

40th Congress of the European Regional Science Association
August 29th -September 1st 2000, Barcelona

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A ROLE FOR DEFICIT IN ECONOMIC GROWTH

Abstract

Long-run economic growth arouses a great interest since it can shed light on the income-path of an economy and try to explain the large differences in income we observe across countries and over time. The neoclassical model has been followed by several endogenous growth models which, contrarily to the former, seem to predict that economies with similar preferences and technological level, do not necessarily tend to converge to similar per capita income levels. This paper attempts to show a possible mechanism through which deficit may hinder human capital accumulation and therefore economic growth. Taking deficit as an indicator for the presence of disequilibrium and inefficiencies in a country, we could think of it as a factor that could be reducing the effectiveness of time devoted to education and training. Following a simple growth model and allowing for slight changes in the law of human capital accumulation, we reach a point where deficit might sharply reduce human capital accumulation. On the other hand, a deficit reduction carried on for a long time, taking that reduction as a more efficient management of the economy, may prove useful in inducing endogenous growth. Empirical evidence for a sample of countries seems to support the theoretical assumptions in the model: (1) evidence on an inverse relationship between deficit and human capital accumulation, (2) presence of a strongly negative association between the quantity of deficit in the economy and the rate of growth. They may prove a certain role for budget deficit in economic growth.

Keywords: deficit, human capital accumulation, economic growth.

¹ I am deeply indebted to professor Enrique López-Bazo for his very helpful discussions and comments on earlier drafts.

1. Introduction

When thinking about the process of economic growth, one of the interesting features that arise is the wide cross-country dispersion in average growth rates. Which are the possible sources of the dispersion mentioned is both a key and broad question to be answered. At first glance, it seems easy to think that differences in economic policies that have been applied by each economy are likely to have generated some of this heterogeneity we can nowadays observe among countries. Devoting our attention to fiscal policy, one can think of its main objectives as being: (1) to provide public goods and services, (2) redistribute income in order to alleviate disequilibria that may arise due to market mechanisms, (3) use the budget to compensate for the cyclical fluctuations (Keynesian stance).

Closely related to fiscal policy there are the concepts of budget deficit and public debt. Economists have assured that public debt (like private) has sense depending on the objective money is used for. Running deficits due to something that is going to be used for a long time (e. g. infrastructures) could not be bad. However, when running them for something temporary, investing in wrong conceived projects, could be deleterious, especially when it is difficult to pay it back. Several countries have increased taxes and reduced their standard of living so as to pay back, which can be dangerous both for future growth and for their ability to ask for future loans. It may also impose borrowing constraints, as it has been the case of Mexico, Brazil, Argentina or Philippines, among others, in the 1980's.

We could view deficits as imposing a burden on future generations mainly in three different ways: (1) they could be seen as a direct transfer, which may impose a reduction on future generations consumption, (2) they can reduce investment in capital goods (crowding out effect) and hence negatively influencing future wages and productivity. Nevertheless, deficits at time t may not have any direct effect on government spending at t and hence no effect on short run interest rates. However, they do affect the levels of debt over time, influencing future short run interest rates and, in turn, current long run interest rates (via the term structure on interest), (3) it can increase external indebtedness. Instead of reducing investment, government may ask for loans to

other countries, which might reduce future standard of living since a part of future income must be devoted to repayment to foreigners.

The role of deficit and debt finance and its bearing on future generations has been of great concern to economists. Ricardo and Pigou advanced what could be called the classical doctrine of debt finance in a full employment economy. The Keynesian view added a new perspective and the nature of tax burden became subject to lively discussion. Modigliani (1961) argued that a permanent deficit translates into each generation, burdening the next one by bequeathing them a smaller aggregate stock of capital. In this sense, it decreases the utility level of future generations. The discussion has mainly focused on the validity of the Ricardian Equivalence hypothesis, which asserts that the mix of government debt and lump sum taxes to finance government expenditures has no distorting effects on the economy, at the expense of agents being perfect foresighters. Barro (1974) showed that government debt is neutral when private intergenerational transfers are positive and when the rate of growth is lower than the interest rate. Carmichael (1982) extended debt neutrality when the rate of growth is greater than the interest rate suggesting as sources of non-neutrality of public debt heterogeneous tastes and uncertainty. Besides, Drazen (1978) argued that when intergenerational transfers take the form of investments in human capital, government bonds might affect the equilibrium employment and increase welfare. By the first nineties, only Drazen had considered the consequences of deficit finance on human capital, since most of the papers on deficit were mainly centered on physical capital. This is an aspect that should be taken into account since, as Trostel (1995) says, recent research suggests that human capital is the most important component of national wealth², in line with Romer (1989), Benhabib and Spiegel (1994) or Temple (1999).

Huge and persistent budget deficits have also raised significant concerns about the long-run sustainability of fiscal policy. Several papers have dealt with sustainability of deficits: they believe that governments should not spend more than tax receipts, contradicting the Keynesian view, which argues that deficits could alleviate the down part of the business cycle. Following Trostel (1995), deficits may have very stimulative initial impacts on consumption, output, physical capital investment and work, that is

Keynesian type effects. However, he shows that the presence of human capital magnifies these short run effects as well as long run negative effects.

Besides, the presence of uncertainty, together with imperfection in credit markets, may introduce additional channels through which deficits can affect welfare. Given this, it should not be difficult to think that an important concern about deficit is the long-run effect that large series of budget deficit might have on macroeconomic stability. That is, a government running long-run expansionary policies or losing control of its actions may have destabilizing effects on GDP over time.

Our goal in this paper is to show that deficit may harm economic growth through the accumulation of human capital. We will model a mechanism through which deficit slows down human capital accumulation and so economic growth. We will apply a simple endogenous growth model where agents accumulate human capital by combining pre-existing human capital with their own time and other economic aspects. To achieve this objective, the rest of the paper is organized as follows. Section II carries out an assessment of the importance of the relation between human capital accumulation and deficit. The empirical evidence shows how deficit is negatively related to human capital and therefore to growth as well as how the presence of deficit could be one possible partial explanation for the bad performance of certain economies. Section III builds up the model and gets different possible equilibria depending on the initial conditions on deficit and human capital. It shows that deficit reduction could be a possible source for endogenous growth. Section IV carries on an empirical analysis using fiscal data for the period 1970-85 in the context of cross-section regressions. The results confirm the negative influence of deficit on human capital accumulation and economic growth. Finally, section V concludes and outlines some directions for future research.

2. Deficit and human capital

Generally speaking, there are three schools of thought concerning the economic effects of budget deficits: Neoclassical, Keynesian and Ricardian. The Neoclassical one envisions farsighted individuals planning consumption over their own life cycles. They

view budget deficits as a way to raise lifetime consumption by shifting taxes to subsequent generations. But higher consumption implies lower savings and thus interest rate must increase so as to bring back capital markets into balance. In this situation, crowding out problems may arise. Under the Keynesian view, an important percentage of the population is thought to be either myopic or liquidity constrained and deficits are seen as having beneficial consequences when appropriately timed. On the other hand, Ricardians consider deficit policy as a matter of indifference, posing their attention on altruistically motivated transfers. Diamond's (1965) paper was one of the first efforts to formally study the effects of budget deficits in the context of Neoclassical models. He argued that a permanent increase in the ratio of domestically held debt to national income depresses the steady state capital-labor ratio. Empirical evidence on economic effects of budget deficits is given by Barro (1989), who argues that they mainly support the Ricardian viewpoint³.

Over the 1970's and the 1980's, growth of public spending has generated large fiscal deficits in both industrial and developing countries. In several economies, further borrowing has no longer been a viable possibility, forcing the country to either decrease non-interest public spending or to increase taxes. Nevertheless, spending reduction, in most cases, has not followed efficiency considerations but political ones, resulting in a structure of public expenditures less conducive to growth, further depressing the economy. On the other hand, in low developed countries, increasing taxes is very difficult. Empirical evidence shows that attempts to increase taxes have not proved very successful. And what is more, when fiscal authorities have been able to increase taxes they have induced large distortions as well as a reduction in the growth potential of the country.

In words of Robert Lucas and Thomas Sargent (1981 pp. 295-296), "the lesson of the 1970's was that massive government budget deficits and high rates of monetary expansion were accompanied not by decreasing unemployment but by growing unemployment and growing inflation", thus worsening the economy even more.

Several papers have emphasized the role of deficit in real economic activity, like Eisner and Pieper (1988) and Boskin (1988), among others. Evidence on debt finance exerting a significant impact on the performance of certain economies, is given by Ihori

(1988), Tanzi and Blejer (1988), Eisner (1989) and van der Ploeg and Alogoskoufis (1994). More evidence on how deficit affects welfare is given in Hansson and Stuart (1987). There are also some authors who have tried to empirically test the relation between deficit and economic growth. Fisher (1993) found that larger budget surpluses were strongly associated with more rapid growth through greater capital accumulation and greater productivity. Easterly and Rebelo (1992) also found a consistent negative relation. Levine and Zervos (1992) created an index of macroeconomic policy and showed that growth was positively associated with large budget surplus and low inflation.

The relation between growth and deficit as pointed out by figure 1 is significantly negative. Thus, high deficit countries seem to face slow and poor growth performance. It reveals that there has not been possible for any country to grow fast when subject to high deficit values (see that the upper-west part of the figure is empty). We can also observe the presence of large dispersion that may be due to technological factors, monetary policy, etc. For instance, there are countries with low growth but not high deficit, like Uruguay or Yugoslavia; countries with high growth and high deficit, like Egypt; or countries with very high growth and low deficit, like Korea, Singapore or Malta. According to the negative relation, we can think of deficit to be one of the factors that may influence growth. On the other hand, the high dispersion shows that there are other factors that determine the rate of growth of a country, accounting for that dispersion.

Figure 2 plots human capital growth as the log-difference of 1970 and 1985 human capital against deficit. The graph seems to reveal no apparent relation. Despite this, according to the data, we could distinguish between two groups, one with high values for starting human capital, and another group of countries with very low values. Once we control for initial values of human capital, we get a significantly negative correlation between deficit and human capital growth, as plotted in figure 3. It relates human capital growth with deficit once we detract from the former the RHS of the regression of human capital growth against the initial value for human capital, in order to pin down the relation between deficit and human capital growth as explained by the empirical evidence. Again, dispersion deserves being mentioned as a characteristic of this relation. Although the general behavior seems to be clearly negative, we can

observe some countries performing very good at human capital accumulation despite their big deficit burden. They could probably be the ones whose starting level was very poor, like Israel, Nepal and Norway. We can also observe some countries with low values for human capital growth, like Pakistan, Thailand and Senegal, but not large values for deficit. Actually, there seems to be a strong negative relation between human capital growth and starting human capital, as depicted in figure 4. It shows what we could call a certain type of “convergence” towards a low value for human capital growth, once the country has achieved large values for human capital. In any case, we can think of dispersion as coming partly from factors like money devoted to education or disposable technology, among others.

Therefore, there seems to exist empirical, as well as theoretical evidence on the relevance of deficit on growth and specifically it seems possible that deficit slows down the accumulation of human capital. This could be a possible channel through which deficit negatively influences economic growth. That is what we will try to model in the next section.

Figure 1. Per capita growth versus deficit
DGDP=0.0267+0.1990 Deficit $R^2 = 0.213$
(0.0034) (0.0501)

Figure 2. Human capital growth versus deficit
DHuman=0.3870+0.2310 Deficit $R^2 = 0.000507$
(0.0699) (0.454)

Figure 3. Human capital growth versus deficit
Umcogh=0.0332+0.672 Deficit $R^2 = 0.0232$
(0.0336) (0.393)

Figure 4. Human capital growth versus initial human capital
DHuman=0.9260-0.4510 Human70 $R^2 = 0.815$
(0.0937) (0.0639)

Figure 2.
DHuman=0.3870+0.2310 Deficit $R^2 = 0.000507$
(0.0699) (0.454)

3. Model with deficit.

3.1. Putting down the model.

We will intend to analyze the effects deficit may have on the economy. Specifically, we will characterize it as a bug agent that slows down human capital accumulation and thus economic growth. Our last goal will be to try to explain how the presence of deficit may influence growth and be able to explain the existence of two different types of equilibria (one with a low level of education and a high level of deficit and another one with a higher education level and a lower value for deficit). We will do this within a framework where human capital accumulation depends positively on existing human capital following the formulation by Azariadis (1990, 1996) and negatively on deficit accumulated in the economy, when this one is huge. We will consider deficit as playing the role of a productivity parameter.

In order to formalize this argument, we will use a simple model where households choose their private consumption time path according to their preferences represented by the following utility function:

(3.1)

where C stands for private consumption; t , time; and ρ is the subjective discount rate. We will follow the literature and assume the utility function as having a constant intertemporal elasticity of substitution:

(3.2)

where $\sigma > 0$ and the elasticity of substitution is $\frac{\sigma}{\sigma - 1}$.

Households also choose the allocation of their time endowment between working hours supplied to firms in order to produce goods and time devoted to human capital accumulation. We will assume that they decide to devote a fixed amount of their endowment to training and education.

Human capital accumulation follows the following law:

(3.3)

where l represents the percentage of time individuals devote to their education coming from the maximization of their discounted permanent income; d is the level of deficit in the economy; d^p will be treated as the maximum level of deficit that does not exert a negative influence on human capital accumulation and subsequently on growth. Given that several of the papers that have dealt with deficit do not dismiss the possibility that small values of deficit might have a positive impact on growth (e.g. Fisher, 1993), we have tried to take this into account by naming this quantity as d^p . We will assume that this value depends on the characteristics of the economy. $F(H)$ is a function of the existing human capital stock; whereas δ is the depreciation rate for human capital. From the accumulation function for human capital, we may infer that the bigger the budget surplus, the larger the economic growth.

With the introduction of $F(H)$ we are assuming that existing human capital positively determines the accumulation of future human capital. The introduction of deficit intends to analyze how economic imbalances may somehow determine human capital accumulation when acting as a burden that hinders and slows down its accumulation, therefore influencing growth.

The functional form $F(H; \delta, l)$ will be characterized by the following conditions: $F(H) > 0 \quad H > 0$,

$F(H)$ being continuous over the whole domain

$\lim_{H \rightarrow 0} F(H) = 0$; $E \in (0, \infty)$

$F'(H) > 0$,

$F''(H) > 0$ for values of H such that $H \in (0, H^i)$

$F''(H) < 0$ for values of H such that $H \in (H^i, \infty)$

$F''(H) = 0$ for $H = H^i$

$F'''(H) > 0$, depending on the values of H .

$F(H)$ satisfies [one of the Inada] conditions:

We could think of $F(H)$ as a logistic function with a general formulation as follows:

(3.4)

Parameters α and β seek to represent various aspects of the economy that may exert an outstanding influence on how existing human capital influences the law of motion for human capital. We can think of α as an external level of human capital that defines the starting level of the economy. It could be seen as a factor that picks up all the likely spillovers that may influence the economy. The β parameter could stand as an indicator of the individuals' efficiency in accumulating human capital or represent the percentage of household spending devoted to education. Z would be a proportionality parameter.

Deficits could be reflecting a blatant economic mismanagement, from which we could infer a mismanagement of the education system. Taking this fact into account, one may wonder whether the value of a unit of l in a high deficit country is the same as in a low deficit country. The possible answer is likely to be negative which will lead us to search for an explanation. Considering deficit as an indicator for government mismanagement, presence of huge economic disequilibria, lack of expenditures control or incorrect assignment of resources, then one could view deficit as a burden that may slow down human capital accumulation by reducing the "quality" of time devoted to education (productivity of l). This is the reason why in this article we will try to show that in the human capital law of motion not only time devoted to training has a role but also there is a role for economic efficiency.

We will consider $F(H)$ as a factor representing the social characteristics of an economy, whereas the other factor, the one consisting of l and d , would stand for economic aspects. Parameters α and β represent the contribution to growth coming from each of the two factors. Parameter α shows the weight that comes from the "social" aspect of the economy, the past actions. Parameter β mainly represents the effectiveness of actual policies.

In the limit, $F(H)$, takes a constant value, therefore, any further human capital accumulation is not influenced by a larger human capital stock in the economy, but exclusively determined by the likely new knowledge, which could be interpreted as an increase in the difficulty in accumulating human capital as it grows up.

In order to pin down a more specific value for d^P we will try and link deficit with the curve coming from the function $F(H)$. If we take into account that the final result of the interaction between $F(H)$ with l and d is what determines human capital growth, given that we have considered l as a fixed parameter, human capital accumulation would be determined by the interaction between $F(H)$ and d . Hence, would take a different form for each deficit value associated to it.

We can get the value d can take at the turning point of $F(H)$ (where $F''(H)=0$). Reordering (3.3), taking as the rate of growth and substituting $F(H)$ by the value it takes at the turning point, we will get the following expression:

$$(3.5)$$

Now we could define d^P as $d^P(B, \dots; l)$, a value that depends on three parameters: deficit influence, weight from the actual policies in the economy, depreciation human capital is subject to, jointly with economic growth and education time.

On the other hand, firms operate combining physical and human capital. We will assume a Cobb-Douglas function with constant returns to scale:

$$(3.6)$$

with $Y(K,0)=0$, $Y(0,H)=0$; where $(1-l)$ is the fraction of time endowment agents devote to work, Y is the production level, A is a technological factor and is the capital output share.

We will take deficit as a proportion of capital, following Sánchez Losada (1998a,b), that measures debt as a fraction of physical capital.

$$(3.7)$$

The law of motion for capital will take the following form:

$$(3.8)$$

This setting up can be solved by using a *discounted Hamiltonian* with *costate* variables n for human capital and m for physical capital.

$$(3.9)$$

The two laws of motion for the *costate* variables, according to the *Maximum Principle*, will be the following:

$$(3.10)$$

$$(3.11)$$

where \dot{K} and \dot{H} are the rates of change for both types of capital.

The marginal values will be:

$$(3.12)$$

$$(3.13)$$

In the limit, goods must be equally valuable in whichever of its both uses – consumption and capital accumulation (eq. 3.10)-. Time must also be equally valuable in its both uses –production and human capital accumulation (eq. 3.11)-.

By defining $y=Y/K$, from (3.10), we obtain:

$$(3.14)$$

From (3.11) and (3.13), taking into account the characteristics of $F(H)$, we will get:

$$(3.15)$$

When attempting to define the worst equilibrium, we could imagine several initial conditions that may lead to it. From the law of human capital accumulation:

(3.3')

we could appreciate the existence of a whole range of low levels of time devoted to education that may lead to a null value for human capital accumulation. Hence, when l_0 is such that $\frac{d_0}{1-d_0} > \frac{1}{1-l_0}$, the economy would be facing a negative growth rate, from which it is likely to infer that H would be reducing. We would get the same result when having large initial values for deficit, that is, having d_0 as high as to get $\frac{d_0}{1-d_0} > \frac{1}{1-l_0}$. Therefore, we face a situation where not only low values for time devoted to education are counterproductive for growth.

Coming from the assumption that each generation of agents choose l so as to maximize their discounted permanent income, we can get:

(3.16)

Equation (3.16) will be $R_t > P_t$ for $l_t=0$ and $R_t = P_t$ for $l_t>0$. When returns to physical capital are greater than returns to human capital, agents will decide not to invest in human capital, thus devoting no time to studying. This is more likely to happen once we have a higher value for deficit (given that the education system will be more inefficient), since the efficiency of l in human capital accumulation will come down and so will P_t . We will refer to any equilibrium that satisfies (3.16) with inequality and $l_t=0$ as an *underdevelopment trap*.

On the contrary, starting from values for education and economic efficiency that are high enough so as to generate a positive rate of growth for human capital, we could reach an interior equilibrium better than the previous one. This would be the case where (3.16) is satisfied with equality and there is a positive value for l .

In order to build up an equilibrium, the *Balanced Growth Path* (Lucas, 1988), we will assume that l is constant along the *BGP* and also that efficiency change in the long run () is proportional to the total variation of the education level in an economy

. That is to say that existing inefficiencies in an economy are assumed to proportionally reduce to rising levels of education. [We have divided total variation in education by population (N) in order to normalize for the increase (reduction)], as showed below:

$$\text{with} \tag{3.17}$$

where n stands for the rate of population growth.

The equilibrium would be characterized as follows. Totally differentiating (3.10) and taking l as fixed:

$$\tag{3.18}$$

Totally differentiating (3.3') and taking l as fixed:

$$\tag{3.19}$$

Totally differentiating (3.13),and considering l as fixed, taking (3.12) and (3.18) and taking into account the characteristics of $F(H)$, we will get:

$$\tag{3.20}$$

Taking (3.17), (3.19) and (3.20), we can appreciate that the rate of change for human capital price becomes:

$$\tag{3.21}$$

From (3.15) y (3.21) we get:

$$\tag{3.22}$$

Equalizing (3.19) y (3.22), we get the equilibrium value for time devoted to education:

$$(3.23)$$

with $l_1 > 0$ y $l_2 < 0$, , once we substitute the parameters into (3.23) for the corresponding values they usually take in the literature. Time devoted to education is a function depending exclusively on parameters, therefore, long run growth of human capital reaches a positive and constant value.

By the definition of *Balanced Growth Path*, is constant, which implies that both the RHS and the LHS are constant. Consequently, we will need to prove that the ratio Y/K is constant. Totally differentiating (3.6), taking into account (3.18) we get:

$$(3.24)$$

Hence, the ratio C/K must be constant, that is:

$$(3.25)$$

Equalizing (3.18) with (3.19), (3.24) and (3.25):

- and > 0

Equalizing (3.10) y (3.12), and defining the rate of growth as we get:

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Redefining the production function in (3.6) and assuming $h = H/K$:

-

From equation (3.8) and defining $c = C/K$:

When finishing in an underdevelopment trap, the values the equilibrium tends to will be the following:

- l^* and B
- n
- β
- α

3.2. Discussion

Parameters β and α influence l^* positively, whilst n exert a negative influence. Results from calibrating the influence of all parameters show a small influence of β and a larger one from α and specially n . The negative influence of n could be seen as an increase in the opportunity cost of acquiring education, whereas the negative influence of n could be interpreted in terms of empirical evidence that shows how low developed countries that face higher values for population growth are associated with low values for education time. The significant and positive influence of α is obvious given that α is the weight given to l in the equation for the accumulation of human capital. On the other hand, the positive influence of B is the expected one since the larger the values for B , the smaller the negative influence of deficit on human capital accumulation, and thus the greater the efficiency of l .

One implication of our model is the existence of a poverty trap: for some initial conditions, the economy evolves to a low growth situation. We could think that these economies burdening too big deficits and finishing with a low value for human capital, could adopt a different technology which might allow them to initially increase their production without requiring so much human capital (e.g. working in the primary sector with a production function with physical capital as its sole input). Later on, they could

adopt a higher technology including human capital, which would allow them to grow faster once the economies had already taken off. Looking at the last expression for the equilibrium with a positive value for human capital, we observe that the long run growth rate depends on the increasing time devoted to education in the overall population, which may give some clues on how future policies could be best oriented.

We have specified the productivity parameter in the law of human capital accumulation as depending on the quantity of deficit existing in the economy trying to reflect misgovernment and incorrect allocation of resources. The model implies that economies may be divided into two groups, according to their level of deficit and time devoted to education: a group facing a positive growth rate and another group with low or no growth. Notice that, according to our model, it is not impossible for a poor country to join the richer ones since it only needs to start with a favorable mix of deficit and human capital.

On the other hand, the equilibrium with positive growth may not be fully optimum because of the different value given to deficit. Individuals may not be aware of the positive influence a small quantity of deficit may exert on the economy. The performance of a Social Planner (or a fiscal authority) imposing a certain level for deficit (optimal), larger than the one in equilibrium, depending on the characteristics of the economy, may lead to a *Balanced Growth Path* where the variables H , Y , C and K grow at constant rates different from zero and larger than the ones obtained in this paper; and where the prices of both human and physical capital (m and n) slow down at constant rates lower than the ones obtained here.

4. Empirical evidence

Statistical evidence seems to support our basic proposition that deficit may harm human capital accumulation and thus slow down growth.

Table 1 summarizes the results on annual average growth rates of per capita real GDP. Results on human capital accumulation are summarized in Table 2. The results apply from 1970 to 1985 to a cross section of mainly 57 countries, except for deficit, which was calculated as the mean value from 1970 to 1988. Data has been obtained

from two different sources. First, deficit comes from Easterly and Rebelo (1992), as well as the mean for per capita growth rate for all the period under analysis. Secondly, the rest of variables come from Barro and Lee data set (1993,1994). $DHuman7085$ is obtained as the difference between the logarithm of $Human85$ and the logarithm of $Human70$. $Human7085$ is the mean value for human capital for the period 1970-1985.

The estimated coefficient on starting per capita product (GDP 1970) in regression 1 of Table 1 is not significant, indicating that growth results have very little correlation with the starting level of per capita product. Regression 2 adds initial school values. In this regression both initial GDP and initial human capital present their expected signs. Initial GDP is negatively related to growth rate whereas initial human capital is positively related. However, neither of the explanatory variables is significantly correlated with per capita growth. When deficit is added, as showed by regression 3, the influence of both initial values is still the correct one, although they are not significant. However, the variable deficit exerts a significant influence showing that the lower the value for the variable deficit, that is, the higher the deficit, the lower the growth of a country.

A surprising result is the one concerning the coefficient on human capital growth ($DHuman7085$) as revealed by regressions 4, 5 or 6. The log difference of human capital always enters insignificantly and even with a negative coefficient. A possible explanation for the negative coefficient is that several countries, most of them from Africa and South America, started the period under analysis with extremely low stocks of human capital. Therefore, improvements in their human capital were not *vis à vis* to output improvements. Rough data reveal that high human capital growth rates for these countries are not at all associated with high per capita GDP growth.

As we can see, deficit is robust to the introduction of new variables. Regressions 3,5,6,7 reveal a significant coefficient on deficit with a t value in regression of 4. A positive coefficient on deficit means that big values for deficit (taken as negative) are associated with low values for per capita growth showing the likely negative influence of macroeconomic disequilibria on growth. The coefficients on deficit imply that a country that has a budget deficit around 1 percent of GDP higher than another, will have a growth rate that is approximately 0.2 percent lower.

Regression 8 shows a positive correlation between growth and average human capital, as posed by Benhabib and Spiegel. The estimated coefficient for human capital mean is significant at 1% level, although it is not robust to the introduction of other explanatory variables.

On the other hand regression 9 reveals a negative relationship between the initial level of human capital stock and human capital accumulation. The associated coefficient for initial human capital is significantly different from 0 with a t value of 7. This result provides clear evidence for educational catching up showing that 1 point increase in human capital stock reduces human capital growth by 0.45 points. It is robust to the introduction of deficit. In the human capital growth regression, deficit enters with the correct sign as revealed by regression 10. This result suggests that countries with higher deficit tend to face lower human capital growth with deficit being significant at 6% level. The coefficient on deficit implies that a country facing a budget deficit that is higher by 1 percent of GDP will have a human capital growth rate that is 0.67 percent lower. This result may suggest that a possible route through which budget deficit may offset growth could be by reducing human capital accumulation.

5. Conclusions

This paper has considered the effects of deficit on economic growth, magnified through the effect on human capital accumulation. The broad range of evidence reviewed and presented here seems to support such effects.

A simple model of growth that links deficit and human capital with economic growth has been posed. It considers deficit as a harmful aspect for an economy mainly when characterized by persistency and largeness. From this simple model, we have derived a negative relationship between deficit and human capital accumulation. That is to say, we have established a way to explain how deficit may slow down human capital growth and consequently economic growth. The model shows how initial values for deficit may determine the future evolution of an economy as well as the likely presence of various equilibria. Big deficits may lead to big inefficiencies and finish in underdevelopment traps, whilst small deficits may drive an economy to a superior equilibrium. Assuming that deficit reductions are proportional to higher educational

levels we get a steady state balanced growth path that is stable and conducive to endogenous growth, with a positive value for time devoted to education. Contrarily, the underdevelopment trap is characterized by null values for education time and a lack of growth at equilibrium.

Differences in fiscal policies that have been applied by different economies may partly explain the different performance of several countries during the last decades. Regarding the empirical evidence, using data for a large sample of countries (the ones for which deficit data were available) during the period 1970-1985, the results we got support the idea that deficit may be negatively related to human capital accumulation. Most large deficits that have been reached after periods of excessive spending by the government, which may not disappear and become permanent, due to the nature of spending, are the most likely to exert deleterious effects on growth. Investing in wrong conceived projects (e.g. defense programs, temporary consumption) may not induce economic growth. Therefore, under these circumstances, deficit could be weakening the economy instead of benefiting it as posed, for example, by the Keynesian view. What might be happening is a reduction in the efficiency of time devoted to education either because of a lack of resources or because it is simply approaching the mismanagement of the economy. On the other hand, continuous deficit reductions that could be reflecting some improvements in the management of an economy, or a better distribution of resources, may translate into a better working of the education system, meaning greater efficiency of human capital accumulation and larger per capita income growth.

One could believe that it is not only time devoted to education what helps improving human capital of agents who get the education, but also the quality of the education acquired. We suspect that quality or effectiveness of training might be closely related to macroeconomic stability. Thus, the conclusion we reach that deficit, taken as an indicator for macroeconomic instability, significantly discourages human capital accumulation and growth may be quite plausible. The distribution of government budget and the good or bad management of the economy could be an interesting aspect to go deep into in future research so as to find possible answers for bad performance of an economy. Besides, for a better explanation of economic growth we would need to make further progress in defining a stable macroeconomic framework as well as in determining the channels through which macroeconomic variables may affect growth.

Table 1

Cross-country growth results: dependent variable DGDP 1970-1985

	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5	Regression 6	Regression 7	Regression 8
Constant	0.0091 (0.0127)	0.0109 (0.0202)	0.0304 (0.0206)	0.0105 (0.0205)	0.0302 (0.0284)	0.0361 (0.0212)	0.0267 ^a (0.0034)	0.0077 ^b (0.0044)
GDP70	0.0012 (0.0016)	-0.00008 (0.0028)	-0.0012 (0.0027)	-0.0012 (0.0040)	-0.0018 (0.0043)	-0.0019 (0.0036)	-	-
Human70	-	0.0044 (0.0025)	0.0046 (0.0024)	0.0096 (0.0098)	0.0069 (0.7269)	-0.0440 (0.0776)	-	-
Human7085	-	-	-			0.0491 (0.0727)	-	0.0064 ^a (0.0024)
DHuman7085	-	-	-	0.010 (0.0161)	0.0044 (0.0144)	-0.0291 (0.0551)	-	-
Deficit7088 *	-	-	0.1979 ^a (0.0515)		0.1960 ^a (0.0492)	0.01910 ^a (0.0488)	0.1990 ^a 0.0501	-
R ²	0.0038	0.044	0.2507	0.0519	0.252	0.260	0.213	0.519
Observations	66	57	57	57	57	57	57	57
F-stat	0.244	1.244	5.913	0.967	4.39	3.58	14.9	3.01

Note: results of OLS estimation using White's heteroscedasticity correction method (1980)

^a 1% confidence level^b 5% confidence level

* Deficits are taken with a negative sign, whereas surpluses are taken with a positive sign.

** Standard errors in parenthesis

Table 2

Cross-country growth results: dependent variable DHuman 1970-1985

	Regression 9	Regression 10
Constant	0.926 ^a (0.0937)	0.9620 ^a (0.0995)
Human70	-0.4510 ^a (0.0639)	-0.4530 ^a (0.0632)
Deficit7088 *	-	0.6730 ^c 0.4050
R ²	0.815	0.819
Observations	57	57
F-stat	242	122

Note: results of OLS estimation using White's heteroscedasticity correction method (1980)

^a 1% confidence level^b 5% confidence level^c 6% confidence level

* Deficits are taken with a negative sign, whereas surpluses are taken with a positive sign.

** Standard errors in parenthesis

² Davies and Whally (1991) suggest that the stock of human capital is about three times as large as the stock of physical capital.

³ Croushore et al. (1990), Bohn (1995), Wu (1996), among others, have studied the sustainability of the budget deficits.

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Appendix

Countries used

1	Argentina	36	Malta
2	Austria	37	Mauritius
3	Barbados	38	Mexico
4	Belgium	39*	Morocco
5	Bolivia	40	Nepal
6	Brazil	41	Netherlands
7*	Burundi	42	Nicaragua
8*	Cameroon	43	Norway
9	Canada	44	Pakistan
10	Chile	45	Panama
11	Colombia	46	Paraguay
12	Costa Rica	47*	Rwanda
13	Denmark	48	Senegal
14	Dominican Republic	49	Singapore
15*	Egypt	50	South Africa
16	Finland	51	Spain
17	France	52	Sri Lanka
18*	Gambia	53	Suriname
19	Germany	54	Sweden
20	Greece	55*	Syria
21	Guatemala	56	Tanzania
22*	Guinea Bissau	57	Thailand
23	Guyana	58	Togo
24	Honduras	59	Trinidad & Tobago
25	Iceland	60	Tunisia
26	India	61	Turkey
27	Ireland	62	United Kingdom
28	Israel	63	Uruguay
29	Italy	64	Venezuela
30	Jamaica	65*	Yugoslavia
31	Korea	66	Zaire
32	Lesotho	67*	Zimbabwe
33*	Luxembourg	68	Burma
34	Malaysia		
35	Mali		

* These countries lack some data.