant association with life expectancy at birth in columns (6) and (7). The estimated coefficient for health spending is always positive and statistically significant. These findings suggest that to raise the health status of the population governments should increase spending on health, maybe reallocating resources from the schooling system. Regarding the control variables, we observe some regularities across specifications: the level of development proxied by real GDP per capita promotes the formation of health human capital and the same applies to urbanisation and the dependency ratio. As countries develop and population ages they tend to spend more on healthcare. Urban areas also facilitate access to the healthcare system. The association between health human capital and globalisation or the pupil-teacher ratio is in most cases not statistically different from zero.

Table 4: Results for the health human capital regression

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Total spending	0.029***			0.014**	0.024***		0.008
	(0.005)			(0.006)	(0.005)		(0.005)
Education spending			0.003		-0.008	-0.010***	-0.013***
			(0.003)		(0.005)	(0.004)	(0.004)
Health spending		0.029***		0.019***		0.026***	0.023***
		(0.004)		(0.005)		(0.003)	(0.006)
lgdppc	0.049***	0.042***	0.032***	0.047***	0.034***	0.029***	0.031***
	(0.008)	(0.007)	(0.006)	(0.008)	(0.006)	(0.005)	(0.007)
lurban	0.048***	0.072***	0.024**	0.056***	0.008	0.026***	0.021**
	(0.008)	(0.014)	(0.010)	(0.008)	(0.009)	(0.007)	(0.008)
pupteacher	-0.000	0.000	0.000	0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
kofgi	-0.000**	0.000	0.001***	-0.000	-0.000	0.000***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
depratio	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	693	697	603	688	562	565	557
Number of groups	37	37	37	37	37	37	37
P-value for joint F-test	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Within R-squared	0.937	0.935	0.938	0.938	0.943	0.946	0.946

Notes: All regressions include time dummies. The explanatory variables are introduced in logs. Columns 1-3 include spending variables one at a time; columns 4-6 include spending variables introduced in combinations of two; column 7 includes all spending variables simultaneously. Total spending does not include health spending in the regressions when the two variables are introduced together (columns 4 and 7). Standard errors in parentheses calculated using the Driscoll and Kraay (1998) methodology to account for heteroscedasticity and autocorrelation. * p<0.10, ** p<0.05, *** p<0.01

Table 5 contains the results of the estimation of the regression that considers the human capital index as the dependent variable. The estimated coefficient for total public social spending is positive but statistically significant only in columns (1) and (5). Including education spending in the regressions produces an indirect impact on the results for health spending in the sense that the respective effect becomes quantitatively more important relative to the regression when health spending is considered alone. However, education spending is never statistically significant. In the case of public health spending, the results show a positive and statistically significant association with the HCI. These results suggest that to increase HCI governments should increase health spending and possibly reallocate resources from education spending. The results for the control variables mainly confirm the ones obtained in Tables 3 and 4 when considering each type of human capital separately, showing a (almost always) positive and statistically significant influence of the dependency ratio, reflecting in this case the influence through health human capital formation. The influence of the pupil-teacher ratio is always negative, reflecting its influence through educational human capital. Urbanisation and globalisation show a positive association, statistically significant in some specifications, reflecting their influence through health human capital. On the contrary, the association between real GDP per capita and the HCI is always negative and in some specifications statistically significant, reflecting the results obtained with educational human capital.

Table 5: Results for the human capital index regression

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Total spending	0.039***			0.005	0.041**		0.009
	(0.010)			(0.009)	(0.015)		(0.012)
Education spending			0.001		-0.012	-0.020	-0.024
			(0.010)		(0.013)	(0.014)	(0.015)
Health spending		0.044***		0.040***		0.051***	0.049***
		(0.008)		(0.009)		(0.012)	(0.011)
lgdppc	-0.006	-0.018*	-0.016	-0.015	-0.013	-0.028**	-0.026*
	(0.011)	(0.010)	(0.014)	(0.010)	(0.015)	(0.014)	(0.014)
lurban	0.107*	0.138***	0.115	0.133***	0.062	0.089	0.083
	(0.061)	(0.047)	(0.078)	(0.045)	(0.070)	(0.053)	(0.056)
pupteacher	-0.002*	-0.001*	-0.001	-0.002*	-0.003**	-0.002**	-0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
kofgi	0.000	0.001	0.002***	0.001	0.001	0.001**	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
depratio	0.001**	0.001**	0.001	0.001**	0.001**	0.001**	0.001**
	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Observations	646	650	563	641	521	524	516
Number of groups	37	37	37	37	37	37	37
P-value for joint F-test	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Within R-squared	0.836	0.838	0.828	0.834	0.815	0.822	0.816

Notes: All regressions include time dummies. The explanatory variables are introduced in logs. Columns 1-3 include spending variables one at a time; columns 4-6 include spending variables introduced in combinations of two; column 7 includes all spending variables simultaneously. Total spending does not include health spending in the regressions when the two variables are introduced together (columns 4 and 7). Standard errors in parentheses calculated using the Driscoll and Kraay (1998) methodology to account for heteroscedasticity and autocorrelation. * p<0.10, ** p<0.05, *** p<0.01

Table 6 presents a summary of the results obtained when considering in the equations with the different human capital measures as dependent variable the other components of public social spending besides health and education spending, taken from the OECD SOCX and included one at a time. Taking broad picture: (i) the statistically significant lagged social spending variables are also positively associated with the different measures of human capital; (ii) health human capital regression presents the highest number of statistically significant components of social spending (6 out of 8). Additionally, spending on old age pensions is in most cases the quantitatively most important social spending component. Overall, these results suggest that most types of social spending are important for health human capital formation, not just direct spending on healthcare, although the quantitative importance varies, which should be taken into account by governments. For educational human capital, old age spending is especially important suggesting that indexing pensions to wages, which in turn depend on human capital, provides an incentive for investing in formal education. However, population ageing is forcing countries to redesign the respective pensions system and so this incentive may become less important. The last set of coefficients, which relates social public components to the human capital index, does not provide much information since most components are not statistically significant. In any case, the results suggest a positive relationship with housing spending and other social policy areas.

Table 6: Summary of the results considering social expenditure composition

	Equation 1 - Education	Equation 2 - Health	Equation 3 - Human capital index
ALMP	-0.035	0.396**	0.004
	(0.037)	(0.169)	(0.004)
Family	0.031	-0.085	0.008
	(0.062)	(0.158)	(0.005)
House	0.021	0.143***	0.004*
	(0.031)	(0.044)	(0.002)
Incapacity	-0.032	1.146***	0.006
	(0.069)	(0.198)	(0.005)
Old age	0.331*	0.601***	0.018
	(0.166)	(0.123)	(0.012)
Survivors	0.057	0.470***	0.003
	(0.040)	(0.114)	(0.002)
Unemployment	-0.000	0.274***	0.000
	(0.033)	(0.060)	(0.003)
Other	0.021	0.131	0.006***
	(0.028)	(0.086)	(0.002)

Notes: All regressions include time dummies. Standard errors in parentheses calculated using the Driscoll and Kraay (1998) methodology to account for heteroscedasticity and autocorrelation. * p<0.10, ** p<0.05, *** p<0.01

5. Conclusion

In this study we have shown the existence of a positive association between social spending and human capital formation for a sample of 37 OECD countries over 1985-2018. Differently from previous contributions, our study pays attention to the composition of social expenditure and different types of human capital, educational and health human capital. Our regressions allow for the investigation of a wider set of policies that contribute to the creation of an adequate environment for human capital formation, not limiting the analysis to spending on health and education, which are expected to have a direct impact on health and educational human capital, respectively. The OECD Social Expenditure database enables the study of how the relationship between social expenditure and human capital differs for nine types of social spending programs (including health spending), to which we add education.

This disaggregate analysis suggests that the association is stronger for health human capital, for which not only healthcare spending but also most other types of social spending matter. Contrary to our initial expectations, education spending has a zero impact on educational human capital, a result that signals possible efficiency issues in the use of the resources devoted to the schooling system. However, old age spending show a positive and strong association with educational human capital, and also with health human capital, suggesting that individuals may decide to invest more on themselves if they feel that, at the end of their career, they will receive higher pensions. Additionally, when considering our composite human capital index that includes both education and health indicators a positive and statistically significant association with other social policy and housing areas emerges, possibly reflecting the importance of providing basic living conditions to the poorer that allow them to keep their children at school

and take better care of their health. A somewhat puzzling result is the negative association between education spending and health human capital. Since we are analysing OECD countries with many already recording high levels of human capital this result suggests that policies that promote overall better living conditions (corresponding to other components of social spending) produce a bigger impact on human capital formation than education spending itself (that has a negative impact). This conclusion is strengthened when spending on education is analysed together with spending on health (in the human capital index equation), with the former leading to quantitatively more important effects of the latter. Overall, these results indicate that countries with already high levels of human capital should prioritise improving the social environment and the health status of the population to guarantee a sustained increase in human capital availability.

The former results are especially relevant given the current pandemic that is questioning the effectiveness of the healthcare system and eroding the role the educational system as promoter of human capital formation. The evidence found suggests that more attention must be paid to the design of social policy from the perspective of promoting human capital formation, aiming at the distribution of resources across different social policy intervention areas that is most effective (and efficient). Our results also encourage research that focus on a single country to track the dynamic interlinkages between the respective social expenditure and human capital levels accounting in a more robust way for country-specific characteristics. The lack of data with sufficient time coverage to allow for robust results precludes for now such analyses that must be left for future research. Another promising extension of this research pertains to the analysis of effects of social spending on human capital formation depending on the pre-existing human capital levels, i.e. the possibility of a non-linear relationship, which has not yet been explored in literature. Future research should also examine the role of social expenditure composition in the process of human capital formation at a lower level of disaggregation.

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