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HEALTHY, EDUCATED AND WEALTHY: IS THE WELFARE STATE REALLY HARMFUL FOR GROWTH?

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1. Introduction*

The Welfare State has been the object of several discussions and reform proposals among scholars and politicians in the last thirty years. Especially in Europe, political support towards the Welfare State has been reducing. Following a standard neoclassical approach, many authors have argued that a reduction of the weight of the Welfare State would stimulate economic growth (see for instance the critical discussion in Atkinson, 1999). A reason recently emphasised by the political economy literature to explain why the political climate has changed toward the Welfare State (e.g. Hassler et al., 2003) is based on the effects of skill biased technical change.[1] The resulting increase in wage inequality determines a political equilibrium characterised by social preferences towards a downsizing of redistributive policies.[2]

The standard neoclassical argument against an extended Welfare State is that distortionary taxes are needed to finance public intervention. Tax distortions discourage entrepreneurship and labour supply and, hence, they entail a negative effect on economic growth. Usually, this argument gains greater political support when public intervention is perceived as inefficient, so that the individuals' common belief is that everyone could be better off if the tax burden is reduced.

As Atkinson (1999) suggests, the above argument is somewhat distorted, since it stresses only a part of the whole story. In fact, together with distortionary taxes, the Welfare State implies *productive* public expenditure that might reasonably have a positive impact on the accumulation of human capital and, hence, on economic growth. Of course, not all public interventions traditionally included in the definition of the Welfare State have a positive impact on human capital accumulation. Nevertheless, it is possible to argue that at least the provision of health and education have such an impact. By considering both the loss deriving from distortionary taxation and the benefits

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[1] Hassler et al. (2003) make predictions about the effects of technology driven changes in wage inequality. For instance, if there is an unexpected permanent increase in the skill premium, agents are likely to increase their investment in education and a larger proportion will, ex post, be opposed to redistributional policies. "Thus, the initial impact of technological inequality is magnified by reduced support for the Welfare State".

[2] Lindbeck et al. (1999) propose an alternative positive model that explains how social preferences toward Welfare State are influenced by income distribution and social norms.

caused by *productive* public expenditure, it is not theoretically obvious what is the overall effect of the Welfare State on economic growth.

From a theoretical standpoint, the above mentioned arguments in favour or against the Welfare State are not exhaustive. For instance, Gintis and Bowles (1982) suggest that both the human capital approach and the standard neoclassical argument do not take into account the institutional aspects related to the Welfare State. In their perspective, the existence of the Welfare State guarantees positive and productive relations between capital and labour, therefore, creating an economic and social environment in which private investments are stimulated. This argument is related to the concept of "social capital". Knack and Keefer (1997) define social capital as the set of "authority relations, relations of trust, and consensual allocations of rights which establish norms", arguing that "trust and norms of civic cooperation are essential to well functioning societies and to the economic progress of those societies". Knack and Keefer also show that there is a positive relationship between the level of social capital and economic growth, indirectly providing empirical support also to the argument of Gintis and Bowles (1982).

Both papers by Gintis and Bowles (1982) and by Knack and Keefer (1997) implicitly maintain the idea that a more equal distribution of resources favours economic growth (see also Putterman et al. 1998), an idea which has recently gained empirical support. Both Persson and Tabellini (1994) and Alesina and Rodrik (1994) provide empirical evidence to the argument that inequality is harmful for growth. The theoretical idea central to their papers is that a more unequal distribution of resources leads to policies that do not allow full private appropriation of returns from investments in human and physical capital and, therefore, leads to less accumulation of capital and less growth.

As it has been recently recognised, the public provision of goods such as health or education can be justified on redistributive grounds (e.g. Balestrino, 1999, for a survey), in addition to the standard textbook argument which build on the presence of positive externalities produced by health or education consumption. Recently, Herbertsson (2003) presents empirical support for positive externalities on economic growth produced by investing in public education.

The puzzling result we are left with is that, by considering all the above arguments, the overall effect of the Welfare State on economic performance remain an empirical matter. In fact, several papers focusing on public expenditure asked this question and found mixed results (e.g. Devarajan et al., 1996; Kneller et al., 1999; Zagler and

Dürnecker, 2003). Quite surprisingly, a point that has not been considered yet in the literature is that reducing public intervention would probably imply an higher allocation of these goods through private markets. However, it is not at all evident which impact this could have on the accumulation of human capital and, hence, on economic growth. In fact, substituting public with private provision might entail a *level* of expenditure and a *distribution* of consumption of health and education sub-optimal from the social point of view and, hence, a different effect on the accumulation of human capital.

In this paper, we study how public and private expenditure in health and education affect economic growth. We build a dataset including both types of expenditure in health and education, and consider a growth accounting framework to highlight how both education and health investments might be relevant for growth through their effects on human capital. The aim of the paper is to explore an issue which is at the core of the theoretical and political debate around the Welfare State: are the effects of public expenditure on economic growth different from those of private expenditure? Is the total (public and private) expenditure in education and health that really matters for growth?

Our empirical analysis is based on a panel of 19 OECD countries observed from 1971 to 1998. Preliminary results show that public and private expenditure have a different impact on economic growth. In particular, we find that public expenditure in health is more effective than private expenditure in increasing human capital and, hence, economic growth. On the contrary, we do not get clearcut results as the effect of expenditure in education is concerned.

The remainder of the paper is organised as follows. In section 2, we review the empirical literature on the relationship between the accumulation of human capital and growth. We distinguish between two widely used alternative methodologies, one based on a structural growth model and the other based on a growth accounting framework. In section 3, we describe our empirical approach, while section 4 is devoted to describing our data and our preliminary results. Section 5 briefly concludes discussing some possible extensions to our results.

2. Linking Human Capital and Growth

There are at least two different methodologies to estimate the contribution of human capital to economic growth. The first one - introduced in the seminal paper by Mankiw et al. (1992) - is based on an equation which links the level (or the variation) of the aggregate product to the steady state values of human capital. Instead, the second methodology is based on a growth accounting equation (e.g. Barro, 1998, for a general discussion). In this section, we review the main features of these two methodologies, analysing some empirical contributions based on them. In particular, we describe the proxy variables used to measure human capital and their main results.

2.1. A Structural Growth Model

For the purposes of this section, let us consider an aggregate production function of the following general form:

$$Y(t) = F\left[K(t), L(t), HC(t), A(t)\right] \quad (1)$$

where Y is the aggregate income, K is physical capital, L is labour, HC is human capital, and A represents the level of technology.

Mankiw et al. (1992) propose a particular functional form for Eq. (1). They specify Eq. (1) as the following Cobb-Douglas production function:

$$Y(t) = K(t)^{\alpha} HC(t)^{\beta} \left[L(t)A(t)\right]^{1-\alpha-\beta} \quad (2)$$

They assume that the accumulation of *per capita* physical and human capital can be described by means of the successive pair of equations:

$$\dot{k}(t) = s_k y(t) - (n + g + \delta)k(t) \quad (3)$$

$$\dot{hc}(t) = s_{hc} y(t) - (n + g + \delta)hc(t) \quad (4)$$

where lower case letters indicate per capita values, s_k and s_{hc} are the fractions of income invested in physical and human capital respectively, n and g are the exogenously given rate of growth of the labour force and the technology, and δ is the depreciation rate (equal for physical and human capital).

From Eq. (3) and (4), steady state values of per capita physical (k^*) and human capital (hc^*) can be easily calculated. By transforming Eq. (2) in per capita terms and by substituting those values, we get an equation which links the level of income per capita to k^* and hc^*, that can be estimated with standard regression methods:

$$\ln y(t) = \beta_0 + \beta_1 \ln(s_k) - \beta_2 \ln(n + g + \delta) + \beta_3 \ln(hc^*) + \varepsilon \qquad (5)$$

where ε is a standard error term and all the other variables are defined as before.

Note that by considering the approximation around the steady state of the speed of convergence, the equation in levels can be transformed into an equation in differences.

Of course, the problem Mankiw et al. (1992) are left with is how to measure human capital. They focus only on the investment in education, explicitly ignoring the investment in health, and use a proxy for the rate of accumulation of human capital which measures the percentage of the working age population enrolled in secondary school. As the authors point out, this variable bears some weaknesses, since it does not include the input of teachers and it completely ignores primary and higher education.

Grounding on the methodology provided by Mankiw et al. (1992), Knowles and Owen (1997) and Webber (2002) study the joint effect of health and education on the accumulation of human capital. In particular, Knowles and Owen (1997) use life expectancy as a proxy for the health status, and the average numbers of years of schooling attained by the population aged over 25 as a proxy for education achievement. Webber (2002) proxies education with three different measures, namely the percentage of the relevant population enrolled in the primary, secondary and higher school, and uses an index of under-nutrition based on calories intake (provided by the United Nations) as a proxy for the health status. In other words, these two papers make explicit the idea that human capital is a function of the health status and the education attainment.

Note, as Wößmann (2003) has recently pointed out, that the most commonly used measures of human capital are inevitably imperfect and (more importantly) linked to data availability. In this respect, the choice of one measure rather than another might bring to different results as the impact of human capital accumulation on economic growth is concerned.

The results on the link between human capital accumulation and economic growth are generally mixed. Mankiw et al. (1992), considering a cross-section of 121 countries, both developed and under-developed, find that the proxy for human capital (namely education) shows a positive and statistically significant impact on both the level and the variation of per capita income. Knowles and Owen (1997), using a cross-section of 77 countries selected from those considered by Mankiw et al. (1992), find a strong positive relation between health status and economic growth, whereas the relation between economic growth and education is found to be not significant. By contrast, Webber (2002) finds that education is consistently more important than health in stimulating economic growth in a cross-section of 46 countries, of which 26 are classified by the World Bank as low- or middle-income countries.

2.2. The Growth Accounting Framework

Studies based on the growth accounting framework also consider as a starting point an aggregate production function of the type described in Eq. (1). Following Barro (1998), time differentiation of Eq. (1) implies that:[3]

$$\frac{\Delta Y}{Y} = \left(\frac{\partial F}{\partial K}\frac{K}{Y}\right)\frac{\Delta K}{K} + \left(\frac{\partial F}{\partial L}\frac{L}{Y}\right)\frac{\Delta L}{L} + \left(\frac{\partial F}{\partial HC}\frac{HC}{Y}\right)\frac{\Delta HC}{HC} + \left(\frac{\partial F}{\partial A}\frac{A}{Y}\right)\frac{\Delta A}{A} \qquad (6)$$

To simplify notation, let *a* be the last term of Eq. (6). It is straightforward to write the rate of growth of technology as:

$$a = \frac{\Delta Y}{Y} - \left(\frac{\partial F}{\partial K}\frac{K}{Y}\right)\frac{\Delta K}{K} - \left(\frac{\partial F}{\partial L}\frac{L}{Y}\right)\frac{\Delta L}{L} - \left(\frac{\partial F}{\partial HC}\frac{HC}{Y}\right)\frac{\Delta HC}{HC} \qquad (7)$$

By assuming that the production factors are paid their marginal productivity, from Eq. (7) we get:

$$a = \frac{\Delta Y}{Y} - S_K\frac{\Delta K}{K} - S_L\frac{\Delta L}{L} - S_{HC}\frac{\Delta HC}{HC} \qquad (8)$$

where S_K, S_L and S_{HC} represent the factor shares.[4]

There are two ways to bring Eq. (8) to the data. The first is the traditional method based on the *observed* factor shares; the second is based on regression methods. In this latter case, the factor shares represent the coefficients to be estimated.

[3] Given the assumption of a Hicksian neutral technology, the last term of Eq. (6) reduces to $\Delta A/A$.

[4] We are implicitly assuming that all the factor shares are observable. This assumption is relaxed in the following section.

For instance, by using the regression method, Bloom et al. (2001) model human capital by means of a nonlinear combination of three terms: schooling (measured as the average total years of schooling of the population aged 15 years and older), aggregate work experience (measured as the amount of time spent in the labour force), and health (proxied by life expectancy). On the other hand, Herbertsson (2003) considers the traditional method. The proxy for the factor share that remunerates human capital is obtained by the estimation of a structural model, in which the externality produced by public spending in education affects human capital with a certain lag.

As before, the results are somewhat mixed. Bloom et al. (2001), using data for a panel of countries from the Penn World Tables, find a positive impact of health on economic growth, whereas they find no clearcut results for schooling and experience. Herbertsson (2003), considering data for five Nordic European countries, finds that human capital contributes between 12 and 33% to explain economic growth.

3. The Methodology

In this section we describe our empirical methodology. The key point we want to stress is that human capital is a function of *total* expenditure in health and education. Previous contributions generally consider only public expenditure as a determinant of human capital, or consider either expenditure in health or expenditure in education (e.g. Barro e Sala-i-Martin, 1995; Barro and Lee, 1996; Herbertsson, 2003). Differently from these approaches, we consider *both* public and private expenditure. To the best of our knowledge, this point has never been considered before in the debate on the Welfare State and its reform.

Whenever public intervention is reduced, the provision of goods such as health and education through private markets is likely to increase (at least in the more developed countries). This is an important point to stress since there could be differences between public and private spending in terms of human capital accumulation and, hence, on economic growth. The differences between the two types of expenditure are likely to be linked to the fact that public intervention takes into account the presence of positive externalities in consumption of health and education, whereas private provision typically do not. Moreover, since the distribution of consumption of these goods among individuals would be different with private provision, there could be a significant divergence in the impact on human capital accumulation also for redistributive reasons.

For these two rationales, we believe that is important in the perspective of the debate on the Welfare State to study whether the effects of public and private intervention are any different.

For our purposes, we model human capital as a function of both public and private expenditure in health and education:

$$HC = f\left(HE^{pu}, HE^{pr}, E^{pu}, E^{pr} \mid I\right) \qquad (9)$$

where *HE* and *E* are expenditure in health and in education respectively, *pu* and *pr* are mnemonic for public and private, and *I* represents the institutional features which can be relevant to explain differences in *quality* and *efficiency* of these two types of expenditure (for instance, whether such goods are provided at the central or at the local level, or whether there exists competition between public and private suppliers). Of course, like all the other proxies for human capital, our measures are subject to criticism. For instance, as expenditure in education is concerned, Wößmann (2003) argues that "such measures of educational inputs are not strongly and consistently linked to cognitive skills, rendering them a poor proxy for educational quality". However, Gupta et al. (2002), by considering only public expenditure in 50 developing and transition countries, provide "evidence supporting the proposition that increased public spending on education and health care matter for education attainment and health status". Moreover, given our aim, this is the only measure available to compare the impact of public and private provision of education and health.

To study the impact of human capital accumulation on economic growth, we log-differentiate Eq. (1) obtaining:

$$\Delta \ln Y = S_K \Delta \ln K + S_L \Delta \ln L + S_{HC} \Delta \ln HC + S_A \Delta \ln A \qquad (10)$$

where all the variables are defined as before. Note that neither S_{HC} nor S_A are observable, therefore, we cannot measure *directly* the contribution of human capital and technology to output because they cannot be separated from the contributions of physical capital and labour. The reason is that the *observed* factor shares of physical capital and labour do include also the remuneration of human capital and technology (see Besley, 2001). Following this rationale, Eq. (10) can be rewritten as:

$$\Delta \ln Y = \sigma_K (\Delta \ln K + \Delta \ln HC + \Delta \ln A) + \sigma_L (\Delta \ln L + \Delta \ln HC + \Delta \ln A) \qquad (11)$$

where σ_K and σ_L are the *observed* factor shares of physical capital and labour respectively.

Under the assumption of constant returns to scale, Eq. (11) can be reduced to:

$$\Delta \ln Y = \sigma_K \Delta \ln K + \sigma_L \Delta \ln L + \Delta \ln HC + \Delta \ln A \qquad (12)$$

Eq. (12) shows that Total Factor Productivity (TFP, hereafter) can be decomposed in two components, one related to pure technological change, the other related to human capital accumulation.

Substituting our definition of human capital given in Eq. (9) into Eq. (12), we obtain:

$$\begin{aligned}\Delta \ln Y = \sigma_K \Delta \ln K + \sigma_L \Delta \ln L + \Delta \ln HE^{pu} + \Delta \ln HE^{pr} + \\ + \Delta \ln E^{pu} + \Delta \ln E^{pr} + \Delta \ln A\end{aligned} \qquad (13)$$

4. The Empirical Analysis

In this section we present our empirical analysis. The main problem we face here is the lack of data for private expenditure in education. Therefore, we start considering only public and private expenditure in health and test our main proposition by using a sample of 19 OECD countries observed from 1971 to 1998. Next, we augment our basic estimation by adding also public expenditure in education. Finally, we also include private expenditure in education; this implies the use of a reduced sample of 14 countries observed only from 1990 to 1996.[5]

Starting from Eq. (13), our general empirical specification can be written as:

$$\begin{aligned}\Delta \ln Y_{it} = \beta_1 \Delta \ln K_{it} + \beta_2 \Delta \ln L_{it} + \beta_3 \Delta \ln\left(HE^{pu}\right)_{it} + \beta_4 \Delta \ln\left(HE^{pr}\right)_{it} + \\ + \beta_5 \Delta \ln\left(E^{pu}\right)_{it} + \beta_6 \Delta \ln\left(E^{pr}\right)_{it} + \lambda_i + \phi_t + \varepsilon_{it}\end{aligned} \qquad (14)$$

where λ_i and ϕ_t are country and time fixed effects, respectively. Finally, ε_{it} represents a standard error term. Note that λ_i and ϕ_t pick up not only differences in technology, but also the institutional differences outlined above.

[5] See notes on tables for a description of the countries used in the estimations.

4.1. The Data

To empirically estimate Eq. (14), we use annual data on a per capita basis from a sample of 19 OECD countries covering the period 1971-1998.[6] Data on macroeconomic variables come from the Penn World Tables 6.1, and include data on population, real GDP per capita at constant prices[7] (GDP, hereafter) and the investment share of GDP. The labour force in each country has been obtained from OECD Health Data (2002). Moreover, following Bloom et al. (2001), we have constructed a measure of private capital stock for each country using a perpetual inventory method. We initialize the capital stock series with investment data in 1971, setting the capital stock equal to the average investment/GDP ratio in the first five years of data, multiplied by the level of GDP in the initializing period, and divided by our assumed depreciation rate (0.07). Each succeeding period's capital stock is calculated using current capital plus the level of current investment minus the 7% depreciation rate of the current stock.

We measure health expenditure using data on public and private spending in health per capita (expressed in international purchasing power parity dollars) from the OECD Health Data (2002).

Similarly, we measure education expenditure using data on public and private spending in education per capita. However, data on education spending are difficult to obtain for a long time span. For public expenditure in education we use two data sources: data published by UNESCO and data from the World Bank database. This allows us to check the robustness of the effect of public spending in education on growth (see tables 2 and 3). Finally, data on private spending in education (covering all levels of education) are from OECD *Education at a Glance*.

Note that due to data availability the regressions including education spending have been performed for a shorter time span and a reduced sample of countries. This is the reason why we perform first the estimations with the health variables, for which we have a larger sample and, afterwards, we introduce the variables regarding spending in education.

[6]Due to data availability, especially in the education data, we have selected a sample of OECD countries for which we could obtain annual series of the variables used in this work.
[7] Constant prices values of GDP are calculated using a Laspeyres index.

4.2. Estimation Technique

The technological shocks implied in our theoretical models can include, at least in theory, temporal and transversal variation. However, it is very difficult to quantify it for the sample of countries we use in the empirical estimation. Omitting this variation from the regressions has negative effects on the quality of the estimates: if this variable is correlated with the explanatory variables included, then there is no guarantee of consistent estimated parameters. Moreover, even when there is no correlation the estimation will gain in efficiency if these effects can be accounted for. Panel data techniques allows us to deal in an adequate way with this problem through the specification of our technological shock as a combination of a temporal effect (constant among countries), an individual effect (different for each country but constant for the time span of our sample), and a specific error term (ε_{it}):

$$lnA_{it} = \lambda_i + \phi_t + \varepsilon_{it} \qquad (15)$$

The time effect, ϕ_t, picks up all those influences on the output growth rate common to all countries in a given year (for instance the economic cycle), while the individual effect, λ_i, picks up the influences specific to each country (for instance, social, religious, climate or geographical factors). This individual factor do not account for the intrinsic effect on the level of production of each country but on its growth rate. The individual effects on the level of the series (maybe more important than the existent in the growth rates series) have been eliminated when differentiating the series to compute the output growth rate.

There are two possible methods to estimate a specification with a disturbance term as presented in (15). These methods consist in treating the time and individual effects as fixed (and include them as regressors), or consider them as part of the error term and, therefore, consider them as random. The choice between the fixed effects model (FEM, hereafter) and the random effects model (REM, hereafter) depends on the existence of correlation between the individual effects and the variables included in the model. When this correlation is present, the estimation of the REM does not give us consistent estimators of the coefficients; consistency is only guaranteed with the FEM. Instead, when this correlation is absent, the REM allows us to obtain efficient estimates. Both specifications of the error term can be estimated in two cases: the so-called 1-way and 2-way error component regression model (for more details see, Baltagi, 1995). In the 1-way case, the error term has the following specification:

$$lnA_{it} = \lambda_i + \varepsilon_{it} \quad (15a)$$

where in the FEM λ_i is the unobservable individual effect, while in the REM case is assumed to be IID (0, σ^2_λ). In the 2-way case, the error term is as presented in (15). In this case, the FEM case ϕ_t is the unobservable time effect, while in the REM case is assumed to be IID (0, σ^2_ϕ). In both cases ε_{it} IID (0, σ^2). Therefore, in the FEM case λ_i and ϕ_t are assumed to be fixed parameters to be estimated and the remainder disturbances stochastic, while in the REM case all the components of the error term are considered random variables that are independent of the regressors included.

We estimate, in a first approximation, Eq. (14) using OLS (or pooled estimator) and panel data techniques for both the FEM and the REM specifications of the error term; we then use different test statistics to determine the more appropriate model, which is the one finally reported in tables 1 to 3. First, a Wald test of joint significance is performed specially for the FEM (LSDV)[8] estimation, i.e. we test if the individual and/or time dummies are jointly significant. Second, we use the Breusch-Pagan's Lagrange Multiplier (B-P, hereafter) statistic for testing the FEM and the REM against the OLS (or pooled estimation).[9] Third, a Hausman (1978) test, which null hypothesis is the absence of correlation between the time and/or individual effects and the variables included in the estimated equation, allows us to choose between the FEM and the REM. High values of the Hausman statistic tends to reject the null hypothesis, indicating that the FEM model is the more adequate.

4.3 Results

Table 1 collects our estimates when considering only expenditure in health. The Breusch-Pagan and the Hausman test indicate that the 2-ways FEM estimation is the preferred model. Moreover, the Wald tests for the joint significance of the dummy variables indicate that both the individual and the time effects must be considered in the empirical estimation of the model. As expected, all coefficients are positive and statistically significant. In column *I*, coefficient on *total* health expenditure is 0.027. In column *II*, we test whether coefficients associated with public and private expenditure differ. Results show that the coefficients on public and private expenditure on health have a different magnitude; in particular, the coefficient associated with public

[8] Least Squares Dummy Variable.
[9] The null hypothesis of the B-P test is that the variance of the error term of the OLS residuals is constant. Therefore, it serves to test if panel data (either the FEM or the REM) is more appropriate than the OLS.

expenditure is signifcantly greater than that on private expenditure. Columns *III* and *IV* suggest that these coefficients are robust and well identified.[10]

Table 1. Production Function in Growth Form.
Health Spending (Public and Private)
Dependent Variable: Growth Rate of GDP; 2-ways FEM using LSDV

Variables	**(*I*)**	**(*II*)**	**(*III*)**	**(*IV*)**
Constant	-0.0881 (-7.38)***	-0.0878 (-7.46)***	-0.0871 (-7.21)***	-0.869 (-7.44)***
Capital	0.5489 (11.7)***	0.5552 (12.1)***	0.5529 (11.8)***	0.5570 (12.4)***
Labour	0.1733 (4.27)***	0.1689 (4.10)***	0.1699 (4.19)***	0.1686 (4.08)***
HE^{tot}	0.0269 (2.43)**	--.--	--.--	--.--
HE^{pu}	--.--	0.0096 (2.00)**	0.0094 (2.08)**	--.--
HE^{pr}	--.--	0.0015 (5.13)***	--.--	0.0015 (5.14)***
N (Parameters)	492 (48)	489 (49)	492 (48)	489 (48)
R^2	0.5494	0.5492	0.5461	0.5471
B-P (*LM*)	337.48 [0.000]	330.04 [0.000]	337.48 [0.000]	334.9 [0.000]
Hausman	49.57 [0.000]	51.25 [0.000]	49.57 [0.000]	52.81 [0.000]
Wald (*Indiv.*)	1520 [0.000]	1388 [0.000]	1268 [0.000]	1217 [0.000]
Wald (*Time*)	2142 [0.000]	1862 [0.000]	1660 [0.000]	1553 [0.000]

Notes: *t*-values in parenthesis and *p*-values in brackets. *,** and *** indicate significance at 90, 95 and 99 percent level, respectively. Estimations performed with individual and time dummies (2-way FEM model). Results obtained using White robust standard errors. Sample of OECD countries used (19): Australia, Austria, Canada, Denmark, Finland, Germany, Iceland, Ireland, Japan, Luxemburg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, UK and US (the number of observations, *N*, differ because some series are unbalanced). Time span: 1971-1998. High values of the Breusch-Pagan (LM) test favour FEM/REM over the Pooled Estimator (OLS). High (low) values of the Hausman test favour FEM (REM).

Table 2 brings together our estimates when augmenting the first set of regressions by considering also public expenditure in education. While the coefficient on physical capital remains unaltered, the one on labour is reduced but it is still statistically significant. However, results show an increase in the magnitude of the coefficients on public and private expenditure in health; both coefficients remain statistically significant. Also the coefficient on public expenditure in education shows the expected sign and is statistically significant. According to these results, public expenditure on health seems to impact more than public expenditure on education on economic growth.

[10] As pointed out by Kneller et al. (1999), our estimates of public spending should suffer from a downward bias caused by the omission of distortionary taxation.

This result matches with the findings of Knowles and Owen (1997). The results are robust to the two variables of public spending on education used (UNESCO and World Bank), with an elasticity around 2-3%.

Table 2. Production Function in Growth Form.
Health Spending (Public and Private) and Public Education Spending
Dependent Variable: Growth Rate of GDP; 2-ways FEM using LSDV

Variables	**(*I*)**	**(*II*)**	**(*III*)**	**(*IV*)**
Constant	-0.0571 (-15.0)***	-0.0599 (-14.8)***	-0.0587 (-12.1)***	-0.0614 (-14.4)***
Capital	0.5675 (12.1)***	0.5635 (12.9)***	0.5645 (11.7)***	0.5620 (12.3)***
Labour	0.0563 (1.29)	0.0428 (0.926)	0.0708 (1.58)	0.0630 (1.32)
HE^{tot}	--.--	--.--	0.0800 (3.97)***	0.0946 (4.27)***
HE^{pu}	0.0558 (3.30)***	0.0737 (5.23)***	--.--	--.--
HE^{pr}	0.0105 (1.44)	0.0127 (1.72)*	--.--	--.--
E^{pu} (UNESCO)	0.0222 (2.17)**	--.--	0.0232 (2.34)**	--.--
E^{pu} (WB)	--.--	0.0306 (2.61)***	--.--	0.0308 (2.72)***
N (*Parameters*)	244 (36)	232 (36)	246 (35)	232 (35)
R^2	0.5325	0.5781	0.5330	0.5763
B-P (*LM*)	148.93 [0.000]	147.0 [0.000]	156.3 [0.000]	154.52 [0.000]
Hausman	3.86 [0.5698]	9.39 [0.094]	5.38 [0.250]	11.10 [0.025]
Wald (*Indiv.*)	2493 [0.000]	1998 [0.000]	1701 [0.000]	1388 [0.000]
Wald (*Time*)	1391 [0.000]	1347 [0.000]	6726 [0.000]	1166 [0.000]

Notes: *t*-values in parenthesis and *p*-values in brackets. *,** and *** indicate significance at 90, 95 and 99 percent level, respectively. Estimations performed with individual and time dummies (2-way FEM model). Results obtained using White robust standard errors. Sample of OECD countries used (16): Australia, Austria, Canada, Denmark, Finland, Ireland, Luxemburg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, UK and US (the number of observations, *N*, differ because some series are unbalanced). Time span: 1980-1996. High values of the Breusch-Pagan (LM) test favour FEM/REM over the Pooled Estimator (OLS). High (low) values of the Hausman test favour FEM (REM).

Finally, table 3 collects our results when further augmenting previous regressions by adding also private expenditure in education. A first problem to be emphasised is the difficulty in gathering the relevant data; this is a problem underlined also by Gupta et al. (2002) in their papers concerning developing and transition economies. The final sample consists only of 58 observations and the panel is still unbalanced.[11] This prevents us to take the results presented in table 3 very cautiously and interpreting them being aware of the drawbacks of the estimation performed. To gain degrees of freedom and because the time span is short in this estimation, we have opted to use the 1-way FEM estimation, using only individual fixed effects.

Table 3. Production Function in Growth Form.
Health (public and private) and Education (public and private) Spending
Dependent variable: growth rate of GDP; 1-way FEM model using LSDV

Variables	**(*I*)**	**(*II*)**	**(*III*)**	**(*IV*)**
Constant	0.0049 (0.345)	0.0084 (0.545)	0.0108 (0.898)	0.0151 (1.31)
Capital	0.4664 (1.81)*	0.3229 (1.52)	0.2857 (1.32)	0.2510 (1.27)
Labour	-0.1565 (-0.524)	0.0455 (0.161)	-0.0388 (-0.131)	0.0336 (0.108)
HE^{pu}	-0.0833 (-2.61)**	-0.0522 (-2.29)**	--.--	--.--
HE^{pr}	0.0007 (0.194)	0.0681 (0.668)	--.--	--.--
E^{pu} (UNESCO)	0.1844 (1.77)*	--.--	0.1368 (1.50)	--.--
E^{pu} (WB)	--.--	0.0473 (0.964)	--.--	0.0403 (0.886)
E^{pr}	0.0096 (1.78)*	0.0057 (1.42)	-0.0005 (-0.114)	0.0001 (0.022)
N (Parameters)	58 (20)	58 (19)	59 (18)	58 (17)
R^2	0.4649	0.4332	0.4183	0.3902
B-P (*LM*)	10.84 [0.004]	11.01 [0.004]	7.73 [0.020]	8.03 [0.018]
Hausman	3.79 [0.7055]	3.38 [0.7599]	7.91 [0.095]	2.11 [0.716]
Wald (*Indiv.*)	258.5 [0.000]	207.6 [0.000]	29.18 [0.010]	16.13 [0242]

Notes: *t*-values in parenthesis and *p*-values in brackets. *,** and *** indicate significance at 90, 95 and 99 percent level, respectively. Estimations performed with individual dummies (1-way FEM model). Results obtained using White robust standard errors. Sample of OECD countries used (14): Australia, Austria, Canada, Denmark, France, Hungary, Ireland, Italy, Korea, Netherlands, Portugal, Spain, Sweden and US (the number of observations, *N*, differ because some series are unbalanced). Time span: 1990-1996. High values of the Breusch-Pagan (LM) test favour FEM/REM over the Pooled Estimator (OLS). High (low) values of the Hausman test favour FEM (REM).

[11] We can further restrict our data base in order to obtain a more balanced panel, however, we lose observation. Taking a sample of 10 OECD countries (Australia, Austria, Canada, Denmark, France, Hungary, Ireland, Netherlands, Spain, Sweden and USA) for the period 1990-1995 we obtain, still with an unbalanced panel, similar results to those obtained in table 3.

A somewhat surprising result is that the coefficient on labour is negative (although not statistically significant) in two of the estimations (columns *I* and *III*), those that use data for public spending in education coming from the UNESCO database. The coefficient on labour can be due to the particular sample at hand: the time period included is from 1990 to 1996, when economies in developed countries were declining.

We obtain different results than in table 1 and 2 for the coefficient on public expenditure in health. In table 3 is negative and statistically significant at the usual confidence levels, while the one on private expenditure shows the expected sign and is not statistically significant. On the contrary, the coefficients associated with public and private expenditure in education are positive. Only in column *I* these estimates are significant; in this case, the elasticity of public expenditure in education is much higher than that of private spending in education. Results are substantially unchanged when eliminating health expenditure.

5. Preliminary Conclusions

In this paper we explore an issue almost neglected in the debate on the Welfare State, focusing on the problem of whether public and private expenditure in health and education have the same or a different effect on economic growth. The key idea behind our analysis is that public intervention is thought to solve two problems faced by private markets in providing goods such as health and education. The first one is related to the difference between social and private returns, stemming from the existence of positive externalities, which results in a sub-optimal level of consumption; the second one is related to the redistribution involved in public intervention.

Our empirical analysis is based on a sample of OECD countries. Preliminary results show that public and private expenditure have a different impact on economic growth. In particular, we find that public expenditure in health is more effective than private expenditure in increasing human capital and, hence, economic growth. On the contrary, we do not get clearcut results as the effect of expenditure in education is concerned; this is mainly due to the lack of data concerning private expenditure. Moreover, when comparing public expenditure in health and education, we find that the former is more effective than the latter, replicating the findings obtained by Knowles and Owen (1997).

It is important to stress that these are only preliminary results. For instance, we do not explicitly address the problem of institutional differences among countries, even if some of these effects might be included in the country dummies. Moreover, we do not control for potential problems of endogeneity of regressors, an issue faced by several papers on economic growth. Relatedly, we do not check for reverse causality. All these problems are left for future research.

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