“HUMAN CAPITAL INVESTMENT, INCOME LEVELS AND ECONOMIC GROWTH IN LATIN AMERICAN COUNTRIES”

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12 de Octubre y San Juan. Te. 0291-4595138

Bahía Blanca, junio 2000

República Argentina.

1. Introduction

There is little doubt that a major source of sustained growth in per capita income stems from the accumulation of knowledge and its subsequent embodiment in either society's physical or human capital. There are many channels through which knowledge is acquired: formal schooling, primary research, on-the-job training, learning by doing, and product innovations (both vertical and horizontal), to name but a few. The primary contribution of the recent theory of endogenous growth, pioneered by Romer(1986), Lucas (1988), and Rebelo (1991) has been to endogenize the process through which knowledge is accumulated and thereby the rate of economic growth itself. The results of this new literature have already led to substantive theoretical and empirical insights into the forces that drive sustained growth.

Then, the new theory of growth propose that endogenous technical progress is a main requisite for a healthy economy and outlines different hypothesis about which are the determinants that can explain a positive per capita growth rate. Sala-i-Martin (1994) classifies endogenous growth models according to the source of growth in five prototypes: AK models (Rebelo (1991)), models based on public spending Barro (1990), learning and spillovers models Romer (1986), human capital models Lucas (1988) and I&D models Romer (1990).

Physical capital growth, just as we measure it conventionally, explains only a small part numerous countries rent growth. For this reason, in the last years economists have focused their attention in the study of human capital investment as a decisive factor in a country' s economic growth. Contributions of Schultz[1] and Becker[2] have been very important in this area. The World Bank Development Report (1995)[3] affirms that " human capital investments can improve life levels because they enlarge employment opportunities, increase productivity, attract capital investments and have importance for economic growth and well-being of the families."

During the last years numerous empirical works on the determinants of economic growth have been carried out. Barro (1991), finds that product per capita growth rate is positively related with the level of initial human capital and negatively with the initial level

of product per capita for a sample of 98 countries in the period 1960-1995. He also finds that countries with more human capital have smaller rates of fertility. Becker, Murphy and Tamura (1990) also corroborate that per capita growth and net fertility move inversely.

Empirical literature about economic growth is based on the study of different countries in the world, however, it doesn't exist enough evidence of determinants of economic growth for Latin American economies with differences in income levels. The issue of income inequality has been studied extensively in the recent literature on economic growth. A general consensus appears to have emerged that, at least for the developed economies, incomes of the poorest countries have tended to converge to those of the leaders (Abramovitz1986; Baumol 1986).

This paper's purpose is to analyse the empirical relationship among per capita growth rate and human capital level (using as proxy variables: primary, secondary and high school enrolment). This study follows Barro's methodology (1995).

It is a cross section study to corroborate the hypothesis that for a given level of per capita income the subsequent growth rate is positively related with initial human capital level. The study includes twenty-four Latin American economies with different income levels per capita, including dummy variables to capture these differences.

2. Data

One problem with empirical studies about economic growth is the availability of data. Only in the last ten years it was possible to have a group of data that could be comparable international and temporarily.

It is necessary to keep in mind certain aspects about the quality of the information. The same one is not the same for each country and in some cases it is not available for all the countries during the same period. In section 3 we work with a sample of 24 countries for the period 1965-1996. They are: Argentina, Barbados, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, Trinidad, Uruguay, Dominican Republic

and Venezuela. The included countries were determined by the availability of data for all the variables selected.

Data were obtained from the World Bank (1998) indicators.

The dependent variable is the rate of growth of the Gross real Output per capita estimated as an average for the period 1965-1996 (GDP). As variable proxy of the human capital we consider the rates of primary schooling (Prim), secondary (Sec) and high (Hig). We also use as regressors the level of Gross real Output per capita (GDP 65) constant price year 1987, the rate of fertility (Fert) measured as the quantity of children for woman (average 1965-1996) and life expectancy (Expec).

Barro and Lee (1993) [4] discusses the statistical measures of human capital and provide some alternative measures.

School enrolment ratios are widely available across countries and have been used in numerous studies. Enrolment ratios are available for three levels of schooling: primary, secondary, and higher. Gross enrolment ratios relate the total number of students at a given level to the population of the age group that national regulation or custom dictates would be enrolled at that level. Net enrolment ratios modify the numerator of the ratio to count only the students enrolled within the designated age group. For example, for a country in which children start primary school at age six and in which primary school has six grades, the gross and net enrolment ratios for primary education are given by

$$\text{Gross enrolment ratio} \quad = \quad \frac{\text{Total enrolment in primary school}}{\text{Total Population aged 6-11 years}}$$

$$\text{Net enrolment ratio} \quad = \quad \frac{\text{Total enrolment aged 6-11 in primary school}}{\text{Total Population aged 6-11 years}}$$

Thus, the net enrolment ratio is between zero and one, whereas the gross enrolment ratio can exceed one. Although the net enrolment ratio is more appropriate for gauging the accumulation of human capital, the gross ratio has usually been used because it is more often available for developing countries. Indeed in this paper we use gross enrolment ratio because net enrolment one was not available for all the countries in the sample.

The dummy variables (D1 and D2) represent low and middle low incomes respectively following the classification of incomes per capita of the World Bank Indicators. According to their income level the groups of countries are the following ones: countries with low income (Haiti, Honduras, Nicaragua, Guyana); countries with middle low income (Bolivia, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Jamaica, Panama, Peru, Dominican Republic and Venezuela) and countries with middle high income (Argentina, Brazil, Barbados, Chile, Mexico, Puerto Rico, Trinidad Uruguay, Venezuela).

3. Human Capital and Growth

The neo-classical theory of economic growth sustains that this is the result of the accumulation of the physical capital and of the amplification of the work force that combined with the technological progress increases capital's productivity. However, they don't say anything about how it can accelerate technological progress.

At the beginning of the '90 decade, Paul Romer (1990), and Robert Lucas (1988) elaborated a new theory about the economic growth that tried to determine the effect of human capital on countries growth rate. They tried to confirm that the real force that moves the economic progress is the productive capacity of the individuals. Increases in productivity is not only given by an exogenous factor but for diverse endogenous factors related with the behaviour of the agents responsible for the accumulation of the production factors and its level of knowledge. They demonstrate that the whole production process benefits with the positive externalities that are generated with the education. A most educated population uses capital more efficiently, introduces innovations in the production form and diffuses the ideas. In this way the elevation in the education level increases all the production factors efficiency. Secondary benefits of teaching also helps to explain important aspects of the relationship between economic growth and physical capital.

Previous theories of growth sustained that capital marginal returns diminish with capital accumulation, because efficiency decreases and it lowers the economic growth rate. However many countries with capital accumulation have achieved high rates of growth and

have sustained it. These models show how diminishing capital marginal returns are compensating in certain measure by the increase of the resulting schooling efficiency.

Human capital theory states that individual differences in skills and productivity explain differences in earnings across individuals. The longer time period the skill can provide a return, the more likely an individual chooses to invest in human capital. The lower the costs of human capital investment, the more likely an individual chooses to invest in human capital. If the individual is patient, then the individual will more likely engage in human capital investment. The worse the other opportunities, the more likely the individual will choose investment. Therefore the human capital model provides convincing explanations why some workers earn more than others. As workers acquire more skills through human capital.

In this context we try to analyse the empirical relationship among per capita growth rate and human capital level (using as proxy variables: primary, secondary and high school enrolment).

Following the methodology of Barro (1995) countries selected are compared in an international cross section study. We make five regressions using GDP per capita growth rate as the dependent variable and the variables: level of GDP per capita in 1965, rate of primary, secondary and higher schooling in the year 1965, life expectancy, rate of fertility and the dummy variables as regressors.

Because heterocedasticity could be a common problem in the cross-section analysis, regressions were done using the ordinary least square method adjusted for the heterocedasticity White test.

TABLE 1: Regressions for GDP per capita.

	Reg. (1)	Reg.(2)	Reg.(3)	Reg.(4)	Reg.(5)
Constant	0,23	-22,73	-12.29	2.48	4.34
	(2,69)	(13,15)	(11,85)	(4.76)	(4.27)
Log GDP (65)	0,13	-0.58	-1.09	-0.50	-0.74
	(0.38)	(0,47)	(0,04)	(0.46)	(0.42)
Prim65		0.03	0.01	0.05	0.02
		(0,02)	(0,02)	(0.01)	(0.01)
Sec65		-0.01	-0.00	-0.00	0.00
		(0,02)	(0,02)	(0.02)	(0.02)
Hig65		-0.01	-0.02	-0.05	-0.02
		(0,08)	(0,07)	(0.09)	(0.08)
Log Expec		6.31	5.22		
		(3,95)	(3,47)		
D1			-2.57		-2.83
			(0,84)		(1.03)
D2			-1.19		-1.18
			(0,59)		(0.84)
Fert				-0.3	0.06
				(0.31)	(0.3)
R	0,05	0,42	0,63	0.39	0.58
D-W	2,01	2,14	2,47	2.54	2.58

Among parenthesis we reproduce standard errors.

Table 1 shows the results of the regressions where the dependent variable is the annual half rate of growth of GDP per capita between 1965 and 1996. The different

columns include different economic variables as regressors. The first one includes the logarithm of GDP per capita in 1965. It is observed that the coefficient of the initial GDP is positive and not significant R2 of the regression is not very important (0.05).

The column 2 shows the regression 2 that includes the variables Log (GDP65), Prim, Sec, Hig and Log (Expec). It is observed that the sign of the coefficient of the initial GDP when the mentioned variables are included in the regression becomes negative and is significantly different from zero. This may show the possible existence of conditional convergence. That is to say, a negative coefficient in GDP once included these variables in the regression would corroborate this convergence.

From the three variables that represent the levels of schooling, the only one significant and with the expected sign is the corresponding to the primary education (Prim). This result would indicate that countries that in 1965 invested more in primary education had a tendency to grow more in the 36 year consecutive. This is coincident with conclusions of previous empirical works (Barro1991-1995).

The importance that has had the secondary and high schooling in the process of growth has not been the same since the sign observed is negative, contrary to that of the variable Prim. This could be explained due to the poor investment level that these countries have carried out in these education sectors in the beginning of the considered period.

Regarding the variable life expectancy is entered in under the logarithm form and is used, as it's own instrument. This variable is highly significant in the growth regression and its sign is positive. This would indicate that higher life expectancy go along with better work habits and a higher levels of skills that would improve the performance of growth (for given measured values of per capita product and years of schooling).

In the third regression dummy variables are included to capture the different income levels in the analysed countries: one for low income and another for middle low incomes. We can observe that the coefficient of the initial GDP rate is significantly negative. The signs of the other explanatory variables don't change. The two dummy variables are negative and very significant. This might conclude that countries whose income levels are contemplated in these variables have grown a lot less than what the explanatory variables predict. Generally dummies are important from an econometric view (it is observed that the

R2 ascend in more than ten points) and they improve considerably the results of the regression.

In the column 4 the rate of fertility is included (Fert) as regressor. The coefficient of GDP65 is similar to that of the regression 2 the negative effect of the income level per capita in the rate of subsequent growth is not modified therefore substantially by the effect of the rate of fertility. On the other hand the estimated coefficient of primary schooling rate improves slightly (0,05). This would indicate that a negative relationship between fertility and growth increases the significance of human capital investment.

With the incorporation of the dummy variables in column 5 we observe that D1 and D2, are highly significant and they improve the regression's result. However, the rate of fertility changes the sign. This would indicate that in countries with low incomes the negative relationship is not verified between the fertility rate and growth. That is to say, a bigger fertility would reflect family's ignorance of the time costs of rearing and education expense of having more children.

4.Conclusions

This work tries to analyse the empirical relationship between the growth rate of per capita income and the human capital level for a group of twenty-four Latin American countries with different income levels.

Big differences exist in the rate of growth per capita of these countries that are related systematically with a group of explanatory quantifying variables.

Following Barro's (1991-1995) methodology the empirical analysis was carried out as a cross section study of regressions. The rate growth of GDP per capita was used as an endogenous variable and as explanatory variables the GDP per capita in the year 1965, the schooling rates (proxies of the human capital), the life expectancy, the rate of fertility. We also use two dummy variables to capture differences in income levels.

The rate of primary schooling was highly significant and with the positive sign while the other proxy variables for human capital (secondary and high schooling) had a negative sign.

.   For a given level of per capita income the rate of growth varies positively with the life expectancy and negatively with the rate of fertility.

The incorporation of the dummy variable that turned out to be negative and very significant would allow inferring that countries with low and middle low incomes should have grown little due a low investment rate in education. However, these results would indicate that the countries with these income levels have still grown less than what these aspects predict. On the other hand, the empirical evidence would seem to be consistent with the neo-classical pattern in the sense that there is enough evidence favourable to conditional convergence. A negative relationship was verified between the rate of per capita growth and the initial level of per capita GDP, conditional to the stationary state.

On the other hand it is important to point out that the cross-section regressions uses average variables for each country which loses the information coming from the temporary evolution of the variables. In this case it is difficult to control the heterogeneity among countries that is an important point in connection with the capacity of the explanatory variables to determine the discrepancies in connection with differences in

income levels. The panel data, could be used, as a technique able to use the temporary dimension of data and also captures differences that exist in the countries.

Cultural, institutional, technological differences among countries are not captured by a simple cross – section regression, so the incidence of these factors rest in the regression residual. If these factors are positively correlated with the variables included in the sample the estimate of the parameters it would be skewed.

In this way it would be important to make a study using panel data to corroborate the importance of the analysed variables as determinants of economic growth under another analysis form.

References

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