UNIVERSITÀ DEGLI STUDI DI FERRARA
DIPARTIMENTO DI ECONOMIA ISTITUZIONI TERRITORIO
Corso Ercole I d'Este, 44 – 44100 Ferrara

Quaderno n. 11/2006

June 2006

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HEALTHY, EDUCATED AND WEALTHY: ARE ALL THE WELFARE STATE POLICIES REALLY HARMFUL FOR GROWTH?[*]

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Abstract In this paper, we study whether public and private expenditure in health and education affects economic growth via their influence on people's health, skills and knowledge. We consider a growth accounting framework in order to test whether countries which devote a larger amount of resources to the consumption of health and educational services experience higher growth rates; we also test whether the effects on economic growth of public expenditure in health and education differ from those of private expenditure. Our empirical analysis is based on a panel of 19 OECD countries observed between 1971 and 1998. The results are consistent with the hypothesis that health and education expenditure positively affects growth; the estimated impact is stronger for health than for education. More importantly, we find some evidence that public expenditure influences GDP growth more than private expenditure. This suggests the possible role of Welfare State policies in solving credit constraints problems at the individual level, stemming from investments in human capital formation.

Keywords: health, education, public and private expenditure, economic growth

JEL classification: H51, H52, I38, O47

[*] We wish to thank L. Becchetti, R. Cagliozzi, E. Fornero, A. de la Fuente, M. Grillo, C. Ornaghi, F. Revelli, D. Sonedda and all seminar participants at the 60th Congress of the International Institute of Public Finance (Bocconi University, Italy), the XV Conferenza Annuale SIEP (University of Pavia, Italy), the VII Encuentro de Economía Aplicada (University of Vigo, Spain), the 46a Riunione Scientifica Annuale SIE (University of Naples, Italy) for their useful comments. Usual disclaimer applies.

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1. Introduction

Welfare State policies have been the subject of several discussions and reform proposals among scholars and politicians over the last thirty years. Political support in favour of such policies has been declining recently, especially in Europe, where a great deal of resources are devoted to their funding. Following a standard neoclassical approach, many authors have argued that reducing the *size* of the Welfare State would stimulate economic growth. The usual argument is that distortionary taxes are needed to finance public intervention, which discourage entrepreneurship, capital and labour supply; and distortions are higher, the higher the tax rates. Unsurprisingly, this argument gains greater political support whenever public intervention is perceived as inefficient, so individuals' common belief is that everyone would be better off if the tax burden were reduced, and welfare services were obtained from private markets, or directly within the family[1].

However, as e.g. Atkinson (1995a, 1995b, 1999) and Lindert (2004) suggest, the ~~(~~above~~)~~ neoclassical argument is somewhat distorted, since it implicitly assumes that all categories of public expenditures are unproductive. On the contrary, together with distortionary taxes, the Welfare State makes also *productive* public expenditure available, that might plausibly have a positive effect on people's health, skills and knowledge and - through these channels - on economic growth. At least public expenditure in health and education should reasonably contribute to this end: a healthy and educated worker may be plausibly expected to be more productive than one who is uneducated and in poor health[2]. According to the last argument, the way welfare expenditure is allocated is crucial; furthermore, by considering both the losses arising from distortionary taxation and the benefits accruing to society through *productive* public expenditure~~s~~, the overall effect of the Welfare State on economic growth is not theoretically obvious.

[1] Another reason recently emphasised by the political economy literature to explain why the political climate has varied, focuses on the effects of skill biased technical change and the resulting increase in wage inequality, favouring the emergence of social preferences claiming for a downsizing of redistributive policies (e.g., Hassler *et al.*, 2003).

[2] As Streeten (1994) points out, "a well nourished healthy, educated, skilled, alert labour force is the most productive asset". However, from his perspective, societies should consume health and educational services *regardless of their effect on economic growth*: "... it is odd that Hondas, beer, and television sets are often accepted without questioning as final consumption goods, while nutrition, education, and health services have to be justified on grounds of productivity... The World Bank's 1993 Development Report on health has the sub-title "Investing in Health" as if good health had to show economic returns higher than the cost of capital. What if the returns to investment in health are zero?".

From a theoretical standpoint, the list of arguments just mentioned in favour or against the Welfare State is not even complete. 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 consequences related to the existence of the Welfare State. From their perspective, it guarantees (as a *social institution*) stable and peaceful relations between capital and labour; thus shaping an economic and social environment in which private investments are stimulated[3].

From the historical point of view, it is undeniable that the Welfare State has to be considered primarily as an extraordinarily powerful redistributive device, aimed at equalizing not only income, but also - and more importantly - opportunities. This is rarely mentioned. However, by allowing an easy access to the consumption of a wider range of goods, the Welfare State certainly reduces the *ex-ante* inequality in opportunities (and, presumably, the *ex-post* inequality in income), that credit and insurance markets' imperfections make enduring.

Given the likely impact on the distribution of resources, the effect of the Welfare State on economic performance needs therefore to be evaluated also in the light of the theoretical arguments claiming for a negative relationship between inequality and growth. Two strands of this literature are worth being identified. The first stresses the effects on growth of the political outcome generated by a given income distribution (see e.g. Perotti, 1992, Persson and Tabellini, 1994, and Alesina and Rodrik, 1994). Its basic claim is that the more the distribution is unequal, the more investments in human and physical capital are discouraged, since it becomes more likely that governments will be called to implement policies that reduce the possibility of obtaining the expected gains from such investments. The second strand of literature emphasises the role of imperfections in capital markets in influencing individual investment decisions in physical and human capital (see e.g. surveys by Putterman *et al.,* 1998, and Aghion *et al.*, 1999). Its basic suggestion is that shortage of resources *at the individual level*, coupled with the presence of credit constraints, originates forgone investment opportunities[4].

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[3] As Gintis and Bowles (1982) point out, "the alternative to the Welfare State is … not simply less redistribution, but includes possible institutional transformation. The possible patterns of economic evolution consistent with the no-welfare-state option … include chaos, stagnation, and the development of new and perhaps unprecedented economic systems".

[4] It is plausible to believe, however, that over a certain threshold the theoretical arguments supporting the existence of a positive relationship between a less dispersed distribution of income and economic growth are not applicable. The reason has been put forward in extraordinarily clear terms by Lindbeck (1997): when the public intervention becomes excessively pervasive, "many individuals are then likely to start regarding the distribution of income as *arbitrarily* determined in the political process, rather than as fulfilling important functions for the allocation of resources and economic efficiency… As a

The discussion above makes clear that the development of the theoretical debate around the Welfare State is such as to leave one observer in a quite uncomfortable situation, since a definitive prediction about its overall effect on economic performance is not available. On the contrary, the direction of this effect is highly uncertain. Unsurprisingly, also the attempts to assess on empirical grounds this relationship are far than conclusive (e.g., Easterly and Rebelo, 1994; Devarajan *et al.*, 1996; Kneller *et al.*, 1999; Zagler and Dürnecker, 2003; Afonso *et al.*, 2005). The main motivation is that the Welfare State is a wide umbrella under which lots of different policies are assembled together. Much of the answer to the question of whether the Welfare State enhances or harms growth, depends then for instance on which welfare policies are actually considered, how the various programs are designed and financed, and what is the degree of pervasiveness achieved by public intervention. These considerations also suggest the relevance of *policy design* in explaining the aggregate effect of the Welfare State on economic growth: welfare policies should be consistent with individual incentives to supply capital and labour[5]; furthermore, they should not open the door to social stigma for welfare recipients.

In this paper, we deliberately concentrate ourselves on two particular welfare policies: health and education. Although the consumption of such goods has a theoretically clear identifiable impact on growth via its effects on people's productivity, in many western countries there are strong claims to reduce public funding also in these policy areas. But a point that - quite surprisingly - has not been addressed yet carefully, is that reducing public intervention would probably imply a higher allocation of health and educational services by means of private markets. However, the effect this could have on people's health, skills and knowledge, is questionable, as substituting public with private provision might entail a *level* and a *distribution* of consumption of such services that is sub-optimal from the social point of view. As it has been recently argued by Martin and Pearson (2005), "there is a suspicion that private provision will favour the rich, and this objection needs to be addressed". In fact, for the reasons outlined above, a more fair *distribution* is likely to allow an aggregate higher level of human and physical capital to be achieved, with obvious consequences on economic growth.

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result, distributional conflicts may in fact, after a point, be accentuated by reduced income differentials".

[5]A related issue concerns the way redistribution should be carried out, in a world where governments lack the relevant information about transfers' recipients. Recent economic theories suggest that, in some circumstances, in-kind transfers can be profitably used along with (distortionary) tax instruments to minimise the efficiency losses associated with the achievement of any given redistributive goal (see e.g. Balestrino, 1999, for a survey). On the importance of policy design, see also Barr (1992).

By considering a growth accounting framework, we study how both public and private expenditures in health and education affects economic growth, as a result of their influence on people's health, skills and knowledge. We are particularly interested in ascertaining whether countries which devote a larger amount of resources to the consumption of health and educational services experience higher growth rates, whether public expenditures in health and education more than offset the efficiency losses caused by distortionary taxation, and whether the effects of public expenditures on economic growth differ from those of private expenditures. The empirical analysis is based on a panel of 19 OECD countries observed from 1971 to 1998. Our results support the hypothesis that the contribution of the two categories of public welfare expenditures more than compensates for the distortions caused by the tax system, and that the estimated positive impact is stronger for health than for education. More importantly, we find some evidence that public expenditures affect GDP growth to a greater extent than private expenditures, suggesting the importance of income distribution and credit constraints in influencing the distribution of human capital.

The remainder of the paper is organised as follows. In section 2, we survey theoretical and empirical papers linking expenditures in health and education to economic growth. We make a distinction between the two concepts of "human development" and "human capital", and discuss their proxies used in the empirical works. In section 3, we describe our empirical approach and our sample, and discuss our results. Section 4 concludes the paper.

2. Linking expenditures in health and education to economic growth

2.1. The "human factor" and its measurement

The theoretical literature mentions several ways to relate *expenditure* in health and education to economic growth. Most of these links relies on the idea that a healthy and educated worker is expected to contribute more to production than one who is uneducated and in poor health. A first strand of literature concentrates on *human development*, a concept introduced by Amartya Sen (e.g. Sen, 1987, 2000), and accepted by the United Nations Development Programme (1990) as a basis for the Human Development Report. The concept of human development is basically related to a person's ability to enjoy achievements in welfare (e.g., Ranis, 2004, for a recent survey). This approach rightly acknowledges that the potential opportunities for

healthy and educated workers - their abilities to function - are different from those of people who are uneducated and in poor health (Anand and Ravallion, 1993). A second interrelated strand of literature focuses on *human capital*, which is a somewhat stricter concept, since it refers only to the skills and knowledge that individuals acquire, and which can be exploited in their role of workers in the labour market.

Both these strands of literature, despite their peculiarities, emphasise what may be called the *"human factor"* contribution to economic growth, and are consistent with two approaches. The first works via a positive effect on labour productivity (the "Lucas approach"), while the other through a positive impact on the rate of innovation (the "Nelson and Phelps approach"). Both these approaches can be formalised by considering an aggregate production function with the following general form (Eq. 1):

$$Y_t = F(K_t, L_t, A_t) \tag{1}$$

where Y is aggregate income, K is physical capital, L *broadly* represents *workers*, A is the level of technology, and t is an index for time. The "human factor" contribution to economic growth is embodied either in L or in A. In the first case (the "Lucas approach"), L is usually dubbed as "effective units" of labour; while in the second case (the "Nelson and Phelps approach"), A is split into two components, one of which is related to "pure technical change" and the other to "labour induced technical change".

Since the choice of the proxy measure is severely constrained by data availability, it is not surprising that the variables used to account for the "human factor" – in both the human development and the human capital approaches - are to a large extent similar. Within the *human development* approach, for instance, the Human Development Report (1990) combines three variables (life expectancy, adult literacy and command over resources needed for a decent living) to construct a "Human Development Index". Aturupane *et al.* (1994) also recommend a basic set of three indicators, which covers the same general categories - infant mortality, primary school enrolment, and per capita income. Although the human development approach acknowledges the role of economic growth in enhancing the performance of the most commonly used indicators of human development, what really matters from its perspective is not economic growth in itself, but the way in which its benefits are distributed among people and the extent to which growth supports public services (Anand and Ravallion, 1993). The belief is that only those countries which devote an

increasing amount of resources to these services (mainly health and education) may expect to move along a sustainable growth path. As Ranis (2004) puts it, "human development seems to be a necessary prerequisite for long-term sustainable growth ... the old-fashioned view of grow first and worry about human development later is not supported by the evidence".

The proxies used to account for the "human factor" within the *human capital* approach are basically the same. On the one hand, in their attempt to take into account the human factor within the standard neoclassical growth model, Mankiw *et al.* (1992) proxy human capital with the percentage of the working age population enrolled in secondary school (explicitly ignoring the health status of the workers). Basing themselves on the same methodology provided by Mankiw *et al.* (1992), Knowles and Owen (1997) and Webber (2002) consider a more complex measurement of human capital, which tries to include both the health status and the educational level of the workforce. Knowles and Owen (1997) use life expectancy as a proxy for health status, and the average numbers of years of schooling attained by the population aged over 25 as a proxy for educational achievement. Webber (2002) proxies education with three different measures (namely the percentage of the relevant population enrolled in primary, secondary and higher school), and uses an index of under-nutrition based on calories intake as a proxy for the health status[6]. Bloom *et al.* (2001), by using a growth accounting strategy, model human capital considering a non-linear combination of three terms. These are 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). Herbertsson (2003) measures investment in human capital by estimating a structural model, in which the externality produced by public spending in higher education produces its effects with a certain lag[7].

[6] The results concerning the link between human capital accumulation and economic growth are mixed. Knowles and Owen (1997), using a cross-section of 77 countries selected from those considered by Mankiw *et al.* (1992), find a strong positive relationship between health status and economic growth, whereas the relationship 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, 26 of which are classified by the World Bank as low- or middle-income countries.

[7] 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 by health on economic growth, whereas no clearcut results for schooling and experience are found. Herbertsson (2003), considering data for five Nordic European countries, finds that human capital makes a contribution of between 12 and 33% to explaining economic growth.

In more general terms, Le *et al.* (2003) and Wößmann (2003), in their surveys on the most commonly used proxies for human capital, identify three broad approaches: a cost-based approach; an income-based approach; and an educational stock-based approach. The cost-based approach basically proxies the human capital stock by considering both the costs of producing the physical human being (in other words, the costs of rearing a child) and the costs of increasing labour productivity (e.g. expenditures in health and education). The income-based approach measures human capital by considering the total income that could be generated by an individual during her lifetime. Finally, the educational stock-based approach considers the educational attainment of the labour force (i.e. the average years of schooling or the adult literacy rates). Since we are interested in assessing the contribution of welfare expenditures to economic growth, we work here within a cost-based approach.

2.2. Public and private welfare expenditures: are they different?

Previous contributions generally considered public expenditures in isolation, or considered either expenditure in health or expenditure in education. Unlike these approaches, we consider *both* public and private expenditures. To the best of our knowledge, this point has never been raised before. There are at least four arguments suggesting differences between the effects of the two types of expenditure. The first argument rests on the answer given to the question of whether private and public expenditures should be considered substitutes or complements. In the former case, public provision may simply crowd out private expenditures. As Filmer *et al.* (2000) point out, "changes in the price or availability of government interventions may induce a private supply response that can mitigate any actual impact on health outcomes". In the latter case, private expenditures can simply be thought of as topping up public expenditures, therefore being less productive if diminishing marginal returns to health and education are assumed. A second argument is that public intervention takes the presence of positive externalities in consumption of health and education into account, whereas private markets typically do not. A third argument emphasises the impact of public intervention, and its differential role with respect to private expenditure, in improving the social environment[8]. A typical

[8] This argument is to some extent related to the concept of "social capital", which has recently received considerable attention in the literature on the determinants of growth. For example, Knack and Keefer (1997), arguing that "trust and norms of civic cooperation are essential to well functioning societies and to the economic progress of those societies", find measures of social capital that are positively

example is public schooling, where a common cultural background is provided to students, that improves social cohesion (e.g. Gradstein and Justman, 2000).

All the above arguments rest on the implicit assumption that, whenever there are positive expected gains from investing in health or education, individuals will undertake the required investments, by relying either on their own resources, or by borrowing the necessary funds from the capital markets. Furthermore, especially for investments in health, it is implicitly maintained that insurance markets will offer the necessary coverage. There are no missing markets or imperfections that can limit the ability of individuals to invest. However, as many authors have recently shown, these conclusions do not need to hold in a second-best environment. In particular, Hoff and Lyon (1995) have argued that asymmetric information on individual abilities causes a distribution of investments in higher education that is sub-optimal from the social point of view. In such circumstances, some individuals will invest "too much", while some others cannot afford investments, since market imperfections raise interest rates for educational loans to prohibitive levels. In the same fashion, in their survey on the perspectives of new growth theories, Aghion *et al.* (1999) argue that "when credit is unavailable, redistribution to the poorly endowed, that is, to those individuals who exhibit the highest marginal returns to investment, will be growth enhancing". The authors note that this "opportunity creation" effect of redistribution does not rely on incentive considerations, but on the assumption of diminishing marginal returns to investments: "even if one could force the poor to invest all their initial endowments … redistributing wealth would still have an overall positive effect on aggregate productivity and growth, because of decreasing returns to individual investments". A similar point is raised by Deaton (2003), who points out that redistribution to credit constrained individuals from those that are not, may increase (aggregate) investment in health. All the arguments centred on the existence of credit constraints, support the idea that redistribution can foster growth via its effects on individual investments. From this point of view, the Welfare State – by directly providing the individuals with health and educational services – may be optimally designed as an institutional device aimed at solving exactly these market imperfections, allowing individuals with positive expected returns to undertake investments in human capital.

According to the above discussion, it is then clear that, at the aggregate level, there are several reasons to believe that public expenditure in health and education is more productive than private expenditure. In the empirical part of the paper, we directly test this prediction.

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related to economic growth. However, the concept of social capital is highly controversial, with the literature providing various definitions and measures (see Durlauf, 2002, for a critical discussion).

3. The empirical analysis

In this section, we describe our empirical methodology, grounded on a cost-based approach to the measurement of the contribution of the "human factor" to economic growth. The key point is that we model the "human factor" as a function of *total* (i.e. public and private) expenditure in health and education. In other words, the "human factor" stems from the *consumption* of educational and health services. In particular, like Grossman (1972), we model the differences between health capital and other forms of human capital, by assuming that only *current* consumption of health services influences health status, whereas *current* and *past* consumption of educational services influence the amount of knowledge.

Like all the others, also our cost-based approach is subject to some criticism. For example, Hanushek (1996) argues that expenditure in education cannot be considered consistently linked to acquired cognitive skill. In a similar vein, Le *et al.* (2003) point out that "there is no necessary relationship between investment and quality of output ... an innately less able and less healthy child is more costly to raise". This criticism need to be carefully evaluated. To begin with, as Wößmann (2003) has recently clarified, all the most commonly used measures of human capital (or human development) are inevitably imperfect and (more importantly) linked to data availability. Moreover, contrary to the above mentioned views, there is a growing body of empirical evidence supporting a causal relationship between expenditures on health care (education) and health status (education attainment) (e.g., Gupta *et al.*, 2002). Furthermore, this correlation is found to increase with the quality of governance (Rajkumar and Swaroop, 2002). This may raise the doubt that the correlations between most of the commonly used measures of human capital or human development (e.g. adult literacy, life expectancy, school enrolment ratios) and output growth are only indirect. These variables may indeed be correlated with expenditures in health or education, and expenditures may have a genuine causal relationship with growth. Finally, expenditures must necessarily be correlated with the internal rate of return of investments (IRR) in health and education, which constitutes the basis for deriving a Mincer formulation to specify human capital stock. In fact, assuming that choices are rationally taken by individuals, the IRR equals costs and benefits of investments (e.g., Wößmann, 2003), hence total spending in health and education can be obtained by capitalising annual benefits with the IRR.

3.1. Methodology

In terms of empirical strategies, there are at least two different methodologies for estimating the contribution of the "human factor" to economic growth. The first is based on an economic model of growth, which takes exogenously given growth rates of the labour force and technology. This methodology provides an equation which links the aggregate product to the steady state values of the growth determinants (e.g., Mankiw *et al.*, 1992). The second strategy is based on a growth accounting framework that - by assuming that the production factors are paid their marginal productivity - considers the GDP growth rate as a function of the inputs' growth rates and output shares (e.g., Barro, 1998). Within this latter strategy, it is possible to distinguish two further methods for estimating the contribution of the "human factor". The first is the traditional method based on the *observed* factor shares; the second is based on regression analysis, where the factor shares represent the coefficients to be estimated. We consider here a growth accounting framework. For our purposes, let us start by differentiating Eq. (1) with respect to time. Dividing by Y yields:

$$\frac{\Delta Y}{Y} = \left(\frac{F_K K}{Y}\right)\frac{\Delta K}{K} + \left(\frac{F_L L}{Y}\right)\frac{\Delta L}{L} + \left(\frac{F_A A}{Y}\right)\frac{\Delta A}{A}, \tag{2}$$

and assuming each input is paid its marginal product, we obtain:

$$\frac{\Delta Y}{Y} = s_K \frac{\Delta K}{K} + s_L \frac{\Delta L}{L} + s_A \frac{\Delta A}{A}. \tag{3}$$

Note that S_A is not observable, and therefore we cannot *directly* measure the contribution of technology to output, because it cannot be separated from the contributions of physical capital and (broadly defined) labour. The reason for this is that the *observed* factor shares of physical capital and labour also include the remuneration of technology, and the contribution of the "human factor" to economic growth (on this point, see also Besley, 2001). Following this rationale, Eq. (3) can be rewritten - assuming constant returns to scale at the aggregate level - as:

$$\frac{\Delta Y}{Y} = \sigma_K \frac{\Delta K}{K} + \sigma_L \frac{\Delta L}{L} + \frac{\Delta A}{A}, \tag{4}$$

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

To define the link between the "human factor" and output growth rate, let us first follow the "Lucas approach" and assume that expenditures in health and education contribute to define effective units of labour L^* as follows:

$$L_t^* = f(L_t, E_t^{pu}, E_{t-1}^{pu}, E_{t-2}^{pu}, ..., HE_t^{pu}, E_t^{pr}, E_{t-1}^{pr}, E_{t-2}^{pr}, ..., HE_t^{pr} \mid I), \qquad (5)$$

where L is the number of workers, HE and E are expenditures in health and in education respectively, *pu* and *pr* are mnemonics for public and private, and I represents the institutional features which may be relevant to explain differences in the *quality*, the *efficiency* and the *effectiveness* of these two types of expenditures (e.g. whether such goods are provided at the central or at the local level, whether there is any competition between public and private suppliers, or whether availability of badly designed public provision distorts individual incentives). Considering the definition of effective units of labour given in Eq. (5), and substituting in Eq. (4), the equation to be estimated can be written as:

$$\begin{aligned} \Delta \ln Y_{it} &= \beta_1 \Delta \ln K_{it} + \beta_2 \Delta \ln L_{it} + \beta_3 \Delta \ln\left(HE^{pu}\right)_{it} + \beta_4 \Delta \ln\left(HE^{pr}\right)_{it} + \\ &+ \beta_5 \Delta \ln\left(E^{pu}\right)_{it} + \beta_6 \Delta \ln\left(E^{pr}\right)_{it} + \beta_7 \Delta \ln\left(E^{pu}\right)_{it-1} + \beta_8 \Delta \ln\left(E^{pr}\right)_{it-1} + \lambda_i + \phi_t + \varepsilon_{it} \end{aligned} \qquad (6)$$

where λ_i and ϕ_t are country and time fixed effects respectively, and ε_{it} represents a standard error term. The time effect ϕ_t includes all those influences on the output growth rate common to all countries in a given year (e.g. the economic cycle), while the individual effect λ_i picks up the influences specific to each country (e.g. social, religious, climate or geographical factors). λ_i and ϕ_t provide also a control for the institutional differences outlined above.

An alternative way of getting to Eq. (6) follows the "Nelson and Phelps approach", and models the "human factor" using efficiency parameter A. In particular, we assume that the efficiency parameter is a function of the technology *TE* and the labour productivity *LP*; hence:

$$A_t = f(TE_t, LP_t) = f(TE_t, E_t^{pu}, E_{t-1}^{pu}, E_{t-2}^{pu}, ..., HE_t^{pr}, E_t^{pr}, E_{t-1}^{pr}, E_{t-2}^{pr}, ..., HE_t^{pr} \mid I). \qquad (5b)$$

In other words, as before, labour productivity stems from the *consumption* of educational and health services. Substituting Eq. (5b) in Eq. (4), we are then back again to Eq. (6).

As Temple (1999) has pointed out, there are several problems in estimating and interpreting growth regressions as Eq. (6) above: from parameters heterogeneity to the presence of possible outliers in the data; from model uncertainty to endogeneity and measurement errors; from spatial correlation to (possibly) reverse causality. These problems notwithstanding, the usefulness of this style of research should not be dismissed, and – as Temple suggests – suitable solutions can in many cases be identified. For instance, "techniques that make more use of time series variation in the data might yet overcome many of the objections often raised to cross-country research". Several advantages are offered by panel data techniques, such as the possibility of controlling for omitted variables persistent over time, or the use of lags of regressors as instruments. In the following analysis, we use these techniques to estimate Eq. (6), and check the robustness of our results by considering additional suggestions by Temple (1999).

3.2. Data

In order to empirically estimate Eq. (6), we use annual data on a per capita basis from a sample of 19 OECD countries during the period 1971-1998[9]. The descriptive statistics and data sources for all the variables included in our empirical analysis are reported in Appendix 1. Data on macroeconomic variables come from the Penn World Tables 6.1, and include data on population, real GDP per capita at constant prices[10] (Y), and the investment share of GDP; the labour force (L) in each country was obtained from OECD Health Data. We have constructed a measure of private capital stock (K) for each country using a perpetual inventory method. We initialise the capital stock series setting the capital stock in 1971 equal to the average investment/GDP ratio in the first five years of data, multiplied by the level of GDP in the initialising period, and divided by 0.07, our assumed depreciation rate (on this point, see Bloom *et al.*, 2001). The capital stock of each subsequent period is

[9] Due to data availability, especially for the data about expenditure in education, we have selected a sample of OECD countries for which we were able to obtain annual series of the variables used in this work. The countries included are: Australia, Austria, Canada, Denmark, Finland, Germany, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, UK, and US.

[10] Constant price values of GDP are calculated using a Laspeyres index.

calculated using current capital, plus the level of current investment, minus the 7% depreciation rate of the current stock.

As for welfare expenditures, health expenditure (*HE*) is measured by using data on public and private spending on health per capita, expressed in international PPP dollars from the OECD Health Data. Similarly, we measure education expenditure (*E*) using data on public and private spending on education per capita. However, data on education spending are difficult to obtain for a long time span. As a result, we are forced to consider only *current* expenditure in education. In order to partially overcome this problem, and check the robustness of our results, we use two data sources for public expenditure in education. These are the data published by UNESCO, and the data from the World Bank database. Finally, the data on private spending in education (covering all levels of education) are from OECD *Education at a Glance*.

We also include additional controls for institutional aspects that might influence the "quality" of spending in different countries. For instance, Tabellini (2005) suggests that public expenditure can be productive or not, according to the ability of politicians to extract rents, which ultimately hinges upon the institutional features shaping their incentives. Data on income inequality as measured by the Gini index (*GINI*) come from Deininger and Squire (1996). Political variables are taken from DPI2000 (Keefer, 2002), and include: a dummy variable equal to one whenever Central Government is supported by left-wing parties (*EXECRLC*), a variable measuring the fraction of seats held by the Government (*MAJ*), and a dummy variable equal to one in the years of legislative elections (*LEGELEC*). Data on the degree of fiscal decentralisation, proxied by the percentage of taxes collected by the Central Government (*CGTAX*), are obtained from the OECD *Revenue Statistics 1965-2002*.

One issue that needs to be tackled in discussing data, concerns whether it is best to use annual data, or five- or ten-years averages to avoid business cycles effects. The question remains largely unsettled (e.g. Temple, 1999). Therefore, we consider annual data, and use 5-yrs. averages as an additional robustness test.

3.3. Results

In this section, we present the main results of our empirical analysis. The key problem is the lack of data for private expenditure on education, which shortens the time span and reduces the sample of countries, making it difficult to identify the parameters of

interest[11]. We therefore start by considering only public and private expenditure on health. We then augment our basic estimation by adding public expenditure on education and, finally, by including private expenditure. As an additional experiment, we also consider a regression with expenditure in education only.

Table 1 shows our estimates when expenditure in health is considered in isolation. The Breusch-Pagan test and the Hausman (1978) test indicate that the 2-way REM is the preferred model. As expected, most of the coefficients are positive and statistically significant at the usual confidence levels. The coefficient associated with physical capital is significantly greater than that associated with labour. This result holds for all our models, and is at odds with findings by Bloom *et al.* (2001). In column *I*, the coefficient for *total* health expenditure is 0.0574: a 1% increase in the HE^{tot} growth rate would increase the per-capita GDP growth rate by 0.06%. In column *II*, we test whether the coefficients associated with public and private expenditures differ. Results show that the coefficients for the two types of expenditure do have a different magnitude, with the coefficient associated with public expenditure greater than that of private expenditure and statistically significant. Regressions in columns *III* and *IV* suggest that these two coefficients are robust and well identified. These results confirm theoretical beliefs on public welfare expenditure being more productive than private. It is worth noting that, as pointed out by Kneller *et al.* (1999), our estimates of the effects of public spending on GDP growth should suffer from a *downward bias* caused by the omission of distortionary taxation. For this reason, our conclusions on the positive impact of public expenditure should then be reinforced.

[TABLE 1 ABOUT HERE]

Table 2 reports our estimates when augmenting the first set of regressions by also considering public expenditure in education. The Breusch-Pagan test and the Hausman test now indicate that the 2-way FEM is the preferred model. While the coefficient for physical capital remains unaltered, the one for labour is now reduced and becomes statistically insignificant. However, results show an increase in the magnitude of the coefficients on public and private expenditure in health, with both coefficients appearing now statistically significant. The coefficient for public expenditure in education also shows the expected sign and is statistically significant. According to these results, public expenditure in health seems to have a greater

[11] See the table notes for the definition of the sample of countries and the time span used in each group of estimations.

impact on economic growth than public expenditure on education; this matches the findings of Knowles and Owen (1997). The results are robust for the two variables of public spending on education used (UNESCO and World Bank), with an elasticity of around 2-3%.

[TABLE 2 ABOUT HERE]

We obtain much less stable results when augmenting previous regressions further, by adding private expenditure in education[12]. The estimated coefficient for physical capital rises sharply compared to previous estimates, while the coefficient for labour is now negative (but statistically not significant) in almost all the estimations. Coefficients on health and education also appear difficult to identify, and are even negative (but statistically not significant) in some regressions. Almost identical results we obtain when expenditure in education (both public and private) is considered in isolation[13]. Estimated coefficient for physical capital is again higher than in previous estimates, whereas the coefficient for labour is negative (but insignificant). The coefficient associated with total expenditure in education is positive and significant, as it is the one associated with public expenditure; the coefficient on private expenditure is negative and not significant. Our explanation for these findings relies on the fact that the final sample is rather small (about 60 observations), with only 9 countries included and a very short time span. This makes parameter identification rather difficult.

3.4. Robustness checks

Our results are consistent with the idea that the Welfare State is not necessarily an obstacle for economic growth, as discussed in previous sections of the paper. Working via the accumulation of human capital, the Welfare State helps solving allocative problems generated by imperfections characterising private markets. In particular, we find empirical support to the hypothesis that public expenditure is more productive than the private one. In order to check the robustness of these findings, we run additional tests, tackling issues related to business cycles effects, institutional settings, endogeneity and reverse causality. Given the difficulties in identifying

[12] Results obtained considering also private expenditure in education as an additional regressor are not reported here for brevity, but they are available in the working paper version of this work (see Beraldo *et al.*, 2005).
[13] See again the working paper version for more details.

parameters of interest when education expenditures are considered, because of the small sample, we limit robustness checks to regressions including expenditures in health only.

As for business cycles effects, we re-run regressions in Table 1 by considering 5-yrs. averages of all the variables. All main results are confirmed (Table 3). Coefficient for capital halves, while coefficient for labour almost doubles; both coefficients are statistically significant. We observe a strong increase in the coefficient associated with HE^{tot}, from 0.05 to 0.13. More importantly, by considering separately public and private expenditures, only the coefficient on public expenditure is positive and statistically significant, with a magnitude close to that of the coefficient on HE^{tot}.

[TABLE 3 ABOUT HERE]

We provide a further robustness test for our findings, by adding specific additional controls to regressions in Table 1, to account for different institutional features that could have not been adequately captured by fixed effects. The reasons for considering these additional variables is easily explained. One of the possible shortcomings of public spending, is that it can be productive or not, depending on the political goals of governments. The effectiveness of public expenditure is expected to be higher, the lower the rents for politicians (e.g. Tabellini, 2005). Of course, the possibility for politicians to extract rents depends on the institutional structure, that shapes their incentives. For instance, according to theories on fiscal federalism, *CGTAX* can be interpreted as a proxy for the accountability of politicians: the lower the amount of taxes collected at the central level, the higher the ability of citizens to reward good policies, as the management of resources occur at a lower level of government, and control of politicians is easier. *LEGELEC* accounts for the stability of governments coalitions: the more the government coalition is unstable, the higher are the incentives to use public expenditure for obtaining and preserving rents. The results for these augmented models are shown in table 4. Again, the main findings are confirmed - the coefficient for *total* health expenditure is now 0.0607, i.e. very close to that previously estimated, and disaggregating public and private expenditure yields coefficients of approximately the same magnitude as before. All of the coefficients for the political variables are statistically insignificant; only the coefficient for *CGTAX* appears as marginally insignificant at the usual levels. The same test has been

conducted for regressions in Table 2 and 3, generating the same conclusions[14]. This result is probably due to the fact that fixed effects absorb all the explanatory power of institutional variables, leaving associated coefficients insignificant. According to this interpretation, differences across countries in the quality, efficiency and effectiveness of public spending *matter*. Still, our conclusion about the greater productivity of public spending remain unchanged.

[TABLE 4 ABOUT HERE]

A third robustness check relates to the problems of endogeneity and reverse causality. A well documented stylised fact is that (total) expenditure in health and education rises with per-capita GDP. Empirical papers trying to address the direction of causality between the Welfare State and economic growth (e.g. Herce *et al.*, 2001) found inconclusive evidence. We do not address *directly* this issue here, and concentrate instead on endogeneity. In order to cope with this problem, we consider the IV estimation of our previous model, using the GMM estimator. Table 5 shows the GMM estimates. To control for fixed effects, the variables are transformed in terms of orthogonal deviations, and a full set of time dummies is included in the regression to account for factors varying over time but which are common to all units. We report results based on consistent one-step estimators, as proposed by Arellano and Bond (1991). We use the lagged values (t-1 up to t-3) of the health expenditure variables as instruments. It is worth noting that, by considering as instruments lagged variables, we are *indirectly* addressing also the reverse causality issue. We also include the Gini index as an additional instrument in the dynamic IV estimations, checking for the validity of instruments using the Sargan test. Given that the GMM estimator uses lagged values of the variables as instruments, under the hypothesis of no autocorrelation in the error term, the series of differentiated residuals should present a significant first-order correlation, while indication of second-order serial correlation should not be present. We provide two statistics, m_1 and m_2, that test for first and second-order serial correlation in the error term, respectively. As expected, m_1 is statistically significant, while m_2 is not, thus confirming the validity of instruments. We also test whether there is any dynamic structure in our model, by introducing lagged values of the GDP growth rate and the spending variables as regressors. Our main results are substantially unchanged with respect to our previous estimates in Table 1, even though, as the finite sample properties of most dynamic

[14] Tables are available upon request from the authors.

panel estimators are not well understood, one should be cautious (e.g. Temple, 1999). The magnitude of the coefficients associated to labour and health spending increases, with coefficients for HE^{tot} being now close to 0.10. Also in this case, the productivity of public expenditures on economic growth appears larger than that of private expenditures. The same type of results holds true in the dynamic version of our model. The coefficient for lagged health expenditures is significant only when considering total expenditures, suggesting that only *current* consumption of health services matters for economic growth.

[TABLE 5 ABOUT HERE]

3.5. Discussion

In order to further study the role of spending in health and education in contributing to economic growth, we decompose the GDP average growth rate at its sources, using the accounting methodology detailed e.g. in Herbertsson (2003). We limit ourselves to the estimates reported in Tables 1 and 2. Results of these exercises are shown in tables 6 and 7. In both cases, half of the reported GDP growth rate is explained by growth in the stock of physical capital. The role of spending on health is significantly higher than that on education, with the former accounting for between 16.44% and 27.30% of economic growth, with much of this result coming from the contribution by public expenditures. The share of GDP growth accounted for by education expenditures is around 3%, a contribution similar to that by labour once we account for the role of the "human factor". The TFP component related to pure technological change contributes between 17.59% and 42.58%. Our results are substantially in agreement with findings by Herbertsson (2003).

[TABLE 6 AND 7 ABOUT HERE]

One point that needs to be discussed is now why the impact of public expenditure is higher than that of private expenditure. In a previous section of the paper, we identified four main theoretical rationales for this result to hold: from the presence of positive externalities to social cohesiveness, from marginal diminishing returns to the presence of credit constraints at the individual level. With the exception of the latter argument, all the others implicitly maintain that, whenever there are expected positive gains from investing in health or education, individuals will be able

to undertake the investments, by relying either on their own resources, or by borrowing the necessary funds from the capital markets. However, market imperfections exist that can limit the ability of individuals to borrow. This is especially true for investments in human capital, whose expected returns are highly uncertain. Empirical evidence on this point is widespread, particularly for education (see e.g. Carneiro and Heckman, 2003, Dearden *et al.*, 2004, and Aakvik *et al.*, 2005). Let us then take seriously the presence of credit constraints at the individual level: what would we expect from a policy aimed at reducing public funding of health and educational services? Individuals would presumably react by increasing the amount of services obtained through private markets and financed out-of-pocket. In the presence of credit constraints, this would reduce the potential (aggregate) stock of human capital, and increase the variance of human capital endowments, in terms of acquired skills and/or health status. In turn, this will exacerbate the *ex-ante* income inequality, and will negatively influence economic growth. We do not provide here additional evidence on this point, relying instead on results available in a growing empirical literature. As for health services, for instance, Jappelli *et al.* (2004) - in a study on public health expenditure in the Italian provinces - find that an increase in the quality of health services reduces both income and health inequality (measured by health status). Decker and Remler (2004) find that the income-health gradient (the association between lower socio-economic status and worse health) reduces more in the U.S. than in Canada for people aged 65, i.e. for those who become eligible for entering the universal Medicare program in the U.S. The results are consistent with the inequality-reducing role of universal health insurance; hence, with the chance of solving credit-constraints problem at the individual level through the public intervention in this area. As for educational services, Goodspeed (2000) shows that – above a positive direct effect – public spending has also an indirect positive effect on economic growth, working through the reduction in inequality.

The view that credit constraints play a role in determining educational attainments is directly tested by e.g. Carneiro and Heckman (2003), Dearden *et al.*, (2004), and Aakvik *et al.*, (2005). All these studies largely confirm that credit constraints matter. However, the estimated impact of these (short-term) constraints seem to be less important than the effect of family background. Besides educational attainments, family background certainly plays a role also for health status: the consumption of health services (especially for diagnostic tests and for prevention) is influenced by the household socio-economic conditions. In our view, this observation, rather than diminishing the importance of relying on public intervention to ameliorate the accumulation of human capital, contribute to specify the right

question to be addressed, in order to design a growth-enhancing public policy, working via the reduction of inequalities. In fact, one need to discriminate between two alternative hypotheses before suggesting any policy: should government limit itself to better target the provision of welfare services toward the poor? Or, alternatively, should it try to alleviate the effects of a bad family background? Further research is needed to adequately address this issue. However, it is reasonably to suspect that properly designed public intervention is the only means available to cope with observed inequalities in human capital accumulation, arising both from income and socio-economic inequalities.

4. Concluding remarks

In this paper, we provide an initial attempt to explore issues that should be placed at the core of the ongoing academic and political debate concerning the Welfare State. Starting from a theoretical standpoint, we have emphasised the role that expenditures in health and education (two traditional welfare policies) play in enhancing the distribution and the (aggregate) level of the "human factor", which positively affects economic growth via either labour productivity or technical progress. We then address the following questions: is there any evidence that countries which devote a larger amount of resources to the consumption of health and educational services experience higher growth rates? Is there any difference between public and private expenditures in health and education? Are the gains accruing to societies because of particular categories of public welfare expenditures able to offset the efficiency losses caused by the distortionary taxes necessary to fund these welfare policies? Our empirical analysis, based on a panel of 19 OECD countries observed from 1971 to 1998, shows a robust positive correlation between expenditures in health and education and GDP growth. The estimated positive impact is stronger for health than for education. More importantly, we find some evidence that public expenditures influence GDP growth to a greater extent than private expenditures. All these results also appear to be robust after controlling for short-term business cycles fluctuations, the importance of institutional settings, the potential endogeneity of welfare expenditures and reverse causality. All our findings seems then to support the view that reform proposals aimed at downsizing welfare policies should not be generalised. In particular, public welfare spending should be consistent with the aim of increasing the accumulation of "human factor", overcoming problems stemming from both income and socio-economic inequalities. The recipe of simply reducing public

expenditures in health and education does not seem to be an adequate policy to promote growth.

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Table 1. Production Function in Growth Form.
Health Spending (Public and Private)
Dependent Variable: Annual Growth Rate of GDP;
2-way REM using GLS

Variables	**(*I*)**	**(*II*)**	**(*III*)**	**(*IV*)**
Constant	0.0085 (2.517)**	0.0092 (2.740)***	0.0102 (3.217)***	0.0118 (3.982)***
Capital	0.7696 (9.194)***	0.7787 (9.234)***	0.7807 (9.370)***	0.8066 (9.282)***
Labour	0.1436 (2.688)***	0.1391 (2.585)***	0.1384 (2.589)***	0.1421 (2.646)***
HE^{tot}	0.0574 (2.208)**	--.--	--.--	--.--
HE^{pu}	--.--	0.0392 (1.749)*	0.0327 (1.480)	--.--
HE^{pr}	--.--	0.0078 (1.164)	--.--	0.0074 (1.104)
N (*par*)	365 (4)	365 (5)	369 (4)	371 (4)
R^2	28.12	28.17	27.96	27.87
B-P (*LM*)	110.21***	108.93***	100.84***	114.83***
Hausman	3.55 [0.3140]	2.93 [0.5696]	3.17 [0.3659]	0.74 [0.8646]

Notes: *t*-values in parenthesis and *p*-values in brackets. *, ** and *** indicate significance at 10, 5 and 1 percent levels, respectively. Estimations performed with individual and time random effects (2-way REM model). Results obtained using White robust standard errors. Sample of OECD countries used (18): Australia, Austria, Canada, Denmark, Finland, Germany, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, UK and US (the number of observations, *N*, differs 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. Production Function in Growth Form.
Health Spending (Public and Private) and Education Spending (Public)
Dependent Variable: Annual Growth Rate of GDP; 2-way FEM using LSDV

Variables	**(*I*)**	**(*II*)**	**(*III*)**	**(*IV*)**	**(*V*)**
Constant	0.0055 (1.754)*	0.0075 (2.551)**	0.0049 (1.321)	0.0055 (1.621)	0.0072 (2.462)**
Capital	0.8599 (6.533)***	0.8719 (6.609)***	0.8146 (6.194)***	0.8188 (6.247)***	0.8318 (6.373)***
Labour	0.0693 (0.765)	0.0467 (0.511)	0.0726 (0.796)	0.0505 (0.551)	0.0425 (0.465)
HE^{tot}	0.0832 (2.665)***	--.--	0.0938 (2.327)**	--.--	--.--
HE^{pu}	--.--	0.0592 (2.128)**	--.--	0.0772 (2.625)***	0.0679 (2.422)**
HE^{pr}	--.--	0.0018 (1.895)*	--.--	0.0125 (1.045)	--.--
E^{pub}(*WB*)	---.--	--.--	0.0299 (2.248)**	0.0293 (2.207)**	0.0292 (2.193)**
N (*par*)	240 (34)	240 (35)	220 (35)	220 (36)	220 (35)
R^2	52.07	52.06	57.10	57.45	57.20
B-P (*LM*)	87.21***	83.77***	95.72***	98.48***	99.53***
Hausman	11.35 [0.0099]	10.68 [0.0303]	10.15 [0.0379]	16.13 [0.0064]	12.36 [0.0148]

Notes: *t*-values in parenthesis and *p*-values in brackets. *, ** and *** indicate significance at 10, 5 and 1 percent levels, 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, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, UK and US (the number of observations, *N*, differ because some series are unbalanced). Time span: 1980-1995. 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). We performed the same estimations as the ones shown in table 3 with data on public spending in education from UNESCO. The main results (not reported but available upon request) do not change much from the ones presented in table 3. The estimated elasticity for public spending on education is around 2% in all the models.

Table 3. Production Function in Growth Form.
Health Spending (Public and Private)
Dependent Variable: 5-yrs. Average Growth Rate of GDP;
2-way REM using GLS

Variables	**(*I*)**	**(*II*)**	**(*III*)**	**(*IV*)**
Constant	0.0058 (0.686)	0.0077 (0.910)	0.0058 (0.736)	0.0168 (2.194)**
Capital	0.4720 (3.533)***	0.4459 (3.244)***	0.4448 (3.378)***	0.5747 (4.616)***
Labour	0.2896 (2.105)**	0.2928 (2.106)**	0.2910 (2.158)**	0.2723 (1.971)**
HE^{tot}	0.1311 (1.694)*	--.--	--.--	--.--
HE^{pu}	--.--	0.1365 (2.070)**	0.1389 (2.153)**	--.--
HE^{pr}	--.--	-0.0199 (-0.659)	--.--	-0.0263 (-0.849)
N (*par*)	70 (4)	70 (5)	70 (4)	70 (4)
R^2	36.63	37.78	36.06	37.92
B-P (*LM*)	27.96***	28.52***	36.39***	41.62***
Hausman	2.88 [0.4104]	3.62 [0.4605]	3.81 [0.2828]	1.56 [0.6687]

Notes: *t*-values in parenthesis and *p*-values in brackets. *, ** and *** indicate significance at 10, 5 and 1 percent levels, respectively. Estimations performed with individual and time random effects (2-way REM model). Results obtained using White robust standard errors. Sample of OECD countries used (18): Australia, Austria, Canada, Denmark, Finland, Germany, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, UK and US (the number of observations, *N*, differs because some series are unbalanced). 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 4. Production Function in Growth Form.
Health Spending (Public and Private) and Institutional Variables.
Dependent Variable: Annual Growth Rate of GDP;
2-way REM using GLS

Variables	**(*I*)**	**(*II*)**	**(*III*)**	**(*IV*)**
Constant	0.0069 (0.566)	0.0099 (0.761)	0.0090 (0.711)	0.0088 (0.701)
Capital	0.7749 (8.933)***	0.7848 (8.952)***	0.7870 (9.81)***	0.8141 (9.524)***
Labour	0.1422 (2.648)***	0.1378 (2.544)**	0.1364 (2.536)**	0.1399 (2.590)***
HE^{tot}	0.0607 (2.309)**	--.--	--.--	--.--
HE^{pu}	--.--	0.04254 (1.876)*	0.0357 (1.589)	--.--
HE^{pr}	--.--	0.0082 (1.220)	--.--	0.0076 (1.128)
GINI	-0.0003 (-1.016)	-0.0003 (-0.971)	-0.0003 (-0.985)	-0.0001 (-0.325)
EXECRLC	-0.0003 (-0.159)	-0.0004 (-0.182)	-0.0002 (-0.092)	-0.0000 (-0.034)
MAJ	0.0100 (0.895)	0.0096 (0.846)	0.0095 (0.852)	0.0096 (0.858)
LEGEL	-0.0025 (-1.163)	-0.0026 (-1.186)	-0.0021 (-0.986)	-0.0022 (-1.021)
CGTAX	0.0121 (1.395)	0.0120 (1.323)	0.0115 (1.297)	0.0122 (1.372)
N (*par*)	364 (9)	364 (9)	368 (9)	370 (9)
R^2	29.35	29.41	29.13	29.05
B-P (*LM*)	116.54***	115.78***	105.99***	119.5524***
Hausman	6.90 [0.5479]	5.86 [0.7541]	6.75 [0.5638]	4.28 [0.8306]

Notes: see table 1.

Table 5. Instrumental Variables: Health Spending. Dependent variable: *Growth Rate GDP*. 1-step GMM estimation								
Variables	**Static IV estimation**				**Dynamic IV estimation**			
Constant	0.0008 (0.193)	0.0019 (0.466)	0.0061 (1.53)	0.0015 (0.399)	0.0073 (1.78)*	0.0039 (1.08)	0.0270 (5.45)***	0.0062 (1.53)
g-GDP (-1)	--.--	--.--	--.--	--.--	0.0652 (0.311)	-0.1048 (-0.563)	-0.0190 (-0.111)	-0.0201 (-0.138)
Capital	0.7829 (2.37)**	0.6882 (2.02)**	0.9755 (3.46)***	0.8063 (3.78)***	0.7984 (1.86)*	0.7582 (2.05)**	0.7185 (3.99)***	0.8172 (3.10)***
Labour	0.1071 (0.836)	0.2114 (1.31)	0.2852 (3.51)***	0.2015 (3.10)***	0.1087 (0.927)	0.2504 (1.55)	0.2119 (1.93)*	0.2195 (3.31)***
HE^{tot}	0.1042 (6.13)***	--.--	--.--	--.--	0.0983 (5.91)***	--.--	--.--	--.--
HE^{tot}(-1)	--.--	--.--	--.--	--.--	-0.0600 (-1.71)*	--.--	--.--	--.--
HE^{pu}	--.--	0.0697 (4.15)***	--.--	0.0720 (4.42)***	--.--	0.0718 (3.58)***	--.--	0.0707 (3.85)***
HE^{pu}(-1)	--.--	--.--	--.--	--.--	--.--	0.0116 (0.300)	--.--	-0.0084 (-0.208)
HE^{pr}	--.--	--.--	0.0081 (1.92)*	0.0095 (2.91)***	--.--	--.--	0.0080 (0.857)	0.0144 (1.99)**
HE^{pr}(-1)	--.--	--.--	--.--	--.--	--.--	--.--	-0.0136 (-1.39)	-0.0063 (-0.803)
N (par)	347 (23)	351 (23)	353 (23)	347 (24)	328 (24)	332 (24)	352 (25)	328 (26)
RSS	0.11359	0.11493	0.1201	0.11400	0.10840	0.11328	0.12063	0.10989
Sargan (df)	61.01 (54) [0.239]	58.02 (54) [0.329]	55.39 (54) [0.422]	121.6 (110) [0.212]	58.20 (51) [0.228]	53.86 (51) [0.365]	44.55 (71) [0.994]	113.8 (105) [0.263]
m_1	-2.238**	-2.399**	-2.428**	-2.329**	-2.282**	-2.006**	-2.332**	-2.898***
m_2	-0.266	-0.075	-0.222	-0.267	0.3983	0.747	0.1681	0.044

Notes: *t*-ratios in parenthesis, *p*-values in brackets. *, ** and *** indicates significativity of estimated parameters at 10%, 5% and 1% level of significance, respectively. Instruments: lagged values (t-1 up to t-3) of the health spending variables; in the third column in the dynamic IV estimation we also include the Gini index as a level instrument. Tests: the Sargan tests the validity of instruments; high *p*-values for the Sargan test fail to reject the null hypothesis and hence the instruments used are valid. m_1 and m_2 test respectively for first and second-order serial correlation in the error term.

Table 6. Health (Public and Private) Spending. Sources of Growth of Output, expressed as percentages						
All Countries	***Capital***	***Labour***	***HE^{tot}***	***HE^{pu}***	***HE^{pr}***	***TFP***
Model (I)	47.09	6.02	16.44	--.--	--.--	30.42
Model (II)	47.65	5.83	--.--	12.89	2.20	31.41
Model (III)	47.77	5.80	--.--	10.75	--.--	35.66
Model (IV)	49.36	5.96	--.--	--.--	2.08	42.58
Model (I) for countries:						
AUSTRALIA	41.94	7.56	13.53	--.--	--.--	36.93
AUSTRIA	46.50	7.08	17.67	--.--	--.--	28.73
CANADA	77.78	8.84	17.23	--.--	--.--	-3.86
DENMARK	13.55	4.15	*19.37*	--.--	--.--	60.91
FINLAND	22.14	1.31	15.43	--.--	--.--	61.11
GERMANY	45.90	12.69	*19.15*	--.--	--.--	22.25
IRELAND	58.96	4.29	10.95	--.--	--.--	25.78
ITALY	33.58	1.73	15.18	--.--	--.--	49.49
JAPAN	61.92	4.87	15.80	--.--	--.--	17.39
LUXEMBOURG	45.89	5.91	10.79	--.--	--.--	37.39
NETHERLANDS	31.59	12.07	17.82	--.--	--.--	38.50
NEW ZEALAND	32.23	14.07	22.02	--.--	--.--	31.65
NORWAY	38.65	4.64	16.59	--.--	--.--	40.11
PORTUGAL	75.08	4.10	20.88	--.--	--.--	-0.08
SPAIN	40.31	6.28	22.39	--.--	--.--	31.00
SWEDEN	26.13	1.44	16.84	--.--	--.--	55.58
UK	42.59	2.89	*19.51*	--.--	--.--	34.98
US	73.18	7.10	17.14	--.--	--.--	2.56

Table 7. Health (Public and Private) and Public Education Spending. Sources of Growth of Output, expressed as percentages							
All Countries	***Capital***	***Labour***	***HE^{tot}***	***HE^{pub}***	***HE^{pr}***	***E^{pub}***	***TFP***
Model (I)	51.18	3.06	24.22	--.--	--.--	--.--	21.52
Model (II)	51.90	2.06	--.--	17.01	0.63	--.--	28.38
Model (III)	48.49	3.20	27.30	--.--	--.--	3.39	17.59
Model (IV)	48.47	2.23	--.--	22.18	--.--	3.33	23.50
Model (V)	49.51	1.87	--.--	19.51	--.--	3.31	25.77

Note: In model (*IV*), the point estimate for private spending in health has been considered as 0 given that is not significant in the estimation

Appendix 1

Descriptive Statistics of the main variables used

Name	Definition	Source	Mean	St. Dev.
$\Delta \ln Y_{it}$	Gross Domestic Product growth rate	PWT 6.1	0.02867	0.02573
$\Delta \ln K_{it}$	Private capital stock growth rate	PWT 6.1 and o.c.	0.01714	0.01518
$\Delta \ln L_{it}$	Employment growth rate	PWT 6.1	0.01242	0.02350
$\Delta \ln(HE^{tot})_{it}$	Total health spending growth rate	OECD Health Data	0.07731	0.04486
$\Delta \ln(HE^{pu})_{it}$	Public health spending growth rate	OECD Health Data	0.07664	0.04932
$\Delta \ln(HE^{pr})_{it}$	Private health spending growth rate	OECD Health Data	0.08126	0.06602
$\Delta \ln(E^{tot})_{it}$	Total education spending growth rate	WB and UNESCO	0.03399	0.05651
$\Delta \ln(E^{pu})_{it}$	Public education spending growth rate	WB and UNESCO	0.01522	0.11203
$\Delta \ln(E^{pr})_{it}$	Private education spending growth rate	WB and UNESCO	0.03967	0.69596
GINI	Gini Index	Deininger and Squire (1996)	32.555	4.1081
EXECRLC	Dummy =1 if government is left-wing	DPI2000	0.3941	--.--
MAJ	Fraction of seats held by government	DPI2000	0.5455	0.1001
LEGELEC	Dummy =1 if general election to be held in the year	DPI2000	0.3095	--.--
CGTAX	% of taxes collected by Central Govt	OECD Revenue Statistics	0.5950	0.1558

Notes: o. c.: own calculations. PWT 6.1*: Penn World Tables Mark 6.1*. WB: World Bank. Descriptive statistics for education spending are taken from World Bank data. DPI2000: Database of Political Institutions: Philip Keefer (2002), The Development Research Group World Bank. See notes on tables presenting regression results with each of the variables presented for details on countries and data spans. Statistics for macroeconomic variables are for countries and data spans for regressions including health spending variables.