

Long-Term Growth in Malaysia: An Application of Endogenous Neoclassical Growth Model

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ABSTRACT

The neoclassical growth model shows that the growth of output is not determined by the saving rate, but it is constrained by the rate of growth of the labour force. Therefore, in order to increase the output growth higher than that of the labour force, factors other than the saving rate like technology and labour productivity must be improved. This article attempts to test this model in the Malaysia's growth experience using data of 1970-1996. The finding from this study shows that the Malaysia's experience is in accordance with the neoclassical growth model postulation that is saving rate does not significantly determine the rate of output growth. Instead, it is determined by the growth of export, population and government expenditure on education. However, level of saving is crucial in determining level of output.

ABSTRAK

Model pertumbuhan neoklasik menunjukkan kadar pertumbuhan output tidak dipengaruhi oleh kadar tabungan, sebaliknya dibatasi oleh kadar pertumbuhan tenaga kerja. Oleh itu bagi meningkatkan kadar pertumbuhan ekonomi melebihi kadar pertumbuhan tenaga kerja, faktor lain daripada kadar tabungan seperti tingkat teknologi dan produktiviti buruh perlu diperbaiki. Artikel ini cuba menguji sejauh mana pendekatan model neoklasik ini benar dalam kes pertumbuhan ekonomi Malaysia dengan menggunakan data tahun 1970-1996. Hasil kajian ini menyokong model neoklasik iaitu kadar tabungan tidak mempengaruhi kadar pertumbuhan ekonomi. Sebaliknya kadar pertumbuhan ekonomi Malaysia dipengaruhi oleh kadar pertumbuhan eksport, kadar pertumbuhan penduduk dan perbelanjaan kerajaan ke atas pendidikan. Walau bagaimanapun tingkat tabungan penting dalam mempengaruhi tingkat output.

INTRODUCTION

Between 1971 to 1996, average annual growth rate of percapita real gross domestic product in Malaysia experiences fluctuation at below 10 percent, despite a stable saving-income ratio. In general, this growth is much lower than the growth of real gross domestic product. Beginning the 1980s, expenditure on investment significantly exceeds domestic savings, as a result of rapid inflow of foreign direct investment as well as foreign debt. Consequently, Malaysia faces a problem of external repayment and balance of payment deficit.

The importance of saving in determining output growth has long been emphasized in the Harrod-Domar growth model. In this model, saving ratio is postulated as a sole determinant of output growth with the assumption that capital-output ratio is constant. Output growth (g) is determined by the ratio of marginal propensity to save ($s = S/Y$) and capital-output ratio ($v = K/Y$). In this regard, developing countries have to raise the value of s in order to increase g since v is assumed to be constant. On the other hand, the neoclassical model postulates that an increase in the marginal propensity to save will not affect the growth of output but instead this growth rate is maintained at the rate of labour force growth (n) (Jones 1975).

This paper attempts to examine determinant factors for Malaysia's economic growth using the neoclassical endogenous growth model. Results from this study would be important for several reasons. First, in order to ascertain the relevance of the theoretical growth model in understanding the growth experience in Malaysia. Second, the empirical investigation should help policy makers in designing appropriate growth oriented adjustment programmes and setting priorities in their implementation. Third, to suggest additional research efforts aimed at the further development of growth models.

THE BASIC NEOCLASSICAL GROWTH MODEL

Neoclassical growth theory attaches considerable importance to domestic savings in explaining the process of capital accumulation. Typically, a higher capital to labour ratio is associated with higher rate of domestic savings (Otani & Villanueva 1990). Figure 1 shows the neoclassical growth model with exogenous labour-augmenting

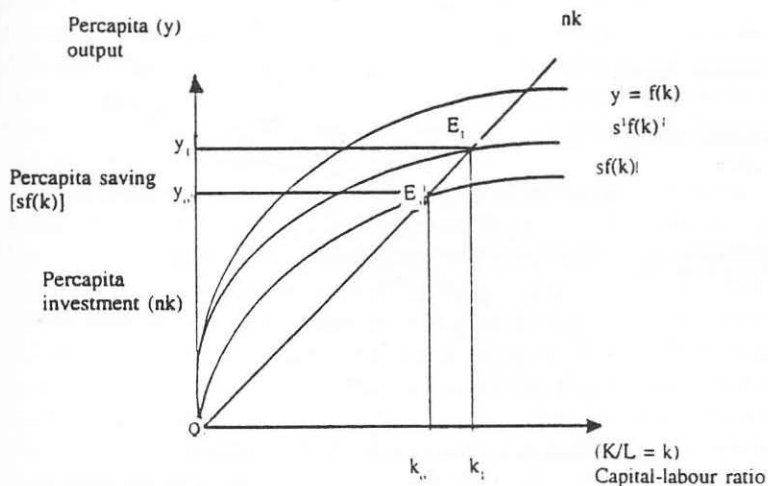


FIGURE 1. Neoclassical growth model

technical change. The vertical and horizontal axes measure the per capita output and capital-labour ratio, respectively.

Initially, the equilibrium point is achieved at E_0 , when per capita saving $[sf(k)]$ is equal to capital-labour ratio (k_0) to maintain the growth of labour force at n or

$$sf(k) = nk$$

At this equilibrium point, the per capita output as well as capital will grow at the same rate n .

Now, supposed that the domestic saving rate (s) rises for some reasons. The higher saving rate shifts the $sf(k)$ curve to $s^1f(k)^1$ and the point of equilibrium moves to E_1 at the capital-labour ratio, k_1 . At this level per capita output increase to y_1 , however the growth rate of output is still attained at n . Therefore, in the long-run a rise in saving rate increases capital intensity but leaves the growth rate of per capita output unaffected, the latter being fixed by the exogenous rate of labour-augmenting technical change.

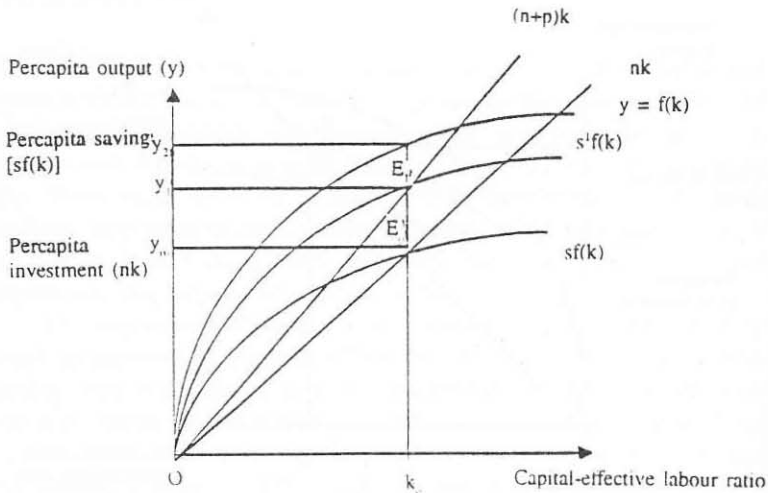


FIGURE 2. Neoclassical growth model with labour productivity

In the above model the growth of labour productivity (p) is assumed to be zero. A positive growth in labour productivity will increase investment to maintain capital-labour ratio constant (nk) to $(n+p)k$ and shifts this curve upward as shown in Figure 2.

When we assume positive labour productivity growth, the concept of effective labour is more significant to be applied. Therefore, in Figure 2 the horizontal axis measures the capital-effective labour ratio. With positive labour productivity, equilibrium point shifts from E_0 to E_1 with higher per capita saving and maintain constant capital-labour ratio at k_0 . Output growth now will increase to $(n+p)$ which is higher than n . Therefore, the growth in labour productivity will induce output growth to increase higher than the growth of the labour force.

From the model above, it is shown that a higher marginal propensity to save leads to a higher capital formation and raises the capital-labour ratio at the given growth of the labour force. The level of saving on the other hand is influenced by the number of population through three adverse impacts (Coales and Hoover 1958). Firstly, age dependency effect will result in a high ratio of children to working adults and diverts household income from saving to consumption. Secondly,

capital shallowing-effect occurs when rapid population growth lowers the ratio of capital to labour. Thirdly, investment-diversion effect occurs when rapid population growth generates a strong demand for government expenditures in areas such as education and health, thereby diverting funds from relatively more productive growth oriented public and private investment.

The impact of saving on economic growth has been cited in many studies. Otani and Villanueva (1990) found that the ratio between saving and gross domestic product (S/GDP) was very significant in determining output level in all countries in their study including Africa, Asia, Europe and Middle East. Other studies used saving-investment ratio (S/I) in measuring the impact of saving on economic growth. In a study by Kormendi and Mc Guire (1985) it was shown that this ratio had a positive relationship with the growth of gross domestic product (GDP). They also examined the impact of saving on population growth, initial level of percapita income, the growth of money supply, inflation, government expenditure and export. Positive relationship was found on growth rate of population and money supply, while saving-investment ratio was negatively related to initial percapita income, inflation, government expenditure and growth of export.

Results from Kormendi and Mc Guire (1985) were also supported by a study by Mankiew, Romer and Weil (1992). They were looking at the level of percapita income and relate it to saving-investment ratio. Their result showed a positive relationship between these two variables. In another study, Knight, Loayza and Villanueva (1993) found that growth of output per worker had a positive relationship with saving-investment ratio. Barro and Wha Lee (1993) also found a positive relationship of this ratio on the growth of gross domestic product whereas Levine and Renelt (1992) used growth of percapita income and supported a positive relationship between this variable and saving-investment ratio. Thirwall and Sanna (1996) on the other hand used investment-output ratio by assuming that at the equilibrium level, investment was equal to saving. Their study found a positive relationship between this variable and growth rate of output.

In Malaysia, a study by Ghazali Atan (1994) using 1961-86 data showed that investment-income ratio (I/GDP) significantly determined the level of output (GDP). In his study it was also shown that saving-income ratio (S/GDP) was positively related to I/GDP which implied that saving ratio was an important determinant of output. Rahmah (1998),

based on 1970-1996 data also found a significant positive relationship between real investment and level of real gross domestic product.

In the neoclassical growth model, the combination of a production function characterized by diminishing returns to physical capital intensity, a constant saving rate and a constant natural growth rate for the labour force, would bring an economy eventually to a steady-state equilibrium (Hess & Ross 1997). As long as there is no technological change or an increase in labour productivity, economic growth will be attained at an exogenously determined labour force growth. The endogenous growth theory attempts to explain the important of technological improvement in bringing the economic growth higher than the growth of the labour force. The contribution of technological progress to economic growth can be seen not only in the invention of new products and procedures, but in the continual improvements in plant, equipment and machinery, and intermediate goods (Hess and Ross 1997). As a result of these, the production function may shift up which subsequently shifting-up the percapita saving $[sf(k)]$ function. This will delay the process of diminishing returns of the production function at the higher level of capital-labour ratio from k_0 to k_1 or k_2 as shown in the Figure 3.

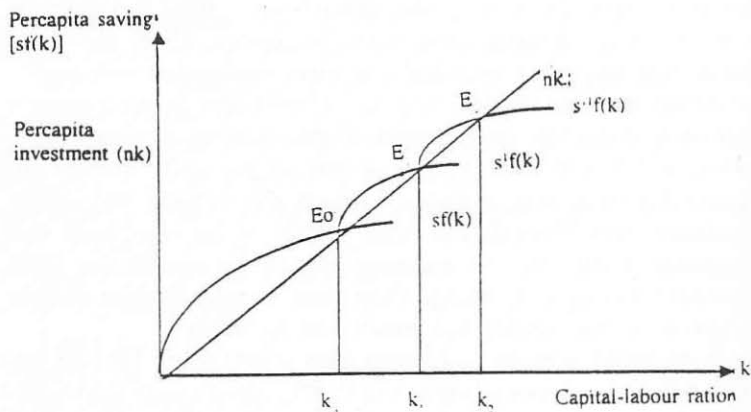


FIGURE 3. Neoclassical growth model with technological progress

In the endogenous growth model, in estimating the production function, variables other than capital and labour are added to the independent variables. To capture the quality of labour, as to reflect labour productivity or effective labour, education variables like years of schooling, enrolment rate and expenditure on education are usually considered in the independent variables. To test the neoclassical growth model, variable of saving rate (S/Y) must be added into the production function. As shown in the model, an increase in the saving rate must be accompanied by an increase in labour productivity in order to increase output growth at the same level of capital-labour ratio. Studies that incorporate both productivity and saving rate variables include Knight, Loayza and Villanueva (1993), Barro and Wha Lee (1993), Levine and Renelt (1992), Mankiew, Romer and Weil (1992). All studies used saving-investment ratio as a measure of saving rate and showed both education variable and saving rate had a significantly positive relationship with output either in terms of growth, percapita growth or absolute value.

MODEL SPECIFICATION

In formulating the model for this study, we follow the Keynesian approach whereby the economy consists of four sectors: household, corporate, government and export. In any economy, these four sectors play a major role in stimulating growth of the economy. The household sector provides labour services and receives income to be used in consumption, paying taxes and saving. The corporate sector produces goods and services using input (such as capital and labour) either from local or imported. This sector will generate income to be paid to factor of production in terms of wages, rent, debt, taxes or transfer. The profit or the remainder of its income is used for investment. The government sector on the other hand collects taxes from the household and corporate sectors and spends it on consumption and investment activities. Deficit from domestic saving will be financed from outside either in terms of debt or foreign direct investment. The export sector plays an important role on the growth of the economy. Goods and services that produced locally will be sold in the international market to earn foreign exchange which in turn can be used to buy foreign goods and services especially inputs for further production. In fact many studies have shown that export sector is a major determinant of output growth (Rahmah 1998; Chen 1979; Khang 1987).

In the macroeconomic framework, the labour market is assumed to be perfectly competitive whereby real wages are assumed to be equal to marginal product of labour. The labour supply will be determined by the age structure of the population or the labour force and its productivity. This enables us to differentiate between physical labours and effective labours. The growth of the labour force is assumed to be exogenously determined at a constant rate. The productivity is assumed to increase endogenously through improvement in human capital investment. This can be done through government expenditure on education, training, health and other related measures.

Short-run macroeconomic equilibrium is obtained when aggregate domestic investment is equal to the ex ante internal savings of the corporate and government sectors plus borrowing and foreign financing. Long-run (steady-state) equilibrium is defined as the solution to the capital-labour ratio when percapita investment is equal to percapita saving (Jones 1976). The balanced growth path in the steady state is achieved when the warranted growth rate of output or income and the rate of growth of the capital stock are equal to the natural rate of growth (of the labour force) (Otani & Vilannueva 1989, 1990). In the steady state, the growth of external debt is also equal to the growth rate of output and exports. Since all structural policies and other parameters (such as the domestic saving rate, export growth rate, cost of capital, etc, enter the capital and labour equations, the steady-state growth rate of percapita output is also a function of all such parameters.

The growth function to be estimated for the empirical analysis is as following:

$$g = f(\text{exed, savty, capy, capl, gexport, gpob}) \quad (1)$$

There are four estimated equations derived from the basic equation (1) by dropping some independent variables to see the differences in results. All estimated equations incorporate variables *exed*, *gexport* and *gpob* but the variables *savty*, *capy* and *capl* are used interchangeably. In equilibrium, saving ratio must be equal to investment ratio. Other variable that is crucial in determining output level is capital-labour ratio. In the neoclassical model, the higher is this ratio, the higher will be percapita output. However, output growth will be determined exogenously by the labour force growth unless the growth of labour productivity is positive.

In order to look at the relationship between level of output and level of total domestic saving and investment, another equations are estimated using double log specification.

The estimated equations are written below:

$$g = \beta_0 + \beta_1 \text{exed} + \beta_2 \text{savty} + \beta_3 \text{gexport} + \beta_4 \text{gpop} + u_1 \quad (2)$$

$$g = \beta_0 + \beta_1 \text{exed} + \beta_2 \text{capy} + \beta_3 \text{gexport} + \beta_4 \text{gpop} + u_2 \quad (3)$$

$$g = \beta_0 + \beta_1 \text{exed} + \beta_2 \text{savty} + \beta_3 \text{gexport} + \beta_4 \text{gpop} + \beta_5 \text{capl} + u_3 \quad (4)$$

$$g = \beta_0 + \beta_1 \text{exed} + \beta_2 \text{gexport} + \beta_3 \text{gpop} + \beta_4 \text{capl} + u_4 \quad (5)$$

$$\text{lgdpp} = \beta_0 + \beta_1 \text{lexedt} + \beta_2 \text{lsavt} + \beta_3 \text{lexport} + \beta_4 \text{lpop} + \mu_5 \quad (6)$$

$$\text{lgdpp} = \beta_0 + \beta_1 \text{lexedt} + \beta_2 \text{lcapy} + \beta_3 \text{lexport} + \beta_4 \text{lpop} + \mu_6 \quad (7)$$

where

g = growth rate of percapita real gross domestic product (GDP).

exed = percentage share of government expenditure on education.

savty = percentage total domestic savings to nominal gross domestic product.

capy = percentage of real investment – real GDP ratio.

capl = real investment – labour ratio.

gexport = growth rate of real export.

gpop = growth rate of population.

lgdpp = logarithm of percapita real gross domestic product.

lsavt = logarithm of total domestic saving.

lexedt = logarithm of total government expenditure on education.

lexport = logarithm of value of real export.

lpop = logarithm of total population.

lcapy = logarithm of real investment.

$u_1, u_2, u_3, u_4, u_5, u_6$ = error terms.

All the equations are estimated using ordinary least squares (OLS) procedure. The data for this study have been drawn from four main sources; Ministry of Finance (Economic Report), Bank Negara (Bank Negara Report), World Bank (World Development Report) and United Nations (World Tables). The study covers 27 years from 1970 to 1996.

Figure 4 shows the trend of domestic saving-GDP ratio and investment-GDP ratio. It is shown that in most of the period, in particular between 1980-86 and 1989-91 the investment-GDP ratio was higher

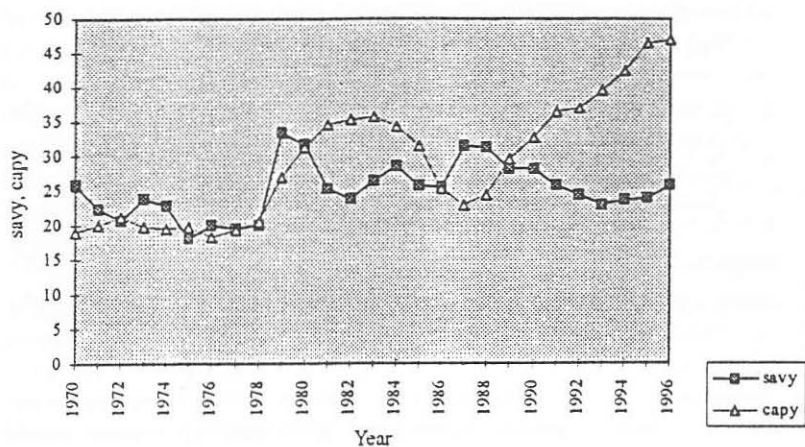


FIGURE 4. Trends of saving-GDP ratio and investment-GDP ratio

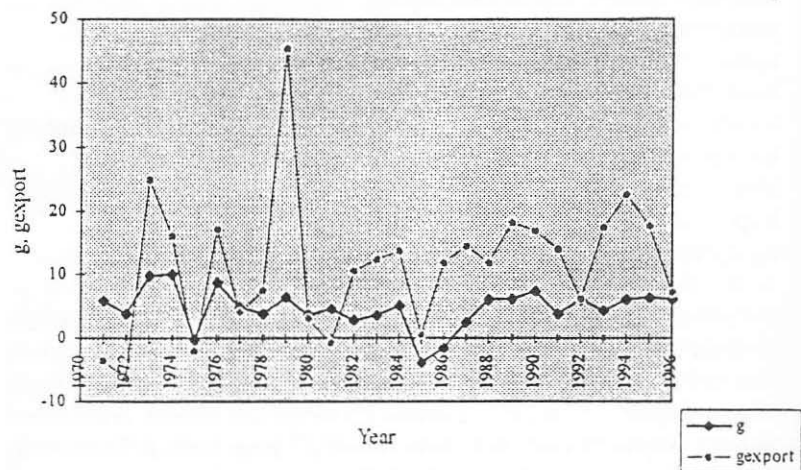


FIGURE 5. Trends of growth rate of percapita real GDP and real export growth

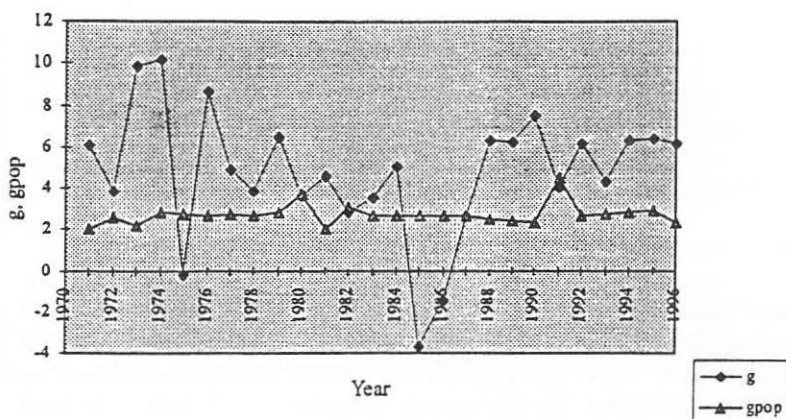


FIGURE 6. Trends of growth rate of percapita real GDP and population growth

than the saving-GDP ratio. The gap was financed either by foreign direct investment or foreign debt.

Diagram 5 shows the trend of percapita real GDP growth and real export growth. During the period under consideration, the growth of real export was higher than the growth of real percapita GDP for most of the years except 1972, 1975 and 1981 where real export growth was negative.

Figure 6 shows the difference between real percapita GDP growth and population growth rate. It is shown that the growth of population is always maintained at the lower rate except for 1975, 1985 and 1986. Real percapita GDP growth was influenced by the population growth. As can be seen from this diagram a higher population growth is associated with a lower real percapita GDP growth rate.

Table 1 shows the means of the variables used in the study. From 1970 to 1996, the average growth of real percapita GDP was 5.267 percent. Even though for certain period, like between 1990 to mid 1997 Malaysia had achieved almost 9 percent economic growth, the depression in the late 1980s resulted in a low average rate of growth percapita with a stable population growth. During the same period, the percen-

TABLE 1. Mean of the variable

Variable	Mean
g	5.267
exed	21.527
savty	25.129
capl	3.096
capy	0.292
gexport	11.510
gpop	2.575

tage expenditure on education from total government expenditure averaged 21.527 percent. This percentage is considerably large as compared to other countries like the Newly Industrialised Countries (NICs). Expenditure for educational development in Malaysia is about 7 percent of GDP as compared to 3 to 5 percent of NICs (Rahmah et al. 1995). The proportion of domestic savings to nominal GDP averaged 25.129 percent during the period under consideration. Real investment-GDP ratio and investment-labour ratio averaged 0.292 and 3.096, respectively. During the same period, growth rate of export was quite high at the average of 11.510 percent, whereas the population grew at the average of 2.575 percent.

RESULTS AND DISCUSSIONS

The R^2 from the estimated regression stand between 0.679 to 0.687 which are quite low for time series analysis. However, these values are reasonable for the growth equation since the variables are taken in terms of changes not in the absolute values. Test for autocorrelation based on Durbin Watson statistics gives an inconclusive results, this problem is further tested using Breusch-Godfrey and the result shows autocorrelation does not significantly apply to the data.

Table 2 shows the results of regression estimation. The important determinant factors of Malaysia's economic growth are growth rate of export, growth rate of population and expenditure on education. Export growth has a positive impact on economic growth. An increase of 1 unit or percentage point of rate of growth of export will increase real GDP between 0.125 to 0.136 percentage point. In the contrary, population

TABLE 2. Results of regression analyses of growth rate equation-Malaysia 1970-96

Variable	Growth rate equation			
	1	2	3	4
constant	1.532 (0.155)	1.840 (0.275)	0.537 (0.053)	3.197 (0.520)
exed	0.477 (1.635)*	0.475 (1.887)**	0.497 (1.672)*	0.443 (1.810)**
savty	0.062 (0.317)		0.067 (0.335)	
g export	0.132 (2.08)***	0.136 (2.506)***	0.125 (1.921)**	0.136 (2.509)***
gpop	-3.730 (-5.174)***	-3.855 (-5.228)***	-3.826 (-5.143)***	-3.805 (-5.245)***
capy		5.301 (0.736)		
Capl			0.250 (0.680)	0.245 (0.684)
R ²	0.679	0.686	0.687	0.685
DW	1.729	1.793	1.765	1.784

Note: figures in brackets are t-values.

* significant at 0.10 level

** significant at 0.05 level

*** significant at 0.01 level

Significance tests are one-tailed, since the theoretical growth model has yield hypotheses about the sign of the coefficient either positive or negative not either difference from zero.

growth has a negative impact on economic growth. The result shows that an increase of 1 unit or percentage point of population growth will decrease output growth between 3.73 to 3.855 percentage point. Percentage share of government expenditure on education has a positive impact on economic growth. From the results it is shown that a 1 unit or percentage point increase in the expenditure on education will increase growth rate of output between 0.443 to 0.497 percentage point.

Saving rate, investment rate and capital-labour ratio do not influence significantly the growth rate of real percapita GDP. However, investment plays an important role in determining the output level in Malaysia (Rahmah 1998). The results imply that an increase in the rate of growth of real GDP during the period under consideration is due to

TABLE 3. Results of regression analysis of logarithm equation

Variable	Logarithm equation	
	1	2
cl	11.688 (4.738)***	11.561 (5.053)***
lexed	0.441 (8.722)***	0.438 (11.377)***
lsavt	0.011 (2.328)**	—
lexport	0.4222 (5.941)***	0.410 (5.766)***
lpop	-1.913 (-5.652)***	-1.898 (-6.053)***
lcap	—	0.025 (2.683)**
R ²	0.995	0.995
D.W	1.785	1.852

Note: Figures in brackets are t-values

** significant at 0.05 level

*** significant at 0.01 level

some other factors than saving rate (S/GDP) or investment rate (I/GDP) or capital-labour ratio. It also implies that the ratio is not important but what is more crucial is the absolute values of those variables. As shown in Table 3 an increase of 1 percent in total domestic saving will increase real gdp by 0.011 percent whereas an increase of 1 percent in investment will increase real gdp by 0.025 percent. Both coefficients are significant at 5 percent level.

POLICY IMPLICATIONS

The real sector plays a major role on Malaysia's economic growth. A significant and positive relationship between export and output growth suggests that Malaysia must adopt export-led growth strategy. In order to compete in the international market, product quality must be upgraded through research and development, human resource development or technological improvement. Apart from this, the output sector must be competitive enough by reducing cost of production and improving productivity. These measures are related to improving human resource through increasing human capital investment. It is obvious from the results that increasing expenditure on education whereby the quality of labour can be improved has a significant and positive impact on economic growth. Even though the percentage educational expenditure in Malaysia is quite large compared to some other countries, its impact either in terms of

expanding or improving the educational level of the people is still minimum. This can be judged from the low enrolment rate at the tertiary level of 7 percent compared to about 37.7 percent for South Korea and 10.4 percent for Hong Kong (Rahmah et al. 1995). Perhaps, what is more important is to look at the structure of education to comply with the needs of the nation.

In line with the development of industrial and services sector, human capital investment must be geared towards producing manpower who are competent in the professional field like engineering, computer programming, designing, telecommunication and so forth. In addition, allocation for technical and vocational education as well improving computer facilities must be increased.

From the results, it is alarming that population growth must be controlled as it gives negative impact on economic growth. However, looking at the current status of the population growth in Malaysia, it is still considerably low at the average of 3 percent. In designing population policy, what is more important is to monitor the age structure of the population as it determines labour supply and the dependency ratio. Failure to produce enough population at the working age (15-64 years old) may retard the economy as it will result in labour shortage. On the other hand, if the population is concentrated at the young age (<15 years old) or old age (>64 years old), it will result in a high dependency ratio (the ratio between population at below 15 and above 64 to the population at 15-64 years of age). This lowers the productivity, hence, income of the economy.

Saving and investment ratios do not seem to play an important role in determining the growth of real GDP. But when total saving and investment are estimated on the level of real GDP these two variables show a significant role (Rahmah 1998). The insignificant role of these variables suggests that saving or investment ratio alone cannot be a strategy to increase the rate of growth of output. They must be accompanied by productivity increases as suggested in the neoclassical theory. Capital intensity also does not significantly explain the growth rate of output. Perhaps what is more important is the level of skills and skill mix of the employment, not the capital-labour ratio. It is of no use to have operational devices which are highly capital intensive but no skills available to operate them efficiently. This is a fall back to the importance of human resource development to produce skilled-technology oriented manpower and to balance them with manpower at the operational level. As stated in the Second Industrial Master Plan (IMP), the

firms must have a correct combination of engineers and technical to output operators to achieved an optimum growth rate of labour productivity. It suggests the ratio between these two employment categories (engineers plus technician: output operators) must be at 1:8 to achieve 5 percent growth rate of productivity (UNIDO 1985).

CONCLUSIONS

There are many factors that can contribute to the growth rate of an economy. In the endogenous neoclassical approach, the emphasis is given to the role of saving, human capital (as determinant for labour productivity) and capital-labour ratio (measures capital intensity as a reflection of level of technology). The results from this analysis show that marginal propensity to save as well as investment-output ratio and capital-labour ratio do not significantly influence the growth rate of the economy but economic growth is determined by export growth, population growth and quality of labour. However the levels of saving and investment are important determinant factors to increase output level. Therefore, to achieve higher rate of growth of output, strategies must be focussed on enhancing export growth, reducing population growth and expanding human capital investment.

The growth of export can be accelerated through several strategies like upgrading the quality of output, reducing cost of production and lowering output price relative to other countries. For this purpose, sectors that have a great potential in the export market must be promoted through incentives. Output quality on the other hand, is influenced by the quality of inputs, like capital and labour. The quality of labour can be improved through human capital investment mainly in the form of education and training. Thus, this two aspects must be emphasized. Apparently, there is a negative relationship between human capital accumulation and population growth which implies that enhancing human capital among people will eventually lowers population growth and contributes to higher rate of output growth.

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