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Investigating the impact of health care spending on economic growth (28 OECD countries for 1990-2008)

WORK IN PROGRESS

Abstract

The determinants of economic growth have been of increasing interest for economists. Since the seminal works of Ramsey, Solow, Swan, Cass, and Koopmans on the neoclassical model, the concept of capital has been broadened from physical goods to include human capital in the forms of education, experience, and health status. Moreover, according to Barro and Alesina and Rodrick public expenditure has been of major influence on the economy's growth rate.

The purpose of this paper is to investigate the impact of health spending on economic development. Health spending influences economic growth through a double channel. On the one hand, health expenditure is a part of public expenditure and has a strong influence on GDP growth. On the other, health spending is a kind of investment in human capital, since there is a positive relationship between health status of an individual and his human capital.

In this paper panel data estimation is employed for 28 OECD countries for the time period 1990-2008. Because the lagged GDP growth is considered to affect the current GDP change, the dynamic Arellano-Bond estimator was used. Moreover, to assess the estimations robustness a sensitivity analysis was followed and seven separate panel regressions were run. According to the findings, an increase in health expenditure may cause a slight but significant decrease in growth, fact that does not change throughout the analysis.

Literature review

The determinants of economic growth have been of increasing interest for economists. Since the seminal works of Ramsey (1928), Solow (1956), Swan (1956), Cass (1965), and Koopmans (1965) on the neoclassical model, the concept of capital has been broadened from physical goods to include human capital in the forms of education, experience, and health status. Moreover, according to Barro and Alesina and Rodrick public expenditure has been of major influence on the economy's growth rate.

Health spending, which is a significant part of a country' public expenditure, is found of major importance on economic development, as it influences it through a double channel. On the one hand, health expenditure has a strong influence on GDP growth. On the other, health spending is a kind of investment in human capital, since there is a positive relationship between health status of an individual and his human capital.

According to Barro's empirical analysis on 100 countries between 1960- 1990 (1996), an extended neoclassical model is utilised to investigate the determinants of growth rates. As the results imply, for a given starting level of real per capita GDP, the growth rate is enhanced by higher initial schooling and life expectancy, lower fertility, lower government consumption, better maintenance of the rule of law, lower inflation, and improvements in the terms of trade. Life expectancy, which was mentioned previously, is used as a proxy for the population's overall health status. To be more specific, the resulting coefficient is 0,042.

Caselli , Esquivel and Lefort (1996) using the GMM (Arellano and Bond) estimation assess the impact of life expectancy, schooling, GDP, existence of political revolutions and black market premiums on growth rates in 91 countries between 1960 and 1985. However, their results indicate a zero growth effect of increasing life expectancy.

Sachs and Warner's (1997) paper offers some econometric evidence regarding the sources of slow economic growth in Sub-saharan Africa during the period 1965-1990, based on a cross-country OLS regression. According to the findings Africa's slow growth is explained by a number of factors, like initial real GDP, openness to international trade, tropical climate, life expectancy, land-locked waters, government savings, institutional quality, natural resource abundance and differential growth in the economically-active population, that represents the difference between the growth rate of the working-age and the growth rate of the whole population. According to the findings a 5 year increase in life expectancy raises growth rates by 6%.

Another study examining the impact of health, in terms of life expectancy, on economic growth is this of Bloom and Williamson (1998). Their econometric analysis is based on 78 Asian and non Asian countries from 1965 to 1990. In the OLS regression which is employed growth rate of real GDP per capita is regressed on a number of explanatory variables. The impact of life expectancy on economic growth is of positive sign and significant. Similar results are drawn from the Bloom, Sachs et al. (1998) study of African countries.

Moreover, Bloom, Canning and Sevilla (2004) estimate a production function model of aggregate economic growth for a panel of countries observed every 10 years over 1960–90. Their main finding is that health has a positive and statistically significant effect on economic growth. It suggests that a one-year improvement in a population's life expectancy contributes to an increase of 4% in output. By controlling for workers experience, they argue that the life expectancy effect in growth regressions appears to produce a real labour productivity effect, and is not the result of life expectancy acting as a proxy for worker experience.

Agenor (2008) examines the optimal allocation of government spending between health and infrastructure in an endogenous growth framework where public spending is an input in the production function of goods as well as health services. The amount of effective labour services that a worker can provide is assumed to be proportional to his average health, which is proportional to the total amount of health services produced in the economy. Thus, by enhancing the productivity of individuals, health influences growth directly, in addition to affecting individual welfare. Infrastructure services, on the other, affect the production of goods and the provision of health services. Therefore it is crucial for the government not only to spend on health, but also on infrastructure. The analysis also reveals that there is a trade-off in increasing public spending on infrastructure: it leads to an increase in the provision of infrastructure services to production of both goods and health services, which increases growth, but it also lowers resources allocated to health and lowers productivity, which in turn lowers growth. So, if public infrastructure is sufficiently productive in the health production, the positive effect of an increase in infrastructure expenditure can outweigh the negative effect of lower spending on health services and growth.

Aisa and Pueyo (2005) examine the relationship between public health expenditure and growth using longevity as an endogenous variable for their model. Their idea is

that finance of more public health services can increase life expectancy levels, which in turn can affect individuals' willingness to save and thus establish a positive linkage between government spending and economic growth. Their theoretical model, however, shows that the public expenditure on health has two opposite effects. The first is that by lengthening life, it promotes saving and encourages growth. The other is that the resources devoted to health are to the detriment of capital accumulation, which reduces growth. The first effect is probably predominant in developing countries, where life expectancy is short and public spending is very effective against death. Contrary, in developed countries, where life expectancy is high spending, further efforts in public health spending can have a negative effect on growth.

Bhattacharya and Qiao (2006) as well, introduce endogenous longevity into an overlapping generations' model with capital. In their model, individuals can privately invest in their longevity by expenses funded from their wage. Such private health investments can be more efficient if they are complemented by tax-financed public health programs. This dynamic complementarity between public health programs and private efforts to improve health and longevity is of major interest in this study. The authors indicate that this presence of the public input in private longevity exposes the economy to aggregate endogenous fluctuations and unavoidable volatility.

Beraldo et al. (2009) in their paper try to test whether countries that devote a larger amount of resources to the consumption of health and educational services experience higher growth rates. They also investigate whether the effects on economic growth of public expenditure in health and education differ from those of private expenditure, based on a panel of 19 OECD countries observed between 1971 and 1998. The estimated coefficient for total health expenditure revealed that a 1% increase in the total health expenditure growth rate would increase the per capita GDP growth rate by about 0,06%. The results also reveal that the coefficients for the two types of expenditure have a different magnitude. In particular, the coefficient associated of public expenditure was found greater than that of private expenditure and statistically significant. Moreover, the estimated positive impact of spending is stronger for health than for education. All these results appear to be robust after controlling for short term business cycles fluctuations, the institutional settings, the potential endogeneity of welfare expenditures, and reverse causality.

Devarajan et al. (1996) in their theoretical model, investigate the conditions under which a change in the mix of public spending could lead to a higher steady-state

growth rate for the economy. These depend not just on the physical productivity of different components of public spending but also on the shares of government expenditure allocated to them. Furthermore, the authors use annual data on 43 developing countries from 1970 to 1990 to examine the relationship between the components of government expenditure and economic growth and verify the validity of their theoretical findings. The pooled data they use include total government expenditures, expenditures for defence, education, health, and transport and communication. The last variable is used as a proxy for expenditure in infrastructure. The key explanatory variable is the share of each component in total government expenditure. Given that the pattern of economic growth has been uneven across the continents, the authors also include continent dummies to control for the continent-specific effect. In addition, they control for level effects, external shocks and other domestic policies. The dependent variable is the five-year forward moving average of per-capita real GDP growth. This number of lags is chosen to reflect the fact that public expenditures often take time before their effects on output growth can be registered. According to the OLS results, the share of capital, transport and communication, health, and education spending had either a negative or insignificant relationship with economic growth. The only broad category which was associated with higher economic growth was current expenditure. These results are in line with the theoretical model, which advocates that seemingly productive expenditures may be unproductive if there is an excessive amount of them.

Gupta (2010) pays special attention to the role of health capital, public infrastructure and environmental pollution in a model of endogenous growth. In the model which is developed, environmental quality and health capital is treated as accumulable inputs. According to the results, the optimum ratio of combined public expenditure on infrastructure and health to national income is equal to the sum of the competitive shares of public infrastructural input and health capital in the unpolluted output of the final good and hence this ratio varies inversely with the level of pollution per unit of production. By analysing the model's transitional dynamics, the author finds that the possibility of indeterminacy in the transitional growth path converges to the balanced growth equilibrium point, while the balanced growth rate in the market economy in this model is not necessarily less than the socially efficient growth rate. However, this model rules out many aspects of reality and thus needs to be revised.

Baltacci et al. (2007) using also an endogenous growth model investigates the impact of spending on social indicators and growth. In their model, health depends on fertility, health spending, income level, urbanization level, governmental policies and other institutional factors approximated by the authors through gender equality. A panel dataset for 118 developing countries from 1971 to 2000 is compiled so as to simulate the effect of spending on social indicators (investment, education, health) and development. As the findings imply, the level of education capital and its changes contribute positively to economic growth. The impact of health capital on growth, however, differs from that of education capital. Changes in the health capital indicator positively affect growth but the coefficient on the level of health capital is insignificant. Furthermore, health capital affects in a positive way investment and education and is positively related to the amount of health expenditure.

Hartwing (2010) uses a panel Granger causality framework to examine whether health capital formation fosters economic growth in rich OECD countries. Against the existing literature on health and growth, no evidence is found that health capital formation Granger-cause per-capita GDP growth with a positive sign. Hartwing provides three possible explanations for this surprising finding. First, maybe the growth effects of shocks to health capital formation are only short-lived. Or maybe the relevant time-lags used in this paper are too long to be able to capture this relationship. According to the third explanation, the effects may indeed be zero and people might care about health mostly from a welfare point of view and not for the economic returns.

Bhargava et al (2001) attempt to investigate the determinants of economic growth, focusing especially on variables that approximate health of the population for 92 countries at 5-year intervals. The model the author used is similar to Barro's (1997). As the empirical results imply economic growth is positively affected by investments in physical capital. Moreover, the lagged adult survival rate and the interaction between it and GDP are significant predictors of economic growth. When adult survival rate is replaced by life expectancy in the model, the results is similar, though the first variable provids a better fit.

Li and Huang (2009) utilise the augmented Mankiw, Romer and Weil's model to examine the relationship between per capita real GDP growth and the physical capital, human capital, and health investment, using panel data models on Chinese provincial data from 1978 to 2005. For analysis purposes, health investment is approximated by

the number of hospital beds per 10,000 persons and by the number of doctors per 10,000 persons. According to the findings, investment rate and the lagged real GDP have significant positive effects on growth. Health and investment in education are also found to affect economic growth in a positive way, while the interaction of health and education stock do not reduce their impact on growth, indicating the existence of a possible trade-off between these two forms of human capital investment. On the other, the workforce growth has a negative effect on economic growth.

Van Zon and Muysken (2001) in their analysis introduce longevity in the basic Lucas model of endogenous growth, so as to catch the impact of ageing on growth and welfare. In their analysis, good health is a necessary condition for people to be able to provide labour services. At the same time, health is produced under conditions of decreasing returns, whereas human capital is produced under conditions of increasing returns. The efficiency of the decreasing returns health sector is considered of major importance for economic performance, since its activity level defines the availability of human capital within the economy. Moreover, the influence of the decreasing returns nature of the health sector on growth could well explain the productivity slow-down. This is because, as the preference of ageing population for a good health rises with the standard of living, then growth would automatically slow down. However, next to being substitutes, health and economic growth could as well become complements. This could become, because the inputs of human capital and labour into the production process depend on the individuals' health status. The authors also pay special attention to the fact that the average age of the population in Western European countries has risen during the last decades. Motivated by this, they assume that the active population determined labour supply, while the total population determines the scale of the demand for health-services. Hence, technological breakthroughs in medicine could be expected to boost overall productivity, raise longevity and thus provide a brake on productivity growth.

Narayan (2010) also investigates the relationship between health and economic growth for 5 Asian countries using panel unit root, panel cointegration with structural breaks and panel long-run estimations for the period 1974–2007. For analysis reasons, investment, exports, imports, and research and development are included in their growth model. According to the findings, per capita income, health, investment, exports, and imports are cointegrated; per capita income, health, education, and investment are cointegrated and per capita income, health, education, R&D, and

investment are cointegrated. Furthermore, while in the long-run health, investment, exports, R&D and the interaction between R&D and education influenced positively per capita income, imports have a statistically significant negative effect on it and education has a statistically insignificant impact on income for the whole panel.

Osang, Ans and Sarkar (2008) examine the growth and welfare effects of lifetime-uncertainty in a model of endogenous growth augmented with human capital. This is achieved by simultaneously including in an overlapping generations' model with finite-lived households, two forms of government investments (in education and health). For analysis purposes, they use three different models, that differ with respect to the mode of financing of education. In their benchmark model, the most general form of human capital accumulation function is used requiring both private and public spending. In the public education model, the government is the sole provider of education, while private individuals are the sole providers in the private education model. An important result of the paper is that the public education model produces results that are inferior to both the benchmark and the private education model. For a fixed income tax rate, long-run growth, interest rates, and the ratio of human-to-physical capital are all lower in the public education model than in the other two models, while longevity and welfare are highest in the private education model and lowest in the public education model. The poor performance of the public education model is due to the fact that the government could not raise the funds needed to run both a public health and a public education system. By endogenizing the income tax rate, the findings reveal that the welfare-maximizing tax rates are more than three times higher in the public education model compared to the benchmark model. In addition, a comparison of welfare levels based on second-best tax rates indicates that the welfare ranking of benchmark versus public education model depends on the size of government spending on education and health. For high levels of public spending on education relative to health, the public education model is welfare superior, while the reverse is true for low public education spending. For this reason, a government that cares about longevity, welfare, and long-run growth should encourage private participation in funding of education, thereby freeing up public funds for the provision of health care and related services.

Sanso and Aisa (2005) adopt a dynamic general equilibrium model, augmented with human capital, innovation in medical technology, health and longevity, in order to identify the relationship between longevity and economic growth. According to the

analysis, individuals decide on both their quality and quantity of life. By doing so, the need to offset the biological deterioration process, enforces medical research at a rate that fits exactly with the rate of deterioration and thereby improves the health conditions of future generations. As a result, individuals' productive capacity improves and economic growth takes place, generating a sufficient amount of resources for the financing of medical research and health expenditure. At the same time, medical and economic progress determines a constant stationary longevity, which can be expanded with changes in individual preferences related to the own consumption elasticity of the utility function, the discount rate of the descendants' utility, or the degree of patience. An increase in any of these three elements would increase life expectancy, in such a way that individuals would choose to extend their education period, which would itself enhance the stock of human capital and, hence, the output level of the economy.

Finally, Gyimah, Brempong and Wilson (2004) investigate the effects of health capital on growth in 21 Sub-Saharan African countries over a 20-year period and 22 OECD countries over a 35-year period. The authors use the Solow model and panel data analysis to find that the stock of health human capital has a positive and significant effect on the growth rate of per capita income in a quadratic way in both samples. This means that increases in health capital lead to increases in growth, but the marginal effect of the growth impact of health capital decreased at relatively large endowments of health stock. According to the results, 22% and 30% of the transition growth rate of per capita income in Sub-Saharan African and OECD countries respectively can be attributed to health. Moreover, the structure of the relationship between health capital and growth in Sub-Saharan African countries is similar to that in the OECD countries and any cross-country differences in income levels were found to be positively correlated with cross-country differences in the stocks of health capital.

Econometric analysis for 28 OECD countries on the determinants of health expenditures, 1990-2008.

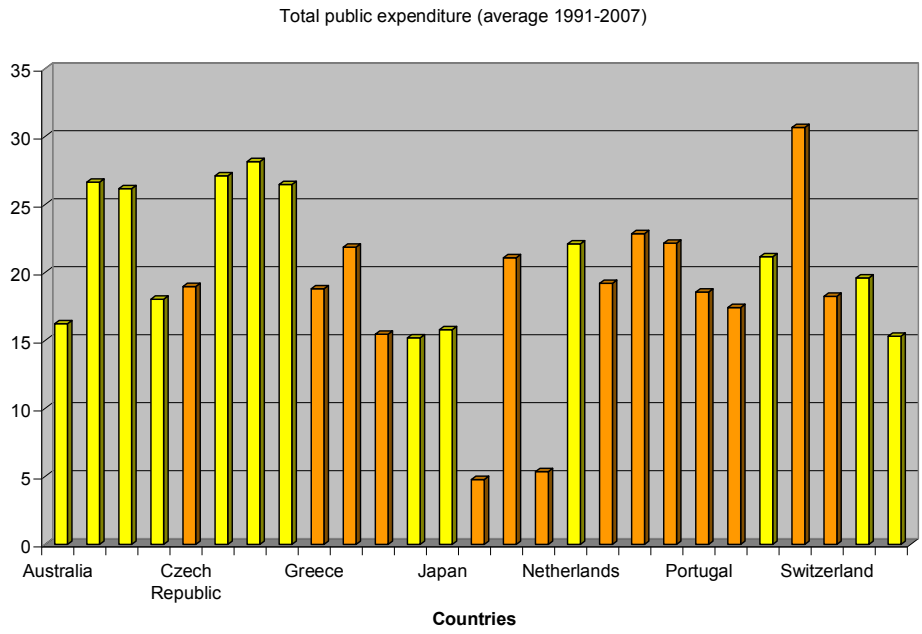
In our analysis, the relationship between health expenditure and economic growth was estimated utilizing a dynamic panel data set including 28 OECD countries for 1990-2008. Economic growth was approximated by the annual percentage change in GDP, while the explanatory variables were: the lagged imports (%GDP), gross fixed capital

formation (%GDP), final consumption expenditure (%GDP), the country's savings (%GDP), the GDP deflator and the annual percentage change in total health spending. Because the lagged GDP growth is considered to affect the current GDP change, the Arellano-Bond estimator was employed. Moreover, to assess the estimations robustness a sensitivity analysis was followed and seven separate regressions were run. In the first of these, the annual GDP growth was regressed on the lagged GDP growth and the current change in total health spending. According to the findings, economic growth is boosted by previous year's growth but hampered by increases in health expenditure. Adding in the control variables the final consumption expenditure does not change the previous findings. However, GDP growth is found to decrease as consumption of goods increases. At a next step, capital formation is also found to affect economic growth in a positive way. On the other, as expected, when inflation is added in the control variables a negative effect on growth is observed. The lagged imports in the sixth regression are also to the detriment of GDP growth, while the effect of national saving in the last regression was found to have a positive impact on growth. The surprising finding in our analysis, however, is the negative coefficient of health spending that does not change throughout the sensitivity analysis. It is found that an increase in health expenditure may cause a slight but significant decrease in growth. This result is in accordance with the findings of Hartwing (2010), Aisa and Pueyo (2005) and Devarajan et al. (1996), whose studies indicate a negative or zero effect of health spending on GDP growth.

Discussion

The negative relationship between health care spending and economic growth can be explained in various ways. To understand it, it would be useful to divide the countries under consideration in two groups. In the first medicine producing countries are included. These are: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Japan, Netherlands, Spain, UK and USA. The rest countries are the group of non medicine producers. According to the first explanation, in the medicine producing countries an important amount of public spending is devoted to health and GDP growth is boosted through pharmaceutical production. However, in some of these countries total public expenditure is excessive. To finance such a high spending, countries are forced to borrow money at a high interest. If their annual growth rate is inferior to the interest rate, GDP growth is hampered and the negative result is

predominant. In the following table average total public expenditure is presented for the 28 countries under consideration. The yellow bars indicate a medicine producing country and the orange bars a country that is not such a producer. As it can be seen, most of the medicine producing countries devote greater amounts in public expenses than their "non producing" counterparts.



A similar explanation may hold for the countries that do not have pharmaceutical production. These countries are forced to borrow in vulnerable conditions to finance their imports of health care goods. So, as previously, the higher the interest rate is, the more arduous the results to growth.

Moreover, in this group of countries, an important aspect in raising economic growth is undoubtedly health infrastructure. It promotes health capital and increases the country's product. Therefore, a significant amount of the publicly expended money should be used to infrastructure improvement and not solely to pharmaceutical or medical provision from abroad. Governments in these countries should not only care about health from a welfare point of view but also take into account the economic returns.

In order to verify empirically these notions, the OECD countries of the previous analysis are now divided in medicine producers and non medicine producers and separate dynamic panel regressions are run for each group. In the regressions, as previously in regression seven, the lagged growth, the lagged imports, gross fixed capital formation, final consumption expenditure, the country's savings, the GDP

deflator and the annual percentage change in total health spending were used as explanatory variables. According to the Arellano-Bond results, the impact of health expenditure on economic growth remains negative and significant in both groups. In particular, a percentage change in total health spending decreases growth by 0,123% in countries without pharmaceutical production and by 0,137% in the rest.

Conclusion

In this paper panel data estimation is employed for 28 OECD countries for the time period 1990-2008. Because the lagged GDP growth is considered to affect the current GDP change, the dynamic Arellano-Bond estimator was used. Moreover, to assess the estimations robustness a sensitivity analysis was followed and seven separate panel regressions were run. According to the findings, an increase in health expenditure may cause a slight but significant decrease in growth, fact that does not change throughout the analysis.