



UNIVERSITY OF THE PHILIPPINES
SCHOOL OF ECONOMICS

Discussion Paper No. 0304

June 2003

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Theory and Evidence**

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Economic Growth in the Philippines: Theory and Evidence

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Abstract

Economic growth in the Philippines is studied using Robert Solow's neoclassical growth model, which predicts savings and population growth to have positive and negative effects, respectively, on growth of per capita output. The empirical results tend to support the predictions of the model, but some limitations are evident. Human capital or education, which underpins technological progress, shows the expected sign but is not statistically significant. This suggests the need for some extensions of the Solow model, say, along the lines of endogenous growth theory. From a policy standpoint, the results suggest that raising savings, investments, and human capital, and slowing down population growth, continue to be well advised.

JEL classification: 111,112,121

Keywords: Solow growth model, steady state, savings, investments, human capital

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Economic Growth in the Philippines: Theory and Evidence

1. Introduction

The Philippines, classified as a low middle-income country by the World Bank (1984) in its *World Development Report*, has caught the attention of economists formulating models of development anchored on standard neoclassical growth theory. Robert Lucas Jr. (1993), for instance, notes that in 1960, the Philippines had a per capita gross domestic product of US\$640, which was about the same as South Korea's. Over the period 1960-1988, Philippine per capita GDP grew at an average of merely 1.8 percent each year, compared to Korea's 6.2 percent. And so the question arises as a matter of course: why did an economic miracle elude the Philippines?

This paper opens up an investigation of economic growth in the Philippines using annual time-series data on per capita GDP. To interpret the data, the study takes off from the contribution to growth theory of Robert Solow (1956). This seems like a reasonable point of departure. A casual look at some comparative figures on savings, population growth, and education suggests that these variables matter in accounting for growth in a sample of East and Southeast Asian economies. Solow's model is equipped to accommodate all variables. The production function exhibits constant returns to scale, with diminishing returns to capital. The steady-state per capita output depends on an exogenous saving rate and employment growth, which is assumed equal to the population growth. The Solow model predicts that the effect of the saving rate on per capita output is positive while that of population growth, negative.

Recent efforts to extract a theory of development from the Solow growth model stress the important role of human-capital accumulation, mainly education (see, e.g., Lucas 1988). There are several mechanisms by which education leads to higher growth. Investment in human capital as Jacob Mincer (1974) emphasizes, for example, increases labor's efficiency units with positive effects on work earnings and aggregate growth performance. In addition, education can slow down population growth rate by inducing couples to choose higher quality children in lieu of child numbers (see, e.g., Gary Becker, Kevin Murphy, and Robert Tamura 1990; Robert Barro and Becker 1991). Child care is time intensive and couples tend to reduce their desired family size as the opportunity costs of their time rise. Moreover, education directly influences total-factor-productivity by raising the ability of countries to innovate and adopt technological progress that enhances domestic production (see, e.g., Paul Romer 1990). This body of work in which education matters for technological progress and long-run growth has come to be part of what is referred to as endogenous growth theory.

In empirically assessing growth in the Philippines, this paper follows essentially the approach of N. Gregory Mankiw, David Romer, and David Weil (1992). The authors treat the saving rate and population growth as exogenous like in the Solow model, and consider education as an input in the production function. Their initial empirical tests support Solow's predictions, but they acknowledge that some limitations are evident. To overcome these, the authors adopt some of the insights from endogenous growth theory in extending their empirical work.

The regression analysis of the study at hand shows preliminary support for the Solow predictions on the growth effects of savings, population growth, and education. All the coefficients have the correct signs. The proxies for savings and population growth yield significant coefficients but not education. In view, however, of the positive link between education and earnings found in several empirical microeconomic studies, there is need to explore alternative approaches and proxy variables in determining the growth contributions of education, say, its role in facilitating technological progress (see, e.g., Jess Benhabib and Mark Spiegel 1994). Unfortunately, data limitations preclude pursuit of such extensions in the aggregate growth model developed here. Instead, some pieces of evidence from microeconomic data sets are cited.

The paper is organized as follows: Section 2 presents some empirical data on output growth, savings, population growth, and education in a sample of East and Southeast Asian economies in an attempt to identify some variables that can be included in a theoretical growth model. Section 3 develops the theoretical framework. Section 4 presents the empirical analysis. Section 5 makes concluding remarks.

2. Philippine Growth in a Comparative Setting

To open up the investigation of economic growth in the Philippines, this section presents some down-to-earth facts on levels and growth rates of real per capita gross national product (GNP) and population, together with savings and investment ratios, both for the Philippines and some countries in the East and Southeast Asian region that includes South Korea, Thailand, Malaysia, and Singapore. A comparative look is useful in so far as it allows similarities and contrasts to emerge among selected economies in the region, thereby helping identify the variables that may be highlighted in theory.

Based on figures taken from the *World Development Report* (World Bank 1996), the Philippines had a per capita GNP of US\$950 in 1994. Table 1 shows that this amount exceeds Indonesia's US\$880, but trails those of Thailand, Malaysia, Singapore, South Korea, and Hong Kong. Taiwan is also regarded as one of the East Asian miracles, but not being a member of the World Bank, its per capita GNP is not reported in the *World Development Report*.¹

With reference to the aforementioned observation of Lucas, it is seen that by 1994, the per capita GNP level of South Korea had outpaced that of the Philippines more than eight times. It is easy to see why. Over the period 1985-1994, real GNP per capita in the Philippines grew at an annual average of only 1.7 percent, the lowest among all the economies listed in Table 1. At this growth rate, it takes 40 years for per capita GNP to double. For Korea, its annual average growth rate of 5.3 percent permits doubling of per capita GNP in 13 years.

Turning now to demographic variables, the population size of the Philippines was 67 million in 1994, growing at an average of 2.4 percent per year in the Eighties, and 2.2 percent in the Nineties. The Philippines has the most rapid population growth, bar Malaysia, among the

¹ Taiwan's per capita GDP in 1994 was US\$13,310 and over the period 1992-1997 grew at an average of 5.4 percent each year, according to the *Asian Development Outlook* released by the Asian Development Bank (1998).

countries listed in Table 2. Population level in Malaysia in 1994, however, was only 20 million. Meanwhile, all the other countries in the same table have gone through a demographic transition, a shift from high to fertility rates, with annual population growth rate averaging less than 2 percent. The rapid annual population growth rate in the Philippines has yielded an age-distribution structure that is concentrated at the younger age cohorts. Such age distribution is bound to affect variables that influence economic growth. With a preponderantly young population, for instance, the child-dependency ratio tends to be high, resulting in high consumption, low savings, and reduced investments not only in physical capital, but also in human capital, especially education.

Table 3 shows gross savings and investments as a proportion of GDP for the same set of countries in the previous two tables. It is useful to note that the gross domestic saving ratio in the Philippines declined from 24 percent in 1980 to 18 percent in 1994. For Thailand, Malaysia, Singapore, and South Korea, the same ratio increased. And although the figures for Indonesia and Hong Kong decreased, their respective saving ratios were significantly higher than that of the Philippines. Looking now at the gross domestic investment ratios, the Philippines emerged as having the lowest among the selected countries in Table 3. At 24 percent in 1994, the Philippines pales in comparison to the 40 percent of Thailand and the 39 percent of both Malaysia and South Korea. Once comparative figures for savings and investments are shown, one is led to thinking about why the per capita GDP growth rate in the Philippines was the lowest in 1980-1994. With low investment, capital per worker suffers, with adverse effects on labor productivity.

It is, however, well understood that investment or physical-capital accumulation, while material for growth, is not all that matters. Human-capital investment, typically in the form of education and training, is equally important, if not more. Table 4 presents the percentage of the age group enrolled in primary, secondary, and tertiary education. The Philippines exhibits some favorable education trends in relation to the other listed countries. There is universal participation at the primary level. Secondary enrollment in 1992 exceeded those of Indonesia and Thailand. At the tertiary level, the percentage of the age group enrolled is 28 percent, paling in comparison only to Korea's 42 percent. One gets curious about why in spite of these favorable education indicators, the per capita GDP growth rate of the Philippines still lagged behind in the region.

3. Theoretical Considerations

To frame the observations in the preceding section in an organized way, insights from the Solow growth model are utilized. The production of a single good in period t is governed by a Cobb-Douglas production function that shows constant returns to scale:

$$(1) \quad Y(t) = A(t)K(t)^\alpha L(t)^{1-\alpha} \quad 0 < \alpha < 1$$

where Y is output, K is capital stock, and L is labor employed. Both K and L have positive but diminishing marginal productivity. The level of technology A is assumed disembodied.

Following Solow, A and L grow exogenously at the rates r and n, respectively. That is,

$$(2) \quad A(t) = A(0)e^{rt}$$

$$(3) \quad L(t) = L(0)e^{nt}.$$

The growth rate of L is assumed equal to the population growth rate.

A constant fraction s of output is saved and invested. Ignoring depreciation

$$(4) \quad dK(t)/dt = sY(t)$$

and using (1), equation (4) is rewritten as

$$(5) \quad dK(t)/dt = sA(t)K(t)^{\alpha}L(t)^{1-\alpha}.$$

Equation (5) can be expressed in per capita terms using the notations $y(t) = Y(t)/L(t)$ and $k(t) = K(t)/L(t)$. The time path $dk(t)/dt$ is given by

$$(6) \quad dk(t)/dt = sA(0)e^{rt}k(t)^{\alpha} - nk(t).$$

In steady state $dk(t)/dt = 0$. From (6), the steady state capital-labor ratio k^* evolves according to

$$(7) \quad k^*(t) = \{sA(0)e^{rt}/n\}^{1/(1-\alpha)}.$$

The production function (1) expressed in per capita is

$$(1') \quad y(t) = A(0)e^{rt}k(t)^{\alpha}.$$

Substituting (7) into (1') and taking natural logs, $y(t)$ evolves in steady state according to

$$(8) \quad \ln y(t) = (1/(1-\alpha))\{\ln A(0) + rt\} + (\alpha/(1-\alpha))(\ln s) - (\alpha/(1-\alpha))(\ln n).$$

Equation (8) yields the predictions that savings has a positive effect on steady-state growth while population growth, negative.

It is widely accepted that human capital, especially education, is an important source of long-run economic growth. The field of economics of education rests on an empirical regularity, namely, a positive correlation between education and earnings. This has given rise to human capital theory associated with, for example, Becker (1964) and Mincer.² In sources-of-growth accounting ala Denison (1961), per capita output growth is broken down into increases in the factors of production and technological progress, the latter underpinned by investments in human capital.

² There is also the theory that education acts as a filter (see, e.g., Kenneth Arrow), according to which, individuals likely to succeed are also the ones who invest in, say, higher education.

Human capital may be accommodated in the Solow model by treating it as a separate factor in the production function similar to what Mankiw, Romer and Weil have done. Let

$$(9) \quad Y(t) = A(t)K(t)^\alpha H(t)^\beta L(t)^{1-\alpha-\beta} \quad 0 < \alpha + \beta < 1$$

where H is the stock of human capital and all the other variables are as earlier defined.

Assume likewise that s_h and s_k are the fixed ratios of human- and physical-capital accumulation to GDP, respectively. This means $dK(t)/dt = s_k Y(t)$ and $dH(t)/dt = s_h Y(t)$. Setting aside depreciation, the respective steady-state time paths wherein $dk(t)/dt = 0$ and $dh(t)/dt = 0$ are

$$(10) \quad k^*(t) = \{s_k A(0) e^{rt} h(t)^\beta / n\}^{1/(1-\alpha)}$$

$$(11) \quad h^*(t) = \{s_h A(0) e^{rt} k(t)^\alpha / n\}^{1/(1-\beta)}$$

where $h(t) = H(t)/L(t)$ and $k(t)$ is as defined earlier.

According to (10) and (11), the steady state time path of physical capital depends on human capital and vice versa. Substituting (10) and (11) in (9) expressed in per capita terms and taking natural logs yield

$$(12) \quad \ln y(t) = \{1-\alpha\beta/(1-\alpha)(1-\beta)\} \{\ln A(0) + rt\} + (\alpha/(1-\alpha))(\ln s_k) + (\beta/(1-\beta))(\ln s_h) \\ + (\alpha\beta/(1-\alpha)(1-\beta))(\ln h(t)) + (\alpha\beta/(1-\beta)(1-\alpha))(\ln k(t)) - \{(\alpha + \beta - 2\alpha\beta)/(1-\alpha)(1-\beta)\}(\ln n) .$$

Equation (12) shows that both saving ratios have a positive effect on steady state per capita output while population growth exerts a negative effect provided $\alpha + \beta > 2\alpha\beta$. Human and physical capital each has an independent positive effect on steady-state output. The next task is to find out whether the data support these predictions of the model. This involves looking for empirical counterparts of the variables in the theoretical framework that can be applied in the regression models based on equations (8) and (12). Equation (12) shows the complications in the specification when human capital is added as a factor of production.

4. Empirical analysis

The empirical analysis begins with a regression model whose specification is based on equation (8). It then proceeds to a second specification based on equation (12). In both (8) and (12), the level of technology and its growth rate are viewed as subsumed in the constant term.

The dependent variable is the real GDP per unit of labor employed, which is denoted by $y(t)$. Annual time-series data on real GDP are taken from the *Philippine Statistical Yearbook* published by the National Statistical Coordination Board (various issues), the agency responsible for officially releasing the National Income Accounts (NIA). Aggregate employment data, meanwhile, are taken from the *Yearbook of Labor Statistics* published by the Department of Labor and Employment (various issues). Labor force data based on uniform concepts, such as,

the working age population 15 years and over, are available only starting 1976.³ But taking all the proxy regressors into consideration, a complete data set for the estimation of the regression models is possible only for the period 1980-2001.

Employment growth is denoted by NGR. It is the percentage change in aggregate employment. Population growth cannot be used since it is estimated only from census data. The census of population is normally undertaken every 10 years, although a few intercensal years exist. In between census and intercensal years, the population growth is projected.

For the saving rate, the proxy variable is gross investment-to-GDP ratio, denoted by INR. This may be justified by the fact that the Philippines is a small open economy with access to official development assistance (ODA) and international financial markets. Capital is mobile and foreign direct investments, liberalized. The constraint posed by domestic savings on investments is eased somewhat by access to ODA and to foreign savings through the international capital market. In view of this, it seems reasonable to use the gross investment ratio as a proxy for the saving rate.

Both employment growth and the gross investment ratio are assumed independent of the error term. Ordinary least squares estimation (OLS) may thus be used. But since time-series estimation is involved, a lagged value of the dependent variable is added as a regressor. This approach draws support from the theoretical argument and empirical evidence in the work of Robert Hall (1978) whereby current consumption is the sole predictor of next year's consumption. In the Philippines, personal consumption spending of households is more than 70 percent of GDP; changes in consumption can therefore be expected to lead to profound changes in GDP over time.

OLS estimation over the period 1980-2001 using double logs yields

$$(13) \quad \ln y(t) = 1.716 + .038 \ln \text{INR} - .024 \ln \text{NGR} + .825 \ln y(t-1)$$

(2.16) (1.51) (-1.64) (10.78)

$$\text{adj } R^2 = .87 \quad F = 41.32 \quad n = 19 \quad D-W = 1.40 \quad \text{s.e.e} = .027$$

The numbers in parentheses are t-ratios. The above regression result supports Solow's predictions on savings (with gross investments as proxy) and population growth (proxied by employment growth). The coefficient of gross investment is positive but significant only at the 20 percent level. That of employment growth is negative and significant at the 5 percent level. The constant term, 1.716, which involves initial technological level and its growth rate, is significant at the 5 percent level. The Hall hypothesis about consumption following a random walk is supported. The coefficient of the lagged value of $y(t)$ is significant at the 1 percent level. The F-ratio indicates a good fit. The adjusted R^2 shows that the specified regression accounts for 87 percent of the total variation.

Extending the empirical analysis to include a human capital variable, the proxy variable is the growth rate of enrollment in secondary education, which is denoted by ENR. Although it

³ From 1956 to 1976, the working age population was 10 years and over; this was adjusted to 15 years and over after that. In addition, reference quarter for who is in or out of the labor-force has been used since 1976.

would be desirable to work with other education measures, ENR is the only one that is available annually over the period of analysis. OLS estimation gives

$$(14) \quad \ln y(t) = 2.306 + .036 \ln \text{INR} - .029 \ln \text{NGR} + .769 \ln y(t-1) + .004 \ln \text{ENR}$$

$$(2.444) \quad (1.41) \quad (-1.792) \quad (8.485) \quad (.338)$$

$$\text{adj } R^2 = .834 \quad F = 22.386 \quad n = 18 \quad D-W = 1.57 \quad \text{s.e.e} = .028$$

The coefficients for investment and employment growth replicate the results in (13) in terms of the signs and the level of significance. The coefficient of education is as predicted by the model but it is not statistically significant. The adjusted correlation coefficient R^2 is even lower than in (13). One reason is that equation (12) cannot be fully specified. Investment patterns in education, according to the model, depend on the physical capital stock, but data on the latter are not available. Moreover, data limitation on education prevents estimation using alternative proxy variables; for instance, annual enrollment in tertiary education is not available.

While a positive effect for education on output per capita cannot be detected in (14), one should not rush to the conclusion that public policy need not bother with investments in education. After all, the constant term 2.306 is significant and based on (12), technology and its growth rate are embedded in it. This suggests the need to explore alternative ways of incorporating education in the aggregate growth model, say, along the lines of endogenous growth theory, wherein technological progress or total factor productivity is a function of education.

One cannot also ignore the plethora of empirical findings that show a positive relationship between education and earnings in different settings (see, e.g., George Psacharopoulos 1981). In a descriptive study of some aspects of the Philippine labor market, Esguerra and Canlas (2001) report that the average quarterly earnings of administrative, executive, and managerial workers, who normally possess high educational attainment, are the tops among the different occupations.

Furthermore, a recent attempt to estimate private rates of return to education reveals that in 1995, investment in college relative to secondary education yields a 14 percent rate of return; for secondary relative to elementary education, 12.8 percent; and for elementary versus no grade, 17.1 percent (see Hope Gerochi 2001). These rates of return suggest that investment in education is remunerative; but the numbers, according to Gerochi, may even be on the conservative side. One reason cited is that earnings of Filipinos who work overseas on temporary contracts are not captured by the surveys. These overseas workers have sufficiently invested in education and training, and earn substantially much more than their counterparts employed locally. The pattern of human capital accumulation, which equation (11) conveys, is a function of the capital-labor ratio. Filipinos who envision working abroad gear their education and training to the foreign capital-labor ratio. Filipino nurses, for instance, look forward to working in hospitals abroad with state-of-the-art medical facilities and equipment. Their productivity and earnings end up being higher than their local counterparts who make do with less advanced capital equipment.

The point is at least two factors are behind why the aggregate empirical model used here does not show any effect of education on growth, namely, missing observations and inadequate proxy variables. It is useful to note that wage and salary workers constitute more than 40 percent of the employed in the Philippines, most of whom have attained secondary education at least; in the aggregate, they contribute substantially to gross personal income. The rest of the employed are either self-employed or unpaid family workers.

Up until this point, the empirical estimates have used only the per capita GDP as dependent variable. Taking a cue from sources-of-growth accounting, the paper now reports regression results trying to account for the variation in real per capita GDP growth using the growth rates of the various explanatory variables. A modification of (13) using growth rates, denoted by the first difference D in logs, yields

$$(15) \quad \begin{aligned} \text{Dln } y(t) = & .019 + .029\text{Dln INR} - .007\text{Dln NGR} + .464\text{Dln } y(t-1) \\ & (1.34) \quad (1.30) \quad \quad (-1.87) \quad \quad (2.19) \end{aligned}$$

$$\text{adj } R^2 = .15 \quad F = 1.82 \quad D-W = 1.68 \quad \text{s.e.e} = .035$$

The findings in (15) do not differ much from the estimates reported in (13). The signs of the coefficients are as expected but are not highly significant. But based on the adjusted R^2 this regression result is inferior, since it accounts only for 15 percent of total variation. Similarly, adding the growth of the human capital variable, which is shown below, does not produce results qualitatively different from (14):

$$(16) \quad \begin{aligned} \text{Dln } y(t) = & .013 + .028\text{Dln INR} - .008\text{Dln NGR} + .425\text{Dln } y(t-1) + .002\text{Dln ENR} \\ & (.72) \quad (1.19) \quad \quad (-1.89) \quad \quad (1.85) \quad \quad (.52) \end{aligned}$$

$$\text{adj } R^2 = .15 \quad F = 1.82 \quad D-W = 1.62 \quad \text{s.e.e} = .035$$

The coefficient of the growth rate of investment is positive and significant at the 20 percent level. For the growth rate of labor, the coefficient is negative and significant at 5 percent. The coefficient of the lagged value of the growth rate of per capita GDP is positive and significant. The coefficient of the growth of the secondary enrollment is positive as expected but not significant. Likewise, only about 15 percent of total variation is explained by the chosen specification.

5. Concluding Remarks

This paper has been an attempt to interpret time-series data on real per capita GDP in the Philippines using the Solow growth model. It has been motivated by recent efforts to extract a theory of development from neoclassical growth theory. Even if the empirical work has been hampered by inadequate data, the results are encouraging. The predictions of the Solow model on savings and population growth rate seem supported. The predictions on the growth effects of human capital is only weakly supported; the sign is as expected but not statistically significant. The results suggest that public policy aimed at raising savings and investments, accumulating human capital, and slowing down population growth continue to be relevant for long-run economic growth.

Acknowledgments

This paper was made possible by a faculty research grant from the Philippine Center for Economic Development. I thank Ferdinand Co for able computational assistance.

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Table 1
Level and Growth Rate of Per Capita Gross National Product

Country	GNP per Capita (1994 US\$)	Average annual growth rate 1985-1994 (in %)
Philippines	950	1.7
Indonesia	880	6.0
Thailand	2,410	8.6
Malaysia	3,480	5.6
Singapore	22,500	6.1
South Korea	8,260	7.8
Hong Kong	21,650	5.3

Source: *World Development Report* 1996.

Table 2
Population Level and Growth Rate

Country	Population (in millions)	Average annual population growth rate (in %)	
		1980-1990	1990-1999
Philippines	67	2.4	2.2
Indonesia	190	1.8	1.6
Thailand	58	1.8	1.0
Malaysia	20	2.6	2.4
Singapore	3	1.7	2.0
South Korea	44	1.2	0.9
Hong Kong	6	1.2	1.5

Source: *World Development Report* 1996.

Table 3
Gross Domestic Saving and Investment
(as percentage of GDP)

Country	Gross domestic saving		Gross domestic investment	
	1980	1994	1980	1994
Philippines	24	18	29	24
Indonesia	37	30	24	29
Thailand	23	35	29	40
Malaysia	33	37	30	39
Singapore	38	51	46	32
South Korea	32	38	25	39
Hong Kong	34	33	35	31

Source: *World Development Report* 1996.

Table 4
Percentage of Age Group Enrolled in Education Level

Country	Primary		Secondary		Tertiary	
	1970	1992	1970	1992	1970	1992
Philippines	108	109	46	74	28	28
Indonesia	80	115	16	38	4	10
Thailand	83	97	17	33	13	19
Malaysia	87	93	34	58	4	7
Singapore	105	107	46	–	8	–
South Korea	103	105	42	90	16	42
Hong Kong	117	108	36	–	11	20

Source: *World Development Report* 1996.