The Contribution of Publicly Provided Health to Growth and Productivity

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RESUMO

Este trabalho analisa o efeito do gasto público em saúde sobre a produtividade. Para isso desenvolvemos uma extensão do modelo ampliado de Solow, considerando uma medida ampla de capital humano, que abrange tanto a educação como a saúde, como determinantes do crescimento econômico e da produtividade. Estimamos diferentes regressões de convergência para os países da OCDE, objetivando verificar em que medida o gasto público em consumo e em investimento em saúde influencia a produtividade, mantendo as características neoclássicas. Os resultados revelam que o gasto de consumo em saúde apresenta efeitos positivos sobre a produtividade, enquanto o gasto de investimento em saúde não produz o mesmo efeito positivo.

PALAVRAS-CHAVE

crescimento econômico, gasto público, capital humano, saúde

ABSTRACT

The aim of this paper is to analyze the effect of public health expenditure on productivity. We develop an extension of the augmented Solow model, which includes education and health as a means of explaining productivity. We run conditional convergence regressions for OECD countries, in order to verify the extent to which government consumption and government investment in health enters into the model explaining productivity. The major conclusion of this research is that government consumption in health has consistently positive effects with respect to productivity, while government investment has no effect on productivity.

KEY WORDS

growth, government spending, human capital, health

JEL classification

O40, S10, J24, I10.

INTRODUCTION

The relationship between the size of the government budget and economic growth has been widely analyzed in economic literature. Public sector activities affect various economic variables whilst also influencing the well-being of individuals. This is the case of health in which the impact of public finance is of particular importance.

The health status of an individual depends on a series of cumulative variables that include behavioral, environment and economic factors one of which is health spending. In this sense it is easy to incorporate the health factor into growth models within the broader context of human capital. Improved health contributes to economic growth, reducing production losses caused by worker illness, preventing poor health from impeding optimum scholastic performance and by freeing resources, that would otherwise have to be spent on treating illness, for alternative uses. The most obvious benefits are fewer working days lost to illness, increased productivity and greater opportunities to obtain better-paying jobs. For the inactive population, improvements in health services contribute to reducing external effects which might include personalized care of the aged, the cost of expensive health treatments and a negative social climate which would prejudice the productivity of the working population.

Almost all developed countries have a similar profile with respect to health spending. The volume of this spending represents between 5.5% and 8.5% of GDP and between 70% and 80% is public expenditure for OECD countries in 1995. The USA is an exception, since private health care spending is greater than public spending. Most health spending is consumption spending and according to Gonzalez-Paramo (1994) public consumption spending may have a three-fold effect on economic growth. Firstly, as the public sector is providing services which are aimed at augmenting consumers´ well-being rather than at productive investment, public consumption has a negative effect on growth. Secondly, public services might increase the stock of human capital and might even indirectly increase private investment in that the effects on productivity would be positive. This might indeed be the case where public spending on education and health is concerned.

This paper sets out to analyze how the composition of public health spending affects improvements in productivity. To this end, we carry out a neoclassical growth model estimation, based on the proposed specifications of Mankiw-Romer-Weil (1992) (henceforth MRW) which includes human capital in the broadest of senses, taking into account both education and health. As a proxy of health, we take health spending, which we break down into current and capital spending. The overall objective of the paper therefore, is to discover whether, and to what extent, health spending considered as whole, and broken down into its components, capital and current health spending affect improvements in productivity in developed countries.

In section 1 we take an overview of some of the most recent results which link productivity and public spending. We then put forward the model we use for the estimations which follow. Section 3 provides a description of the data used and presents the results of the estimations carried out, while in the last section we present our main conclusions.

1. PREVIOUS RESULTS ON PUBLIC SPENDING, HEALTH AND ECONOMIC GROWTH

There is much literature which attempts to study the effects of public spending on economic growth. Landau (1983) obtains an inverse relationship for the share of consumption and GDP growth rates for a group of developed and developing countries. The negative effect which he obtains however, disappears when the sample is confined to the countries which are poorer than average. Grier and Tullock (1989) obtained similar results when analyzing the consumption spending in 113 countries.

Ram (1986), on the other hand, uses a two-sector production function and finds that increased public spending has a strong positive effect on economic growth. This article provoked great interest but was not exempt from criticism. Carr (1989) and Rao (1989), for example, claim that the results were due to measurement problems and erroneous assumptions with respect to the productivity of the factors at both sector and country level, and this is what biased the results.

One of the most influential works within this field of research has been the study carried by Aschauer (1989a). His results would seem to indicate that public capital plays a crucial role in the evolution of the total productivity of the factors. This analysis was enlarged upon in later research, which focussed on 7 industrialized countries (ASCHAUER, 1989b). Aaron (1990) criticized Aschauer´s results, claiming that the relationship between productivity and public capital was due to the parallel evolution of two non-stationary variables, which were completely unlinked by any causal relationship.

Munnell (1990), Garcia-Milá and McGuire (1992) and Garcia-Milá *et al*. (1993) have all carried out panel data estimations for the USA and all obtain lower elasticities for output, with respect to public capital, than the elasticities obtained when using aggregate data. The panel data estimations sometimes even give non-significant coefficients depending on the type of estimation carried out.

According to Barro (1989) the different components of public spending favor or prejudice growth, depending on whether or not they reinforce the positive effect of other factors within the production function. If their effect is positive as is the case for infrastructure, justice, etc., both private and public returns improve. In other case, the effect could be negative and there would be price-distortion due to the need of taxes to finance public spending.

Although there has been much research into how different public policy variables affect economic growth, there are very few analyses which consider health spending independently and even fewer which attempt to analyze the composition of this spending. Among the studies which analyze how health spending affects productivity the work of Bishai and Simon (1987) use simulation techniques in order to study the effect of health spending on economic growth. Their results seem to indicate that growth is linked to the rate of technological progress. When the rhythm of technological advancement is slow, health spending accelerates economic growth in the short-run and slows economic growth in the long run. If technological progress is rapid, health spending tends to favor growth in per capita income, but this effect is not especially strong.

Easterly and Rebelo (1993) study the impact of health spending on economic growth, together with other public policy variables. They obtain a positive coefficient for private investment but this coefficient is non-significant. They also obtain, however, a positive correlation between per capita income and health spending. Currais and Rivera (1999a) analyze the role of health attainment in human capital accumulation. They estimate a conditional convergence regression that indicates the importance of this variable in growth analysis. Results demonstrate that investment in health contributes significantly to explaining variations in output through human capital.

This overview of some of the more important research in the field seems to contribute little when it comes to quantifying the extent to which public capital determines productivity, specially health spending. What can be gleaned from contemporary literature is that the debate should no longer exclusively focus on the size of public spending but also in the composition of that spending.

2. HEALTH SPENDING AND PRODUCTIVITY: THE MODEL

We develop an extension of the augmented Solow model in order to analyze the role of health spending and the composition of that spending with respect to output. Public health spending is considered both as consumption spending and investment spending according to the OECD classification. (OECD, 1998) However, given that both types of expenditure go to form capital, we may consider investment spending simply as a type of physical capital whilst current spending may be considered quite simply as investment in human capital.[1] We use the terms "physical health capital" and "human health capital" therefore, in order to refer to capital health spending and current health spending respectively.

The extension of the model which is very similar to that of MRW (1992) incorporates the idea of human capital in its widest sense, using education and health spending in order to explain variations in productivity. The Solow model takes as its starting point the Cobb-Douglas production function, characterized initially by a technology which increases work-efficiency and is identical for all regions

$$Y(t) = K(t)^{\alpha} E(t)^{\beta} H_h(t)^{\eta} H_{ph}(t)^{\gamma} (A(t)L(t))^{\mu}, \qquad (1)$$

where $\mu = 1 - \alpha - \beta - \eta - \gamma$.

Y represents aggregate output, *K* the stock of physical capital, *L* labor and *A* the level of technology; *E* and *H* are variables which express human capital where: *E* is the stock of education and *H* is the stock of health. Health capital is used as a proxy of health status and is divided into human health capital, H_h, and physical capital health, H_{ph}. We assume that *L* and *A* grow at exogenously given rates *n* and *g*, thus

$$L(t) = L(0)e^{nt},$$

$$A(t) = A(0)e^{gt}.$$

1 It might be assumed that the capital formation implies that some resources are saved for use later on, while consumption refers to immediate use. The model, however, treats both types of expenditure symmetrically.

The model assumes that output can be used for consumption of investment and a constant fraction of this is saved, thus giving rise to investment. If we normalize all the variables in terms of effective labor by dividing equation (1) by *AL*, this yields

$$\hat{y}(t) = \hat{k}(t)^{\alpha}\hat{e}(t)^{\beta}\hat{h}(t)_h^{\eta}\hat{h}(t)_{ph}^{\gamma}, \tag{2}$$

where $\hat{y} = Y/AL$, $\hat{k} = K/AL$, $\hat{e} = E/AL$ y $\hat{h} = H/AL$. The evolution of the economy is determined by

$$\dot{\hat{k}}(t) = s_k\hat{y}(t) - (n+g+\delta)\hat{k}(t), \tag{3a}$$

$$\dot{\hat{e}}(t) = s_e\hat{y}(t) - (n+g+\delta)\hat{e}(t), \tag{3b}$$

$$\dot{\hat{h}}_h(t) = s_h^h\hat{y}(t) - (n+g+\delta)\hat{h}_h(t), \tag{3c}$$

$$\dot{\hat{h}}_{ph}(t) = s_h^{ph}\hat{y}(t) - (n+g+\delta)\hat{h}_{ph}(t) \tag{3d}$$

Where n is the rate of population (labor) growth, g is the level of technological progress and δ is the rate of depreciation. Equations (2) and (3) imply that the economy converges to a steady state defined by $\hat{k}^*$, $\hat{e}^*$, $\hat{h}_h^*$ and $\hat{h}_{ph}^*$. We assume that the same production function applies to human capital, physical capital and consumption. In addition, and in accordance with MRW (1992), we assume that human capital depreciates at the same rate as physical capital. In order to simplify the analysis we assume that maximizing companies compete for the available physical and human capital until the net marginal product for the two rates of capital is the same. This implies that the quantity of human capital will be proportional to the quantity of physical capital and thus the dynamic for the accumulation process will be the same for both types of capital.

Taking the logarithms of (2) we reach the equation for the steady state

$$\ln \hat{y}^* = \alpha \ln \hat{k}^* + \beta \ln \hat{e}^* + \eta \ln \hat{h}_h^* + \gamma \ln \hat{h}_{ph}^* \tag{4}$$

Substituting the steady state values of $\hat{k}^*$, $\hat{e}^*$ $\hat{h}_h^*$, and $\hat{h}_{ph}^*$ into the logarithm of the production function defined in (4) and then simplifying we derive the steady state level for income in units of effective labor as

$$\ln \hat{y}^* = \frac{\alpha}{\mu}\ln s_k + \frac{\beta}{\mu}\ln s_e + \frac{\eta}{\mu}\ln s_h^h + \frac{\gamma}{\mu}\ln s_h^{ph} - \frac{1-\mu}{\mu}\ln(n+g+\delta) \quad (5)$$

Equation (5) defines the steady state of income per efficiency units as a function of the rate of investment in physical capital, the rate of investment in health, the rate of investment in educational attainment and the rate of population growth. Health spending is used as a proxy for health status and average years of schooling as a proxy of education levels. Since the data used with respect to education is expressed in levels rather than rates, equation (5) must be adapted.

Starting from equation (5) therefore, and taking into consideration the steady state of $\hat{k}^*$, $\hat{e}^*$, $\hat{h}_h^*$ and $\hat{h}_{ph}^*$ we obtain the output as a function of the rate of investment in physical capital, of the rate of investment in health, of the rate of population growth and of education levels. From $\hat{k}^*$ we reach

$$\ln s_e = \frac{\mu \ln \hat{e}^* + \ln(n+g+\delta) - \alpha \ln s_k - \eta \ln s_h^h - \gamma \ln s_h^{ph}}{\mu + \beta} \quad (6)$$

By substituting (6) into (5) we can rewrite the expression for output in terms of effective labor in the steady state and thus obtain equation (7) as

$$\ln \hat{y}^* = \frac{\alpha}{\mu+\beta}\ln s_k + \frac{\beta}{\mu+\beta}\ln \hat{e}^* + \frac{\eta}{\mu+\beta}\ln s_h^h + \frac{\gamma}{\mu+\beta}\ln s_h^{ph} - \frac{1-\mu-\beta}{\mu+\beta}\ln(n+g+\delta) \quad (7)$$

Loglinearizing a Taylor expansion in the steady state we can analyze the convergence process via the following expression:

$$\frac{d \ln \hat{y}(t)}{dt} = \lambda(\ln \hat{y}^* - \ln \hat{y}(t)), \quad (8)$$

where $\lambda = (n+g+\delta)(1-\alpha-\beta-\eta-\gamma)$ determines the rate of convergence. This equation implies that

$$\ln \hat{y}(t_2) = \left(1-e^{-\lambda\tau}\right)\ln y^* + e^{-\lambda\tau}\ln \hat{y}(t_1), \tag{9}$$

Where $\hat{y}(t_1)$ is effective per worker income at an initial moment in time and $\tau = (t_2 - t_1)$. Subtracting $\ln \hat{y}(t_1)$ from both sides we obtain the following convergence equation

$$\ln \hat{y}(t_2) - \ln \hat{y}(t_1) = (1-e^{-\lambda\tau})\ln \hat{y}* - \left(1-e^{-\lambda\tau}\right)\ln \hat{y}(t_1) \tag{10}$$

Substituting (8) into the steady state of $\hat{k}^*$, $\hat{e}^*$, $\hat{h}_h^*$ and $\hat{h}_{ph}^*$ we obtain the long run evolution of income which may be expressed in the following way

$$\ln\left(\frac{\hat{y}(t_2)}{\hat{y}(t_1)}\right) = \ln \hat{y}(t_2) - \ln \hat{y}(t_1) = (1-e^{-\lambda\tau})\frac{\alpha}{\mu+\beta}\ln s_k + (1-e^{-\lambda\tau})\frac{\beta}{\mu+\beta}\ln \hat{e}*$$

$$+(1-e^{-\lambda\tau})\frac{\eta}{\mu+\beta}\ln s_h^h + +(1-e^{-\lambda\tau})\frac{\gamma}{\mu+\beta}\ln s_h^{ph} - (1-e^{-\lambda\tau})\frac{1-\mu-\beta}{\mu+\beta}\ln(n+g+\delta)$$

$$-(1-e^{-\lambda\tau})\ln \hat{y}(t_1) \tag{11}$$

3. DATA AND RESULTS

The estimations in this study have been carried out using a sample from 24 OECD countries for the time period 1960-1990. The OECD countries were chosen for a variety of reasons. Firstly, only the OECD countries provide good quality, detailed health data. Secondly, we are particularly interested in analyzing the effect of higher levels of human capital on increased productivity for those countries with high levels of welfare and per capita income. The analysis itself was cross-section rather than panel data since there would have been problems with availability for some variables.

The estimation of the model was carried out using data from different sources. Per worker GDP and the investment rate with respect to GDP were obtained from the Summers-Heston data set (1991) which is a source of data which is often used in empirical growth studies. Both variables are expressed in terms of purchasing power parities and at 1985 prices.

The information which refers to education was obtained from Kyriacou (1991) and uses the average schooling years for the working age population as a proxy. The data, which refers to both the labor force and health spending was obtained from OECD (1998). In accordance with most studies of this kind, we assumed that the rate of physical capital depreciation, δ, is 0.03 and that the technical progress, g, is 0.02. (ROMER, 1989, p. 60; MRW, 1992, p. 412; ANDRÉS *et al*. 1993, p. 16) Publicly financed health spending was expressed in terms of GDP and divided into human and physical capital spending.[2] In every case the variables were expressed in purchasing power parities at 1985 prices. The variables, investment rate, education, labor force and health capital are the mean values for the period being studied.

With the object of analyzing how the composition of health capital affects variations in output, we carry out different estimations of income for the initial year, the rate for physical capital, the population growth rate, and education and health with respect to variations in per worker GDP. All the regressions consider the idea of human capital in its broadest sense, that is, they take into account both education and health jointly. In Table 1 we present different versions of the model. Column 1 gives the results in which the variable total spending is expressed as a proportion of GDP and the resultant coefficient is 0.22, which is statistically significant. The coefficients for physical investment and for education are also significant taking values of 0.33 and 0.20 respectively. Column 2 looks at the composition of health spending and a distinction is made between human and physical health capital. The results reflect a significant positive effect for human health capital while the reverse is true for physical health capital which has a non-significant effect. These results are analyzed individually in column 3 where we consider human health capital on its own and which positively influences output variation when the value of the coefficient remains the same. Column 4 confirms that physical health capital fails to significantly affect output

2 According to the OECD (1998), public expenditure on health refers to: a) general current government expenditure on health care, which includes government or social security transfer for medical care and final government consumption on health, b) government investment in hospitals, dispensaries, etc. and the capital transfers. These two classifications correspond to the variables human health capital and physical health capital respectively.

and the coefficient obtained is therefore non-significant. The coefficients for all the estimations for investment and education remain within the range of values generally accepted in the literature.

TABLE 1 - HEALTH SPENDING AND ITS COMPOSITION. OECD, 1960-1990

	Human capital	Composition of health spending		
Observations	(1)	(2)	(3)	(4)
CONSTANT	5.73	6.11	6.1	4.55
	(8.51)	(7.44)	(6.45)	(4.76)
ln *y(0)*	-0.59	-0.64	-0.64	-0.54
	(-18.35)	(-11.50)	(-10.48)	(-11.12)
ln $(n+g+\delta)$	-0.45	-0.49	-0.52	-0.40
	(-2.42)	(-2.26)	(-2.38)	(-1.89)
ln s_k	0.33	0.30	0.31	0.36
	(2.51)	(2.79)	(2.56)	(2.61)
ln e^*	0.20	0.20	0.19	0.26
	(4.52)	(3.09)	(3.13)	(4.79)
ln s_h	0.22	-	-	-
	(2.40)			
ln s_h^h	-	0.25	0.25	-
		(1.84)	(1.87)	
ln s_h^{ph}	-	0.025	-	0.024
		(0.68)		(0.78)
R^2	0.88	0.88	0.88	0.86
SE	0.11	0.11	0.10	0.11

Note: The dependent variable is the log difference of per worker GDP, 1960-1990. *y(0)* is per worker GDP in 1960. The estimation is by MCO using White´s covariance matrix. *t*-statistic heterocedasticity robusts are in parenthesis. R^2 is the adjusted R-squared. SE is the standard error of the regression. The sample includes 24 countries.

We next reestimate the model using two-stage instrumental variables (IV) to derive consistent coefficient estimates.[3] If the causation between health and income runs in both directions it implies that the regressor and the disturbance term are correlated. Hence the estimation by OLS would yield inconsistent estimates of the structural parameters. The null hypothesis that health

3 For an analysis of the causal relationship between health and income see CURRAIS AND RIVERA (1999b).

expenditure is exogenous to income is tested by including the residual from the first-stage regression as a covariate in the second-stage equation and by then testing its significance. (HAUSMAN, 1978) We use different instruments as exogeneous determinants of health capital. We need variables that are determinants of health capital but exogenous with respect to income growth. We used as instruments the variables doctors per inhabitant and consumption of medicines.[4] We use an F-test of the significance of the instruments in the first-stage regression to check that their correlation with health expenditure is strong, since this is an indispensable condition for good IV estimates. The identifying instruments are strongly jointly significant in the first-stage, indicating that the IV parameter estimates are consistent if the exclusion restrictions are valid. The instrument set achieves significance at the 5% level. The effect of health capital produces the expected behavior which is in accordance with the previous regressions and which increases slightly in magnitude after instrumenting (the value of the coefficient obtained via the estimation of instrumental variables is 0.27 (t=2.03)). The values obtained by using the Hausman test negate the exogeneity hypothesis with a probability of 0.054.[5]

Table 2 gives the estimations of the equation wherein there is the added restriction that the coefficients $\ln s_k$, $\ln e^*$, $\ln s_b$, $\ln s_h^h$, $\ln s_h^{ph}$ and $\ln(n+g+d)$ add up to zero. The theoretical restriction is accepted by the data, as the p-value indicates, and we again find that the results are within the range of values usually found in similar literature. The coefficients reinforce the hypothesis that human health capital exerts a positive significant influence while physical health capital does not appear to be a factor which determines variations in output. The first variable, contributes increasing levels of human capital through the positive effect it influences on health status. This effect is not noticeable when we consider physical capital.

The result itself is in line with much of the findings in current literature (see ASCHAUER, 1989a; MUNNEL, 1992; and MAS *et al*., 1994 for a review). These studies are non-significant with respect to what is termed non-productive social capital, estimated via the stock of capital in education. In this sense, as

4 The variables were obtained from OECD (1998). They are expressed as mean values for the period 1960-1990.

5 Available from the authors on request.

Drucker (1989) suggests, both the education and health infrastructures may be important factors in the geographical location of industry having a more highly qualified labor force and augmenting the quality of human capital. The influence of these factors, however, would of course be felt somewhat later than those of other infrastructures and consequently it is more difficult to capture and measure their effects. As regards health spending, this is principally consumer spending and only about 3% of total spending goes towards physical capital in the OECD countries for the year 1995. (OECD, 1998)

TABLE 2 - RESTRICTED REGRESSION. TEST OF THE CONDITIONAL CONVERGENCE

	Human Capital	Composition of health spending		
Observations	(1)	(2)	(3)	(4)
CONSTANT	4.26	5.67	5.67	4.24
	(5.69)	(7.12)	(6.56)	(6.21)
ln $y(0)$	-0.56	-0.65	-0.64	-0.55
	(-8.64)	(-10.57)	(-9.81)	(-10.45)
ln s_k-ln $(n+g+\delta)$	0.32	0.28	0.27	0.31
	(2.38)	(2.58)	(2.25)	(2.32)
ln e^* -ln $(n+g+\delta)$	0.18	0.17	0.17	0.24
	(4.61)	(3.21)	(2.99)	(5.47)
ln s_h – ln $(n+g+\delta)$	0.20	-	-	-
	(2.34)			
ln s_h^h - ln $(n+g+\delta)$	-	0.24	0.24	-
		(1.85)	(1.99)	
ln s_h^{ph} - ln$(n+g+\delta)$	-	0.024	-	0.024
		(0.65)		(0.73)
R^2	0.88	0.88	0.88	0.87
Test of the restriction				
p-value	0.24	0.52	0.51	0.15
SE	0.11	0.11	0.10	0.11

Note: The dependent variable is the log difference of per worker GDP, 1960-1990. $y(0)$ is per worker GDP in 1960. The estimation is by MCO using White´s covariance matrix. t-statistic heterocedasticity robusts are in parenthesis. R^2 is the adjusted R-squared. SE is the standard error of the regression. The sample includes 24 countries.

Although the results which are obtained seem to confirm the positive effect of human health capital on productivity, this does not imply that an indiscriminate increase in this kind of spending is justified. In this sense, research into relationship between income and health based on country level data are in accordance with the evidence of bounded health gains in health status and also with the convergence of health indicators among countries.[6] Therefore the relationship between health expenditure and the population's health changes for high levels of health, and other factors such as the distribution of spending, life style etc., play an important role in the health levels of population. This is especially true in the rich countries. Tests of the hypothesis need to be specified in the context of an explicit model of the determinants of individual health, which takes account not only health expenditure but also other determinants of individual health. Estimated aggregate level relationships do not appear to be robust to the specification of these functional forms. This relationship can only be tested using individual level data, which makes comparison among countries difficult.

CONCLUSIONS

The way and the extent to which public spending contributes to economic growth have been and remain a source of contentious debate for economists. The various studies carried out which attempt to analyze the effects of the increase in the weight of the public sector, obtain divergent results. This divergence seemingly depending on the territorial or geographical nature of the sample and how it is broken down, the time period under consideration, and the techniques used in the estimations. It is perhaps a little surprising therefore that in spite of the obvious contribution of the health service to social well-being, the effect of health capital on economic growth has not been studied in great depth. Our aim therefore has been to develop a model capable of explaining variations in productivity, in which health spending is incorporated within a neoclassical Solow growth model. The model adopts health spending as a further independent variable, which, along with education, constitutes a broad measure of human capital. This study goes a step further in that it tries to focus not only the importance of health capital as whole, but also goes on to draw a distinction between human and physical health capital thus highlighting the importance of the composition of health capital.

6 The behavior of bounded gains is discussed in PRICHETT and SUMMERS (1996) and widely analyzed in KAKWANI (1993). Other evidence in health levels among countries is presented in INGRAM (1992), BARRO and SALA (1995) and CURRAIS and RIVERA (1997).

The model is estimated for the OECD countries for a time period of 30 years and by means of a cross-section analysis. We conclude that health capital exerts a significant positive influence, thus justifying its inclusion within the model. On taking into consideration the composition of health capital we find evidence to support the hypothesis that human health capital has a significant effect on output while physical health capital on the other hand, affects output non-significantly.

There is much empirical evidence to suggest that health investment does not significantly affect economic growth and that health spending may be categorized along with other social investment as a non-productive investment. Nevertheless, given the results obtained, we should underline the importance of the distinction between the composition of health capital especially with respect to their impact on, and implications for public policy. The positive effect of good health, in terms of human capital accumulation, seems to be reflected in human health capital which behaves differently from other types of spending such as spending on infrastructures.

We should point out that these conclusions ought to be interpreted with a certain amount of caution. It might be prudent to state that the relationship should not lead us to believe that indiscriminate increases in health capital will produce ever greater levels of productivity. Taken as a whole the results appear to underline the necessity of considering the health services contribution to increased economic growth via its influence on human capital. The accuracy of any analysis which omitted this variable therefore, would be open to question.

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