# Determinants of Economic Growth:

# U.S., Japan, China, Singapore and Indonesia


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Empirical findings from 1980 to 1995 show that China, Japan, Singapore, and Indonesia have different economic growth models than that of United States. For example, one experiment indicates that the trade effect on growth is significantly different between China and U.S. The fact that each country has different dominant determinants of growth supports the notion that they have different economic growth models. Higher secondary level enrollment and terms of trade deterioration enhances growth of U.S, with the secondary level enrollment as the biggest factor. Whereas Japan has higher secondary level enrollment and lower inflation rate as key growth factors, predominantly the secondary level enrollment. Growth of China is stimulated by higher saving rate, lower inflation rate, and terms of trade improvement, but the saving rate plays the biggest role. Higher life expectancy and saving rate mostly explain growth of Singapore, especially the life expectancy. At last, higher government consumption ratio and lower life expectancy equally explains the growth of Indonesia.


## I. Introduction

At the height of Asian economic crisis in 1997, International Monetary Fund (IMF) arrived on the scene in Indonesia to approve a $10 billion bailout package that tied to economic reform measures. The reform required budget cut, tight credit, high interest rates, and bank closings; in order to lower inflation, end weakening currency, and stop foreign exchange loss. These solutions were similar to the countries that IMF typically faced, but the problems were very different. The government of those countries spent beyond its means, and financed the budget deficits by printing money through its central bank. The results were high inflation, weakening currency, and loss of foreign exchange reserve.

In contrary, Indonesia had budget surplus, inflation was low, and foreign exchange reserves were stable. Instead of restoring public confidence, the IMF remedies caused bank panic and economic meltdown. The closure of 16 insolvent banks in November 1997 set off $2 billion withdrawal from two third of all the country's bank. The tight monetary and fiscal policies deprived businesses from bank loans and government funds that were necessary to avoid mass unemployment and bankruptcies. The whole economy eventually shrank by 13.7 percent in 1998, from an averaged 7 percent growth in previous 25 years.

This economic blunder[1] raises the following key question. *Does each country at different development stage, with different social choices, and different economic structure, respond similarly to reform policies to promote economic growth?* In other words, *does each country with different social and economic characters have a similar economic growth model?* If the answer is yes, policy makers should shape their economic policies according to their condition, and international agencies, such as IMF and World Bank, should formulate reform strategies accordingly.

We attempt to answer the above question by *comparing economic growth models* of four distinctive countries against the United States (U.S.). If they indeed have different economic growth models, what are *key determinants of their corresponding economic growths*? We select these countries because of their distinctive characteristics.

[1] The author does not imply that IMF worsened the crisis, but they could have done better during the early stage of the crisis.

**United States** has the largest real GDP ($9 trillion[2]) and also one of the highest real GDP per capita ($ 33,000) in the world. It has total population that ranks fourth globally (276 million), close to Indonesia's, and total area of 9.4 million km$^2$ that matches China's. **Japan**'s real GDP ($2.8 trillion) is one third of US's and half of China's. But it has real GDP per capita ($22,000) that is almost six times higher than China's, and not far behind from US's and Singapore's. Its total population of 127 million people, almost half of US's, lives in only 378 thousand km$^2$ of total area, a twenty five times smaller than US's. **China** is the most populous country in the world (1.3 billion) and occupies a total area (9.6 million km$^2$) that is similar in size to US's. Its real GDP ($4.9 trillion) is half of US's, but the people earn only $3,847 per capita, ten times less than that of US's. **Singapore** has a small economy with $101 million real GDP, but a rich economy with $24,000 per capita. It also has a small population (4.2 million) and a very small total area (633 km$^2$). **Indonesia** is almost a total opposite of Singapore. It is the fifth most populous country with 225 million populations that live in 2 million km$^2$ of total area. It has a bigger economy than Singapore's with $598 million of real GDP, but a poorer economy with $2,662 per capita, almost ten times less than Singapore's.

The *second* section of this paper discusses economic growth theories, Neoclassical and Endogenous, and how does this paper fit into these theories. It also describes how does it differ from other empirical works in economic growth. The *third* section explains the data that is used in the analysis and defines each dependent and independent variables. The *fourth* section developed a pooled regression model to test if there is a significant different between each country's growth model against the US'. If they are significantly different,

[2] All statistics in this paragraph are in year 2000 (source: CountryWatch.com)

we will discuss key determinants of their growths that explain the differences. The *fifth* section discusses the empirical findings and policy implications, and the *sixth* section draws conclusion from this research and suggests potential further research.

## II. Economic Growth theories

### *A. Neoclassical*

In the late 1950's and the 1960's, economic growth theory is mainly the neoclassical growth theory developed by Solow (1956), Swan (1956), Cass (1965), and Koopmans (1965). The theory focuses on capital accumulation and its link to savings decisions and population growth. It says that increase in the *savings rate* raises output growth rate in the short run, but not in the long run. In the long run, economy will reach a steady state where per capita output is not growing anymore or constant. The key assumption here is diminishing marginal product of capital. And it applies to population growth factor as well. Increase in the *population growth rate* raises an aggregate output growth rate, but reduces level of output per capita. The theory implies that country with a lower initial income per capita will eventually catch-up or converge with those of higher income per capita as long as they have equal savings rate, population growth, and technology. The paper does *not* concern with this *absolute convergence* property of the theory, but instead it uses the savings rate and population growth variables to explain the output per capita growth rate of each country.

Neoclassical implies that only technological progress affects per capita output in the long run. But it does not explain what are determinants of the technological progress. The technological part is exogenous (i.e. Solow residual), and endogenous growth theory focuses on the determinants of that part.

*B. Endogenous*

Starting from late 1980s, endogenous becomes a focus of growth theory development with Romer (1986) and Lucas (1988). The theory looks at how societal choices affect the technological progress. Specifically, they look at *human capital* and more recently *social-political institutions*. The assumption of the theory, contrarily with neoclassical, is a constant marginal product of capital. This means that the technology increases the productivity of capital and labor which allows output per capita to grow endlessly. Therefore countries with lower income per capita will converge with those of higher income per capita only if their determinants of technological progress (i.e. human capital and social-political institutions) are the same. The paper again does *not* concern with this *conditional convergence* property of the theory. Instead it uses the human capital and the institution variables to explain the output per capita growth rate of each country.

Many empirical studies in endogeneous growth, namely Barro (1991), Barro and Sala-i-Martin (1992), Barro (1996), perform a cross section analysis across various countries and mainly concern with conditional convergence issue. Whereas this paper performs a pooled regression analysis that combines thirty years time series with five cross sectional countries (as dummy variables), and only concerns with comparison of growth models. But it uses some of Barro's endogenous variables for our growth model. Equation (1) is an example of Barro's growth equation in a complete form (see Barro 1996).

*Per Capita growth rate = log (initial GDP) + initial male secondary and higher schooling + log(initial life expectancy) + log(initial GDP)*male schooling + log(fertility rate) + government consumption ratio + rule-of-law index + terms-of-trade change + democracy index + democracy index squared + inflation rate + Sub Saharan Africa dummy + Latin America dummy + East Asia dummy* .............................................. (1)

Next section defines these variables, neoclassicals, and other variables, in more detail.

## III. The Data Set

The dependent variable for our growth equations is the annual growth rate of real GDP per capita of each country from 1970 to 2000. The independent variables are based on neoclassical and endogenous theories, with four country-dummy variables to identify the country of each time series data.

The neoclassical variables are savings rate and population growth rate, explaining the capital and labor factor of production function respectively. The endogenous variables can be classified into government institutions, trade (open-economy), and human capital related[3]. Government institution variables are government consumption ratio to GDP for fiscal policy choice, and inflation rate for monetary policy choice. The trade variable is annual change of export to import ratio, primarily for countries with smaller domestic market thus more dependent on international trading. Human capital variables are gross secondary enrollment ratio for educational measure, and life expectancy at birth for health measure. The four country-dummy variables will be discussed in next section. See Appendix A for variables descriptions and data sources.

We compile most data from a single source, that is IMF's International Financial Statistics Year Book, for data consistency to allow cross-country comparison. The exception to this are gross secondary enrollment ratio and life expectancy at birth (see Appendix A for their sources). Furthermore, China[4] dataset are practically not available annually before 1980. Appendix B lists data that are *available* for our analysis using method that is discussed in the next section.

[3] We omitted law and political institution variables (see Barro, 1996) from our model due to time and budget constraint.

[4] China in this paper refers only to Mainland China, excluding Hong Kong and Macao.

## IV. The Model

In order to compare growth model of our distinctive countries, we pool about 150 observations (30 time series observations for five countries) to estimate a *pooled regression* using four *dummy variables*. This method enables us to combine many time series observation with few cross-sectional observations into a single common regression, to improve precision of estimated parameters due to higher degree of freedom. The common growth equation is shown below:

$$\begin{aligned} Y_1 = {} & \beta_1 + \beta_2 Saving - \beta_3 Population - \beta_4 Government - \beta_5 Inflation + \beta_6 Trade \\ & + \beta_7 Education + \beta_8 Health \\ & + \beta_9 Japan + \beta_{10} China + \beta_{11} Singapore + \beta_{12} Indonesia + \varepsilon_1 \end{aligned} \quad \text{.......................} \ (2)$$

Note that we are treating U.S. as the base country for others to compare with. Therefore, $\beta_1$ is the base intercept for U.S. and $\beta_9$, $\beta_{10}$, $\beta_{11}$, and $\beta_{12}$ are *differential intercepts* for Japan, China, Singapore, and Indonesia respectively. After running regression (2), we can determine if the differential intercepts are statistically significant individually, or/and simultaneously. For example, a statistically significant $\beta_{12}$ means that the intercept value of Indonesia's growth model is different from that of U.S.' growth model. Overall, we will perform five separate zero hypothesis testing, $\beta_9 = 0$, $\beta_{10} = 0$, $\beta_{11} = 0$, $\beta_{12} = 0$, and a simultaneous $\beta_9 = \beta_{10} = \beta_{11} = \beta_{12} = 0$.

Due to data deficiency of life expectancy, secondary enrollment, and China, as previously mentioned, we will conduct the hypotheses testing for three regression equations. The first regression (equation 2) encompasses all variables, but only considers 1980 to 1995 time series. Because China and life expectancy variable only have 1980 to

2000 data, and secondary enrollment variable has 1980 to 1995 data. Table 1 provides descriptive statistics for variables that are used for this regression.

*Table 1: Descriptive Statistics for Regression model with all variables (1980-1995)*

| Variable | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Real GDP per capita growth | 80 | -36.28 | 25.40 | 2.1199 | 11.2584 |
| Saving rate | 80 | 16.60 | 48.50 | 31.1375 | 8.0717 |
| Population growth | 80 | -2.43 | 11.76 | 1.4514 | 1.4513 |
| Government consumption | 80 | 7.83 | 21.16 | 12.6515 | 4.1677 |
| Inflation rate | 80 | -1.40 | 24.20 | 5.5813 | 4.9548 |
| Terms-of-trade change | 80 | -32.12 | 31.02 | .6413 | 10.9362 |
| Secondary enrollment | 80 | 29.00 | 103.40 | 69.1550 | 23.9502 |
| Life expectancy | 80 | 53.42 | 80.10 | 71.2377 | 7.1076 |
| Japan dummy | 80 | 0 | 1 | .20 | .40 |
| China dummy | 80 | 0 | 1 | .20 | .40 |
| Singapore dummy | 80 | 0 | 1 | .20 | .40 |
| Indonesia dummy | 80 | 0 | 1 | .20 | .40 |

The second regression excludes secondary enrollment and life expectancy variables, but considers a longer 1970 to 2000 time series with an exception of China that begins from year 1980. The second equation is shown below:

$$Y_2 = \beta_1 + \beta_2 Saving - \beta_3 Population - \beta_4 Government - \beta_5 Inflation + \beta_6 Trade \\ + \beta_9 Japan + \beta_{10} China + \beta_{11} Singapore + \beta_{12} Indonesia + \varepsilon_2 \quad \text{.......................} (3)$$

The reasons for having this regression are incompleteness and inconsistency of social indicators, in comparison to that of economic variables. For example, life expectancy data comes from different sources (consistency issue) and its earlier data are only available in five to ten years period (completeness issue). Table 2 provides descriptive statistics for variables that are used for the second regression.

*Table 2: Descriptive Statistics for Regression model without social variables (1970-2000)*

| Variables | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Real GDP per capita growth | 145 | -52.89 | 25.40 | 1.9096 | 12.0098 |
| Saving rate | 145 | 11.60 | 48.50 | 29.9695 | 8.6159 |
| Population growth | 145 | -2.43 | 11.76 | 1.4397 | 1.2575 |
| Government consumption | 145 | 4.34 | 22.80 | 12.5034 | 4.3960 |
| Inflation rate | 145 | -3.09 | 57.60 | 6.6070 | 7.8054 |
| Terms-of-trade change | 145 | -32.12 | 64.27 | 1.3050 | 12.1366 |
| Japan dummy | 145 | 0 | 1 | .21 | .41 |
| China dummy | 145 | 0 | 1 | .14 | .35 |
| Singapore dummy | 145 | 0 | 1 | .21 | .41 |
| Indonesia dummy | 145 | 0 | 1 | .21 | .41 |

The third regression is similar to equation (2), in terms of using 1980 to 1995 time series, except that we perform additional hypothesis testing ( $\beta_0 = 0$) to compare growth effects of terms of trade change between U.S. and China. If the *differential slope coefficient* ( $\beta_0$) is significant, it means that their terms of trade change effects on growth are different. The third equation is shown below:

$$
\begin{aligned}
Y_3 = \beta_1 + \beta_2 Saving - \beta_3 Population - \beta_4 Government - \beta_5 Inflation + \beta_6 Trade \\
+ \beta_7 Education + \beta_8 Health \\
+ \beta_9 Japan + \beta_{10} China + \beta_{11} Singapore + \beta_{12} Indonesia \\
+ \beta_0 China.Trade + \varepsilon_3 \qquad \text{.......................} \ (4)
\end{aligned}
$$

This equation also enhances the result of equation (2) because it considers both interrupt and slope differentials, although not all slope differentials from all possible combination of country-dummy and social-economic variables. We exclude other slope differentials to avoid lenghty interpretations later. Therefore this regression is experimental by this nature.

We realize that our pooled regression method implicitly makes key assumptions regarding regression parameters and the stochastic error term. First, we assume that the parameters do not change over time (temporal stability) and do not differ between various cross-sectional countries (cross-sectional stability). We believe that having 15 years (1980-1995) data in equation (2) and (4), and 30 years (1970-2000) data in equation (3) improve the temporal stability. We certainly solve part of the cross-sectional stability by having differential intercepts in our equations, but still allowing most differential slopes to be the same. In other words, we disregard complete interaction effects or interaction dummy among countries. Considering that having five countries will multiply the number of interaction dummy thus complicating our model and interpretation afterward. Second, we assume that error variances of the five countries' growth equations are homoscedastic, and the error in country A's equation at time t is uncorrelated with that of country B at time t. These are the usual Ordinary Least Square properties that we assume to be true in our case.

If we accept these assumptions and later find that differential intercepts are statistically significant in at least one of the equations, we can proceed to run five separate growth equations for each country, as stated below, using variables that resemble closely to those done by Barro (1996) in his cross-country growth study. Equation (5), (6), (7), (8), and (9) are growth equations for U.S., Japan, China, Singapore, and Indonesia respectively.

$$\log(Economy)_{US} = \beta_{13} + \beta_{14} Saving - \beta_{15} \log(Population) - \beta_{16} Government - \beta_{17} Inflation + \beta_{18} Trade + \beta_{19} \log(Education) + \beta_{20} \log(Health) + \varepsilon_3 \quad \text{.......} (5)$$

$$\log(Economy)_{JP} = \beta_{21} + \beta_{22} Saving - \beta_{23} \log(Population) - \beta_{24} Government - \beta_{25} Inflation + \beta_{26} Trade + \beta_{27} \log(Education) + \beta_{28} \log(Health) + \varepsilon_4 \quad \text{.......} (6)$$

$$\log(Economy)_{CH} = \beta_{29} + \beta_{30} Saving - \beta_{31} \log(Population) - \beta_{32} Government - \beta_{33} Inflation + \beta_{34} Trade + \beta_{35} \log(Education) + \beta_{36} \log(Health) + \varepsilon_5 \quad \text{.......} (7)$$

$$\log(Economy)_{SG} = \beta_{37} + \beta_{38} Saving - \beta_{39} \log(Population) - \beta_{40} Government - \beta_{41} Inflation + \beta_{42} Trade + \beta_{43} \log(Education) + \beta_{44} \log(Health) + \varepsilon_6 \quad \text{.......} (8)$$

$$\log(Economy)_{IN} = \beta_{45} + \beta_{46} Saving - \beta_{47} \log(Population) - \beta_{48} Government - \beta_{49} Inflation + \beta_{50} Trade + \beta_{51} \log(Education) + \beta_{52} \log(Health) + \varepsilon_7 \quad \text{.......} (9)$$

Please note that "Economy" in above equations refers to real GDP per capita, and "Population refers to total population. Also note that we may drop some of the variables, with proper justifications, in the final growth equation of each country if they are highly correlated (*multicollinearity*). The final equation enables us to focus separately on significant key determinants of economic growth for each country, without presence of *serial correlation*.

For these country regression runs, we use two years period of data since annual frequency will likely be affected by business-cycle effect. We realize that longer intervals, such as five or ten years, are probably more effective to smooth out the cyclical effect. But since we have only 20 years dataset for China, and we need at least 10 cases to assess the significance of the result, we have to settle on 2-years period.

## V. Empirical Results

Table 3 shows results from regressions that use equation (2), (3), and (4). Regression (2) results indicate that Japan, China, Singapore, or/and Indonesia's differential intercept(s) is statistically different, individually or simultaneously, from that of U.S.

*Table 3: Economic Growth Regression (2), (3), and (4) Comparison*

| Variable | Regression (1) | Regression (2) | Regression (3) |
|---|---|---|---|
| Japan dummy | -40.038 | -1.211 | -44.708 |
| | (*-2.576*) | (*-.152*) | (*-2.834*) |
| | (.012) | (.880) | (.006) |
| China dummy | -60.568 | -1.597 | -61.268 |
| | (*-3.627*) | (*-.239*) | (*-3.431*) |
| | (.001) | (.811) | (.001) |
| Singapore dummy | -51.504 | 3.450 | -54.952 |
| | (*-3.009*) | (*.424*) | (*-2.885*) |
| | (.004) | (.672) | (.005) |
| Indonesia dummy | -84.597 | -12.161 | -88.164 |
| | (*-3.447*) | (*-1.548*) | (*-3.618*) |
| | (.001) | (.124) | (.001) |
| China.Trade | | | -.459 |
| | | | (*-2.197*) |
| | | | (.031) |
| Number of observations | 80 | 145 | 80 |
| Adj. R-square | .220 | .127 | .262 |
| F-stat. | 3.363 (.001) | 3.330 (.001) | 3.334 (.001) |

Note: Regression (2) and (4) with all variables (1980-1995), Regression (3) without social variables (1970-2000)
t-statistics in *italic* parenthesis, significance level in normal parenthesis

Results from regression (3) are not significant enough in their coefficients and regression for our interpretation. This probably means that *the social variables, education and health, may enhance the explanation of the economic growth*, because regression (2) with social variables has a lower adjusted R-square (.127). The higher number of observations in regression (3) does not help its significant either. This is probably due to higher business cycles effect from more frequent observation.

China.Trade coefficient is significant at 3% level, which means that *China's trade variable is different from that of United States in affecting growth*. US' terms of trade have not improved since 1991, but it can afford to do so because of its huge domestic economy. On the other side, China has to depend more on his export to spur growth. This extra variable in equation (4) slightly improves equation (2) as can bee seen from a higher adjusted R-square (.262). Based on the results of regression (2) and (4), we can say that *Japan, China, Singapore, and Indonesia seem to have different economic growth models than that of United States*. If this is the case, the next question is what are key determinants that may explain differences of their growth models.

*Table 4: Correlation Matrix among Economic Growth Regressors for United States, Japan, China, Singapore, and Indonesia (only significant high correlations are shown)*

| | | Population | Government | Inflation | Trade | Education | Health |
|---|---|---|---|---|---|---|---|
| **Saving** | **USA** | | | | | | |
| | **Japan** | **-.876** | **-.747** | **.782** | | **-.791** | **-.866** |
| | **China** | **.702** | | **.636** | | **.742** | |
| | **Singapore** | **-.650** | | | | **-.592** | |
| | **Indonesia** | **.651** | | | | **.710** | **.690** |
| **Population** | **USA** | | **-.892** | **-.600** | | **.889** | **.974** |
| | **Japan** | | **.607** | **-.759** | | **.913** | **.993** |
| | **China** | | **-.796** | | | **.907** | **.865** |
| | **Singapore** | | **-.582** | | | **.645** | **.952** |
| | **Indonesia** | | **-.544** | | | **.975** | **.969** |
| **Government** | **USA** | | | | | **-.714** | **-.869** |
| | **Japan** | | | | | **.644** | **.619** |
| | **China** | | | | | **-.666** | **-.644** |
| | **Singapore** | | | | | | **-.507** |
| | **Indonesia** | | | | | | |
| **Inflation** | **USA** | | | | | **-.532** | **-.503** |
| | **Japan** | | | | | **-.660** | **-.746** |
| | **China** | | | | | | |
| | **Singapore** | | | | | | |
| | **Indonesia** | | | | **.737** | | |
| **Trade** | **USA** | | | | | | |
| | **Japan** | | | | | | |
| | **China** | | | | | | |
| | **Singapore** | | | | | **.704** | |
| | **Indonesia** | | | | | | |
| **Education** | **USA** | | | | | | **.923** |
| | **Japan** | | | | | | **.939** |
| | **China** | | | | | | **.705** |
| | **Singapore** | | | | | | **.581** |
| | **Indonesia** | | | | | | **.951** |

Before we discuss those determinants, we detect if any of those variables are highly correlated. For example, Table 4 shows that health and education variables of U.S. are highly correlated. Therefore we drop one of the variables such that it optimizes the significant of coefficients and the regression, and the adjusted R-square. For U.S. final equation, we drop saving, population, government, inflation, and health. It does not mean that these variables are not determinants of U.S. growth. It merely says that education and trade seem to play a more significant role in its growth during 1970-2000. The same logic applies to other countries as well. The Durbin-Watson statistics suggest no strong evidence of serial correlation. Therefore we are comfortable to present the remaining variables as significant key determinants of growth for respective countries as shown in Table 5.

*Table 5: Economic Growth Regression Results of United States, Japan, China, Singapore, and Indonesia*

| **Log(real GDP per capita)** | **United States** | **Japan** | **China** | **Singapore** | **Indonesia** |
|---|---|---|---|---|---|
| **Saving rate** | | | .111<br>(*6.392*)<br>(.000) | 1.611E-02<br>(*2.205*)<br>(.046) | |
| **Log(population growth)** | | | | | |
| **Government consumption ratio** | | | | | .241<br>(*4.162*)<br>(.001) |
| **Inflation rate** | | -4.877E-02<br>(*-3.821*)<br>(.002) | -2.945E-02<br>(*-3.728*)<br>(.007) | | |
| **Terms-of-trade change** | -7.850E-03<br>(*-2.342*)<br>(.036) | | 9.734E-03<br>(*2.324*)<br>(.053) | | |
| **Log(secondary enrollment ratio)** | 1.590<br>(*4.953*)<br>(.000) | 7.408<br>(*6.528*)<br>(.000) | | | |
| **Log(life expectancy)** | | | | 9.792<br>(*19.541*)<br>(.000) | -2.635<br>(*-4.778*)<br>(.000) |
| **Adj. R-square** | **.681** | **.913** | **.795** | **.968** | **.811** |
| **Durbin-Watson** | 1.505 | 1.131 | 1.666 | 2.183 | 1.579 |
| **Number of observations** | 16 | 16 | 11 | 16 | 16 |
| **F-stat** | **17.040**<br>(.000) | **79.952**<br>(.000) | **13.899**<br>(.002) | **226.754**<br>(.000) | **33.130**<br>(.000) |

Note: t-statistics in *italic* parenthesis, significance level in normal parenthesis

*1. Saving Rate*

In the neoclassical model for a closed economy, the saving rate is equal to the ratio of investment to output. This should justify our use of gross capital formation ratio to GDP as a proxy to saving rate. We learn from the previous discussion of neoclassical that saving rate may not affect long-run growth rate without exogenous technological factor. Empirically, Blomstrom, Lipsey, Zejan (1993) and Barro (1996) reach the following conclusion regarding investment and growth. They find that their relations are reverse causation, meaning that an investment decision in a particular economy relate to its growth opportunity. Barro (1996) concludes this after finding that the estimated coefficient of the investment variable is statistically significant only if he use a more recent, compared to the previous five years, investment ratio. Table 5 shows that saving rates are significant growth factors for China and Singapore. *For a one percent increase in saving rate, the real GDP per capita grows on average at 11.1 percent for China, and 1.6 percent for Singapore*. Because China has a lower current level of per capita output than that of Singapore, capital accumulation in China has a higher marginal product. Whereas Singapore probably experiences diminishing marginal product of capital, as predicted by neoclassical theory.

*2. Population Growth*

As population grow, more capitals are required for additional labor, instead of increasing capital per labor. This is why we should expect that a higher population growth rate has a negative effect on economic output per capita based on neoclassical theory. We use log of population growth rate rather than log of fertility rate in Barro (1996) because of data adequacy issue. Barro attributes a significant negative coefficient of the fertility rate to the increased resources that must be devoted to child rearing, rather than to production of goods (see Becker and Barro, 1988). *None of our countries have population growth rates as significant growth factors, because they are highly (and positively) correlated to education and health factors* (see Table 4). This means that as population grows, secondary enrollment ratio and life expectancy increases as well, assuming that total spending in education and health grow at the same time.

*3. Government Consumption*

Our use of government consumption ratio to GDP to measure government spending is intended to approximate the size of government in relative to economy. Big government means higher non-productive (government) spending, and its associated taxation, because it “crowds out” higher return (more productive) private spending. Therefore we should expect a negative effect of higher government consumption ratio on economic growth. Please note that Barro (1996) excludes education and defense spending in his government consumption variable. His estimated coefficient is negatively significant. Contrarily, we have a positive significant coefficient for Indonesia. Specifically, *for a one percent increase in government consumption ratio, real GDP per capita of Indonesia increases on average by 24%*. This probably means that private sector is not functioning well because of ineffectiveness rule of law and political instability. Inclusion of these factors should capture these effects separately.

*4. Inflation Rate*

The general view is that inflation is costly, whether it is the average rate of inflation or the variability and uncertainty of inflation. The reason is that businesses rely on stable and predictable inflation to perform properly. But how bad is inflation before it reduces growth? Barro (1996) estimates that an increase in the average inflation rate by 10 percentage points per year will lower the growth rate of real per capita GDP by 0.3-0.4 percentage points per year. This means that the level of real GDP will be lowered after 30 years by 6-9%. Therefore the magnitude of the effect is not that large and takes a longer term. We have a bigger magnitude effect than the one reported by Barro. Table 5 shows that *for a one percent increase in inflation rate, real GDP per capita decreases on average by 2.9 percent for China and 4.9 percent for Japan*. This bigger magnitude probably reflects business cycles effects due to shorter interval frequency of our observations.

*5. Terms of Trade*

Changes in terms of trade – measured as the ratio of export to import – has often been thought as important effect on developing countries, which has to rely on their exports in key products. But the improvement in this ratio does not always mean a positive impact on real GDP. We can see in the case of oil importing country that cuts production and employment due to increase in oil prices. Barro (1996) shows that change in terms of trade has a significant positive coefficient. But our results are mixed. *This trade variable has a small positive impact (0.79%) on growth for China, but a small negative impact (-0.97%) for U.S.* We interpret this as China is more dependent on trade for growth than U.S.

*6. Secondary Enrollment*

This education variable is an important part of human capital, especially in industrialized countries. In fact, Mankiw, Romer, and Weil (1992) report that the share of human capital factor is about one third of production function in those countries. Although this factor is a more difficult element to measure precisely, Barro (1996) manages to use average years of schooling at the secondary and higher level for males aged 25 and over as a proxy for human capital. Since this data is only available at 5 years period, we have to use gross enrollment ratio for secondary level regardless of age and sex. This is a better explanatory variable than a lower level, e.g. primary, education according to Barro. His result shows a significantly positive effect on growth from the years of schooling that apply across 100 countries. Specifically, an extra year of male upper-level schooling is estimated to raise growth rate by a substantial 1.2 percentage points per year. Our results show that both U.S. and Japan have education variable as key determinants of growth. Specifically, *for a one percent increase in secondary enrollment ratio, real GDP per capita increases on average by 1.6 percent for U.S., and 7.4% for Japan*. As developed countries, U.S. and Japan have to rely more on human capital and less on physical capital and raw labor to spur growth.

*7. Life Expectancy*

Dornbusch, Fischer, and Startz (1998) mention that health factor is probably a major contributor to human capital in poor countries. We should be able to support this view from our findings in Table 5. But first the cross-country result by Barro (1996) shows that the log of life expectancy at birth[5] has a significantly positive effect on growth. He interprets this result by broadly proxying life expectancy to the quality of human capital. Our results are mixed in this case. Human clearly has a strong positive impact on growth for Singapore, but a negative impact for Indonesia. *For a one percent increase in life expectancy at birth, real GDP per capita increases by 9.8 percent for Singapore, but decreases by 2.6 percent for Indonesia*. Major improvement in health status of Singapore has coincided with their substantial increments of economic growth. But a health upgrade

[5] Barro reports a similar result for infant mortality rate, instead of life expectancy, as a proxy for health.

in Indonesia, without a proportionate upgrade in education, seems to create a social burden that suppresses its growth.

In addition to these seven variables, we would like readers to consider these differences as well to explain distinctive growth between U.S. and the other four countries: initial GDP level, rule-of-law effectiveness, political freedom, and religion. Country with a lower initial GDP level tends to grow at a higher rate, assuming other explanatory variables are held constant (Barro and Sala-i-Martin, 1995). One of these omitted explanatory variables that worths mentioning is infrastructure investment. Country without proper infrastructure in place (i.e. Afghanistan) will have stalled growth rate irrespective of its initial GDP level. Discussions of law, political, and religion factors are beyond the scope of this paper. Instead, we will focus on the findings of our seven variables.

Different key determinants of growth for U.S., Japan, China, Singapore, and Indonesia provide some explanation of why growth models of the last four countries are different from that of U.S. This result should alert policy makers that no common growth policy could be fitted to a particular country. Differences in the seven explanatory variables have to be considered as well. Particularly for U.S. and Japan, *education* should be on the top of their agendas. For China, Singapore, and Indonesia, policy makers should give priorities to *saving, health,* and *law-political* correspondingly.

## VI. Conclusion

Empirical findings from 1980 to 1995 suggest that economies of China, Japan, Singapore, and Indonesia grow differently than that of United States. The social indicators, education and health, explain some of these differences. One small experiment shows that the trade effect on growth is different between China and U.S. But looking at each economy separately, we find that each has different key determinants of growth.

Higher secondary level enrollment and terms of trade deterioration enhances growth of U.S. Whereas Japan has higher secondary level enrollment and lower inflation rate as key growth factors. Growth of China is stimulated by higher saving rate, lower inflation rate, and terms of trade improvement. Higher life expectancy and saving rate mostly explain growth of Singapore. But lower life expectancy and higher government spending ratio correlates to increased growth of Indonesia. Overall, increased secondary level enrollment is a key growth determinant of U.S. and Japan. Higher saving rate is an important growth factor of China. Improved life expectancy highly coincides with the growth of Singapore. Higher government consumption ratio and lower life expectancy equally explains the growth of Indonesia.

The challenge of time series growth regression for few countries is to overcome business cycle effect by having higher interval frequencies observations. But some developing countries, such as China, have only about 20 years of data. Future research will enable a more accurate analysis using five or ten years of more observations. Other possible growth research can be taken by incorporating additional social and political institution factors, such as rule of law (see Barro, 1996), democracy (see Barro, 1999), and religion (see Iannaccone, 1998).

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## Appendix A: Variables Description and Sources

*Economy*: Annual growth rate of real GDP per capita. Current GDP in local currency are deflated at 1995 constant price, and then converted to IMF's SDR currency[6], before divided by total population. Source: International Financial Statistics Year Book, 1999-2001, IMF.

*Saving*: Gross capital formation as a percentage of GDP. Sources: International Financial Statistics Year Book, 1999-2001, IMF, and The World Bank Group, World Development Indicators database.

*Population*: Annual population growth rate. Sources: International Financial Statistics Year Book, 1999-2001, IMF, and The World Bank Group, World Development Indicators database.

*Government*: Government consumption as a percentage of GDP. Sources: International Financial Statistics Year Book, 1999-2001, IMF, and Asian Development Bank (ADB).

*Inflation*: Annual change of consumer price index. Sources: International Financial Statistics Year Book, 1999-2001, IMF; The World Bank Group, World Development Indicators database; and San Jose State University, Economics Dept., Dr. Watkins (China, 1979-1986).

*Trade*: Annual change of terms of trade, that is export (fob) to import (cif) ratio. The trade data are based on custom data. Source: International Financial Statistics Year Book, 1999-2001, IMF.

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[6] SDR or Special Drawing Rights is determined using a basket of currencies (US$, Euro, Yen, Pound). Weights are assigned to the currencies to reflect their relative importance in world's trading and financial systems.

*Education:* Gross secondary enrollment ratio, that is total enrollment in secondary level, regardless of age, expressed as a percentage of the official school-age population corresponding to secondary level. Sources: UNESCO online database.

*Health:* life expectancy at birth in years. Source: U.S. Bureau of the Census, International Data Base; National Center for Health Statistics, National Vital Statistics Report, Vol. 47, No. 28, Dec 13, 1999; Berkeley Mortality Database (Ministry of Health and Welfare, Statistics and Information Department); and The World Bank Group, World Development Indicators database.

*Japan:* A Dummy variable that takes a value of 1 if the data belong to Japan, or 0 otherwise.

*China:* A dummy variable that takes a value of 1 if the data belong to Mainland China only, excludes Hong Kong and Macao, or 0 otherwise.

*Singapore:* A Dummy variable that takes a value of 1 if the data belong to Singapore, or 0 otherwise.

*Indonesia:* A Dummy variable that takes a value of 1 if the data belong to Indonesia, or 0 otherwise.

Note: If all dummy variables take zero value, the data belong to United States.

# Appendix B: Data available for regressions

| Year | *Economy* Growth rate % | Saving rate % | *Population* Growth % | Government % of GDP | Inflation rate % | Trade Change % | *Education* Enrollment ratio % | Health Years | Japan Dummy | China Dummy | Singapore Dummy | Indonesia Dummy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1970 | -4.91 | 17.40 | 1.17 | 22.80 | 5.90 | 3.79 | 83.70 | 70.80 | 0 | 0 | 0 | 0 |
| 1971 | -6.04 | 18.50 | 1.27 | 22.24 | 4.30 | -10.48 | | 71.10 | 0 | 0 | 0 | 0 |
| 1972 | 4.37 | 19.50 | 1.08 | 21.78 | 3.30 | -7.22 | | 71.20 | 0 | 0 | 0 | 0 |
| 1973 | -5.95 | 20.30 | 0.96 | 20.78 | 6.20 | 15.76 | | 71.40 | 0 | 0 | 0 | 0 |
| 1974 | -2.73 | 19.50 | 0.92 | 21.48 | 11.00 | -7.31 | | 72.00 | 0 | 0 | 0 | 0 |
| 1975 | 3.14 | 17.00 | 0.99 | 22.08 | 9.10 | 14.64 | 84.40 | 72.60 | 0 | 0 | 0 | 0 |
| 1976 | 5.39 | 18.70 | 0.96 | 21.08 | 5.70 | -14.26 | | 72.90 | 0 | 0 | 0 | 0 |
| 1977 | -0.97 | 20.20 | 1.01 | 20.44 | 6.50 | -12.88 | | 73.30 | 0 | 0 | 0 | 0 |
| 1978 | -2.73 | 21.40 | 1.07 | 19.84 | 7.60 | 2.09 | | 73.50 | 0 | 0 | 0 | 0 |
| 1979 | 0.93 | 21.60 | 1.11 | 19.62 | 11.30 | 6.97 | | 73.90 | 0 | 0 | 0 | 0 |
| 1980 | 1.99 | 19.70 | 1.20 | 20.38 | 13.50 | 4.67 | 91.20 | 73.70 | 0 | 0 | 0 | 0 |
| 1981 | 11.05 | 20.60 | 0.96 | 20.16 | 10.30 | -0.51 | 94.40 | 74.10 | 0 | 0 | 0 | 0 |
| 1982 | 2.49 | 18.20 | 0.97 | 21.00 | 6.20 | -2.76 | 94.60 | 74.50 | 0 | 0 | 0 | 0 |
| 1983 | 8.88 | 18.20 | 0.92 | 20.82 | 3.20 | -10.27 | 96.90 | 74.60 | 0 | 0 | 0 | 0 |
| 1984 | 13.59 | 20.80 | 0.88 | 20.36 | 4.30 | -15.13 | 96.10 | 74.70 | 0 | 0 | 0 | 0 |
| 1985 | -8.15 | 19.70 | 0.90 | 20.85 | 3.60 | -3.99 | 97.30 | 74.70 | 0 | 0 | 0 | 0 |
| 1986 | -8.03 | 19.20 | 0.92 | 21.16 | 1.90 | -4.29 | 97.70 | 74.70 | 0 | 0 | 0 | 0 |
| 1987 | -11.64 | 19.90 | 0.90 | 21.04 | 3.70 | 0.76 | 96.65 | 74.90 | 0 | 0 | 0 | 0 |
| 1988 | 8.81 | 19.00 | 0.91 | 20.30 | 4.00 | 17.19 | 94.55 | 74.90 | 0 | 0 | 0 | 0 |
| 1989 | 5.04 | 19.10 | 0.93 | 20.04 | 4.80 | 5.19 | 93.50 | 75.10 | 0 | 0 | 0 | 0 |
| 1990 | -6.98 | 18.00 | 1.06 | 20.36 | 5.40 | 3.15 | 93.10 | 75.40 | 0 | 0 | 0 | 0 |
| 1991 | -2.05 | 16.60 | 1.08 | 20.64 | 4.20 | 8.97 | 94.50 | 75.50 | 0 | 0 | 0 | 0 |
| 1992 | 6.08 | 16.90 | 1.08 | 20.11 | 3.00 | -2.47 | 97.30 | 75.80 | 0 | 0 | 0 | 0 |
| 1993 | 1.62 | 17.40 | 1.06 | 19.47 | 3.00 | -4.80 | 98.50 | 75.75 | 0 | 0 | 0 | 0 |
| 1994 | -3.06 | 18.50 | 0.98 | 18.82 | 2.60 | -3.43 | 97.30 | 75.70 | 0 | 0 | 0 | 0 |
| 1995 | -0.07 | 18.30 | 0.94 | 18.54 | 2.80 | 1.99 | 97.40 | 75.79 | 0 | 0 | 0 | 0 |
| 1996 | 6.13 | 18.70 | 0.92 | 18.20 | 2.90 | 0.24 | | 76.12 | 0 | 0 | 0 | 0 |
| 1997 | 9.99 | 19.40 | 0.96 | 17.84 | 2.30 | 0.74 | | 76.51 | 0 | 0 | 0 | 0 |
| 1998 | -0.97 | 20.20 | 0.95 | 17.46 | 1.60 | -5.71 | | 76.70 | 0 | 0 | 0 | 0 |
| 1999 | 5.87 | 20.30 | 0.95 | 17.61 | 2.20 | -8.25 | | 76.98 | 0 | 0 | 0 | 0 |
| 2000 | 7.62 | 21.40 | 3.04 | 17.50 | 3.40 | -6.28 | | 77.12 | 0 | 0 | 0 | 0 |
| 1970 | 8.02 | 39.00 | 1.13 | 7.44 | 7.70 | -3.88 | 86.60 | 72.00 | 1 | 0 | 0 | 0 |
| 1971 | 7.72 | 35.80 | 1.30 | 7.96 | 6.40 | 18.98 | | 72.94 | 1 | 0 | 0 | 0 |
| 1972 | 11.32 | 35.50 | 1.41 | 8.16 | 4.90 | 0.14 | | 73.54 | 1 | 0 | 0 | 0 |
| 1973 | 3.40 | 38.10 | 1.42 | 8.30 | 11.70 | -20.89 | | 73.79 | 1 | 0 | 0 | 0 |
| 1974 | -10.69 | 37.30 | 1.33 | 9.12 | 23.10 | -7.14 | | 74.41 | 1 | 0 | 0 | 0 |
| 1975 | 4.41 | 32.80 | 1.28 | 10.04 | 11.80 | 7.74 | 91.80 | 75.08 | 1 | 0 | 0 | 0 |
| 1976 | 8.99 | 31.80 | 1.08 | 9.86 | 9.40 | 7.51 | | 75.48 | 1 | 0 | 0 | 0 |
| 1977 | 21.68 | 30.80 | 0.97 | 9.83 | 8.20 | 9.59 | | 75.93 | 1 | 0 | 0 | 0 |
| 1978 | 19.72 | 30.90 | 0.91 | 9.66 | 4.10 | 8.12 | | 76.09 | 1 | 0 | 0 | 0 |
| 1979 | -16.30 | 32.50 | 0.84 | 9.70 | 3.80 | -24.20 | | 76.42 | 1 | 0 | 0 | 0 |
| 1980 | 25.40 | 32.20 | 0.81 | 9.81 | 7.80 | -0.89 | 93.20 | 76.20 | 1 | 0 | 0 | 0 |
| 1981 | 4.09 | 31.10 | 0.73 | 9.92 | 4.90 | 14.86 | 93.50 | 76.54 | 1 | 0 | 0 | 0 |
| 1982 | 1.14 | 29.90 | 0.70 | 9.90 | 2.70 | -0.76 | 93.10 | 77.06 | 1 | 0 | 0 | 0 |
| 1983 | 8.71 | 28.10 | 0.70 | 9.94 | 1.90 | 10.45 | 92.40 | 77.10 | 1 | 0 | 0 | 0 |
| 1984 | 2.28 | 28.00 | 0.65 | 9.80 | 2.20 | 7.21 | 93.10 | 77.51 | 1 | 0 | 0 | 0 |
| 1985 | 16.67 | 28.20 | 0.63 | 9.58 | 2.00 | 8.95 | 95.40 | 77.80 | 1 | 0 | 0 | 0 |
| 1986 | 15.50 | 27.70 | 0.54 | 9.65 | 0.60 | 21.70 | 96.20 | 78.23 | 1 | 0 | 0 | 0 |
| 1987 | 15.12 | 28.50 | 0.49 | 9.43 | 0.10 | -7.32 | 96.60 | 78.65 | 1 | 0 | 0 | 0 |
| 1988 | 9.44 | 30.40 | 0.40 | 9.14 | 0.70 | -7.70 | 96.80 | 78.40 | 1 | 0 | 0 | 0 |
| 1989 | -6.35 | 31.30 | 0.40 | 9.07 | 2.30 | -7.59 | 96.40 | 78.84 | 1 | 0 | 0 | 0 |
| 1990 | 2.99 | 32.30 | 0.33 | 9.02 | 3.10 | -6.46 | 97.10 | 79.07 | 1 | 0 | 0 | 0 |
| 1991 | 10.34 | 32.20 | 0.39 | 9.02 | 3.30 | 8.71 | 96.40 | 79.39 | 1 | 0 | 0 | 0 |
| 1992 | 5.10 | 30.80 | 0.37 | 9.18 | 1.70 | 9.71 | 95.70 | 79.47 | 1 | 0 | 0 | 0 |
| 1993 | 11.63 | 29.70 | 0.33 | 9.42 | 1.30 | 2.88 | 98.90 | 79.63 | 1 | 0 | 0 | 0 |
| 1994 | 5.97 | 28.70 | 0.28 | 9.54 | 0.70 | -3.79 | 99.60 | 80.10 | 1 | 0 | 0 | 0 |
| 1995 | -3.60 | 28.60 | 0.23 | 9.81 | -0.10 | -8.54 | 103.40 | 79.96 | 1 | 0 | 0 | 0 |
| 1996 | -3.99 | 30.00 | 0.23 | 9.68 | 0.10 | -10.79 | | 80.21 | 1 | 0 | 0 | 0 |
| 1997 | -3.72 | 28.60 | 0.25 | 9.72 | 1.70 | 5.59 | | 80.33 | 1 | 0 | 0 | 0 |
| 1998 | 4.35 | 26.30 | 0.27 | 10.17 | 0.60 | 11.30 | | 80.45 | 1 | 0 | 0 | 0 |

| Year | *Economy* | Saving | *Population* | Government | Inflation | Trade | *Education* | Health | Japan | China | Singapore | Indonesia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Growth rate % | rate % | Growth % | % of GDP | rate % | Change % | Enrollment ratio % | Years | Dummy | Dummy | Dummy | Dummy |
| 1999 | 12.07 | 26.11 | 0.08 | 10.29 | -0.30 | -2.58 | | 80.57 | 1 | 0 | 0 | 0 |
| 2000 | -2.89 | 25.90 | 0.28 | 16.60 | -0.60 | -6.27 | | 80.70 | 1 | 0 | 0 | 0 |
| 1970 | | | 2.88 | | | -20.11 | 24.30 | 61.70 | 0 | 1 | 0 | 0 |
| 1971 | | | 2.70 | | | 29.13 | | | 0 | 1 | 0 | 0 |
| 1972 | | | 2.29 | | | -0.91 | | | 0 | 1 | 0 | 0 |
| 1973 | | | 2.33 | | | -12.90 | | 63.29 | 0 | 1 | 0 | 0 |
| 1974 | | | 1.85 | | | -19.14 | | 63.29 | 0 | 1 | 0 | 0 |
| 1975 | | | 1.72 | | | 6.33 | 46.20 | 63.29 | 0 | 1 | 0 | 0 |
| 1976 | | | 1.41 | | | 7.46 | | | 0 | 1 | 0 | 0 |
| 1977 | | | 1.33 | | | 0.92 | | | 0 | 1 | 0 | 0 |
| 1978 | | | 1.36 | 13.24 | | -14.99 | | 67.30 | 0 | 1 | 0 | 0 |
| 1979 | | 36.20 | 1.33 | 15.07 | 2.00 | -2.55 | | | 0 | 1 | 0 | 0 |
| 1980 | 6.48 | 34.90 | 2.12 | 14.48 | 6.00 | 4.14 | 45.90 | 67.00 | 0 | 1 | 0 | 0 |
| 1981 | -0.79 | 32.30 | 1.23 | 14.38 | 2.40 | 10.14 | 39.40 | 67.80 | 0 | 1 | 0 | 0 |
| 1982 | 2.42 | 32.10 | 1.21 | 14.03 | 1.90 | 15.78 | 36.20 | 68.15 | 0 | 1 | 0 | 0 |
| 1983 | 10.82 | 33.00 | 1.86 | 13.79 | 1.50 | -10.22 | 35.70 | 68.50 | 0 | 1 | 0 | 0 |
| 1984 | -14.47 | 34.50 | 1.47 | 14.24 | 2.80 | -8.22 | 37.40 | 68.85 | 0 | 1 | 0 | 0 |
| 1985 | -10.85 | 38.50 | 1.45 | 13.47 | 8.80 | -32.12 | 39.70 | 69.20 | 0 | 1 | 0 | 0 |
| 1986 | -17.05 | 38.00 | 1.54 | 13.49 | 6.00 | 11.41 | 42.50 | 69.33 | 0 | 1 | 0 | 0 |
| 1987 | -5.48 | 36.70 | 1.61 | 12.64 | 7.20 | 26.53 | 44.80 | 69.46 | 0 | 1 | 0 | 0 |
| 1988 | 15.41 | 37.40 | 1.60 | 11.75 | 18.70 | -5.79 | 45.60 | 68.98 | 0 | 1 | 0 | 0 |
| 1989 | -17.21 | 37.00 | 1.54 | 12.35 | 18.30 | 3.33 | 46.10 | 68.50 | 0 | 1 | 0 | 0 |
| 1990 | -14.50 | 35.20 | 1.41 | 12.29 | 3.10 | 31.02 | 48.70 | 68.37 | 0 | 1 | 0 | 0 |
| 1991 | 3.08 | 35.30 | 1.28 | 13.30 | 3.50 | -3.15 | 51.80 | 68.67 | 0 | 1 | 0 | 0 |
| 1992 | 10.92 | 37.30 | 1.15 | 13.50 | 6.30 | -6.50 | 55.00 | 68.97 | 0 | 1 | 0 | 0 |
| 1993 | 11.55 | 43.50 | 1.08 | 13.04 | 14.60 | -16.28 | 56.80 | 69.27 | 0 | 1 | 0 | 0 |
| 1994 | -27.98 | 41.30 | 1.04 | 12.82 | 24.20 | 18.58 | 61.00 | 69.58 | 0 | 1 | 0 | 0 |
| 1995 | 9.17 | 40.80 | 0.97 | 11.44 | 16.90 | 10.14 | 65.80 | 69.90 | 0 | 1 | 0 | 0 |
| 1996 | 12.40 | 39.30 | 0.98 | 11.49 | 8.30 | -5.58 | 68.90 | 70.19 | 0 | 1 | 0 | 0 |
| 1997 | 15.11 | 38.00 | 0.95 | 11.65 | 2.80 | 18.19 | 70.10 | 70.48 | 0 | 1 | 0 | 0 |
| 1998 | 2.39 | 38.10 | 0.92 | 11.88 | -0.80 | 1.74 | | 70.78 | 0 | 1 | 0 | 0 |
| 1999 | 8.89 | 38.30 | 0.88 | 12.95 | -1.40 | -10.04 | | 71.08 | 0 | 1 | 0 | 0 |
| 2000 | 14.32 | 37.93 | -0.45 | 13.09 | 0.30 | 2.72 | | 71.38 | 0 | 1 | 0 | 0 |
| 1970 | 9.85 | 38.70 | 1.47 | 11.94 | 0.50 | -16.88 | 46.00 | 65.80 | 0 | 0 | 1 | 0 |
| 1971 | 7.96 | 40.20 | 1.93 | 12.62 | 1.80 | -1.73 | | | 0 | 0 | 1 | 0 |
| 1972 | 14.50 | 41.10 | 1.90 | 12.14 | 2.10 | 3.91 | | | 0 | 0 | 1 | 0 |
| 1973 | 11.75 | 39.20 | 1.86 | 10.96 | 19.60 | 10.50 | | | 0 | 0 | 1 | 0 |
| 1974 | 10.58 | 44.60 | 1.83 | 10.35 | 22.40 | -2.69 | | | 0 | 0 | 1 | 0 |
| 1975 | -0.17 | 37.60 | 1.35 | 10.64 | 2.50 | -4.66 | 51.90 | 67.55 | 0 | 0 | 1 | 0 |
| 1976 | 8.38 | 40.80 | 1.33 | 10.52 | -1.80 | 9.82 | | | 0 | 0 | 1 | 0 |
| 1977 | 6.26 | 36.20 | 1.75 | 10.70 | 3.20 | 8.42 | | | 0 | 0 | 1 | 0 |
| 1978 | 8.47 | 39.00 | 0.86 | 11.02 | 4.90 | -1.41 | | | 0 | 0 | 1 | 0 |
| 1979 | 7.03 | 43.40 | 1.28 | 9.91 | 4.10 | 3.97 | | | 0 | 0 | 1 | 0 |
| 1980 | 15.35 | 46.30 | 1.26 | 9.75 | 8.50 | 0.04 | 59.90 | 71.63 | 0 | 0 | 1 | 0 |
| 1981 | 21.35 | 46.30 | 1.24 | 9.51 | 8.20 | -5.78 | 52.60 | 71.80 | 0 | 0 | 1 | 0 |
| 1982 | 8.20 | 47.90 | 1.23 | 10.93 | 3.90 | -2.95 | 54.10 | 72.22 | 0 | 0 | 1 | 0 |
| 1983 | 15.71 | 47.90 | -2.43 | 10.88 | 1.20 | 5.06 | 56.80 | 72.29 | 0 | 0 | 1 | 0 |
| 1984 | 11.58 | 48.50 | 1.24 | 10.82 | 2.60 | 8.29 | 59.00 | 72.85 | 0 | 0 | 1 | 0 |
| 1985 | -10.64 | 42.50 | 1.64 | 14.26 | 0.50 | 3.36 | 62.00 | 73.52 | 0 | 0 | 1 | 0 |
| 1986 | -12.43 | 37.50 | 1.61 | 13.42 | -1.40 | 1.60 | 67.20 | 74.18 | 0 | 0 | 1 | 0 |
| 1987 | -0.40 | 37.90 | 1.19 | 12.37 | 0.50 | -0.08 | 68.90 | 74.35 | 0 | 0 | 1 | 0 |
| 1988 | 8.11 | 34.20 | 11.76 | 10.52 | 1.50 | 1.71 | 69.90 | 74.46 | 0 | 0 | 1 | 0 |
| 1989 | 12.18 | 35.00 | 2.81 | 10.33 | 2.30 | 0.37 | 69.90 | 74.57 | 0 | 0 | 1 | 0 |
| 1990 | 6.05 | 36.60 | 3.07 | 10.20 | 3.50 | -3.53 | 68.10 | 76.04 | 0 | 0 | 1 | 0 |
| 1991 | 11.48 | 34.80 | 2.32 | 9.94 | 3.40 | 2.82 | 67.40 | 76.88 | 0 | 0 | 1 | 0 |
| 1992 | 6.70 | 36.40 | 2.91 | 9.33 | 2.30 | -1.42 | 67.40 | 77.09 | 0 | 0 | 1 | 0 |
| 1993 | 12.62 | 37.90 | 2.52 | 9.37 | 2.30 | -1.27 | 67.30 | 77.62 | 0 | 0 | 1 | 0 |
| 1994 | 11.96 | 33.50 | 3.07 | 8.44 | 3.10 | 8.61 | 72.00 | 77.86 | 0 | 0 | 1 | 0 |
| 1995 | 5.99 | 34.60 | 3.27 | 8.57 | 1.70 | 0.72 | 73.40 | 77.96 | 0 | 0 | 1 | 0 |
| 1996 | 7.93 | 37.10 | 4.03 | 9.48 | 1.40 | 0.21 | 74.10 | 78.67 | 0 | 0 | 1 | 0 |
| 1997 | -6.86 | 38.90 | 3.60 | 9.54 | 2.00 | -0.85 | | 79.66 | 0 | 0 | 1 | 0 |
| 1998 | -6.09 | 34.20 | 3.48 | 10.16 | -0.30 | 11.20 | | 79.79 | 0 | 0 | 1 | 0 |
| 1999 | 7.12 | 32.44 | 0.52 | 9.70 | -3.09 | -1.60 | | 79.92 | 0 | 0 | 1 | 0 |

| Year | *Economy* | Saving | *Population* | Government | Inflation | Trade | *Education* | Health | Japan | China | Singapore | Indonesia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Growth rate % | rate % | Growth % | % of GDP | rate % | Change % | Enrollment ratio % | Years | Dummy | Dummy | Dummy | Dummy |
| 2000 | 8.23 | 31.30 | 3.34 | 10.45 | 1.40 | -0.77 | | 80.05 | 0 | 0 | 1 | 0 |
| 1970 | -10.28 | 13.60 | 2.58 | 8.77 | 12.30 | 1.13 | 16.10 | 38.65 | 0 | 0 | 0 | 1 |
| 1971 | -12.38 | 15.80 | 2.56 | 9.29 | 4.40 | 1.17 | | 38.65 | 0 | 0 | 0 | 1 |
| 1972 | 5.05 | 18.80 | 2.54 | 9.07 | 6.50 | 1.69 | | | 0 | 0 | 0 | 1 |
| 1973 | -0.91 | 17.90 | 2.52 | 10.60 | 31.00 | 3.43 | | 45.55 | 0 | 0 | 0 | 1 |
| 1974 | 3.38 | 16.80 | 2.48 | 7.85 | 40.60 | 64.27 | | | 0 | 0 | 0 | 1 |
| 1975 | 6.66 | 20.30 | 2.78 | 9.92 | 19.10 | -22.97 | 20.00 | | 0 | 0 | 0 | 1 |
| 1976 | 9.57 | 20.70 | -1.58 | 10.29 | 19.90 | 1.19 | | 50.52 | 0 | 0 | 0 | 1 |
| 1977 | 1.33 | 20.10 | 2.32 | 10.93 | 11.00 | 15.63 | | | 0 | 0 | 0 | 1 |
| 1978 | -34.79 | 20.50 | 2.32 | 11.69 | 8.10 | -0.10 | | | 0 | 0 | 0 | 1 |
| 1979 | 2.82 | 20.90 | 2.32 | 11.66 | 16.30 | 24.39 | | | 0 | 0 | 0 | 1 |
| 1980 | 9.75 | 20.90 | 3.11 | 10.32 | 18.00 | -6.59 | 29.00 | 53.42 | 0 | 0 | 0 | 1 |
| 1981 | 12.43 | 29.80 | 2.59 | 11.10 | 12.20 | -6.24 | 31.10 | 54.12 | 0 | 0 | 0 | 1 |
| 1982 | -1.97 | 27.90 | 2.21 | 11.57 | 9.50 | -30.15 | 34.50 | 54.84 | 0 | 0 | 0 | 1 |
| 1983 | -25.23 | 28.70 | 2.21 | 10.41 | 11.80 | -2.36 | 36.50 | 55.57 | 0 | 0 | 0 | 1 |
| 1984 | 3.60 | 26.20 | 2.21 | 10.15 | 10.50 | 21.93 | 39.00 | 56.32 | 0 | 0 | 0 | 1 |
| 1985 | -14.43 | 28.10 | 1.89 | 11.25 | 4.70 | 14.91 | 41.30 | 56.71 | 0 | 0 | 0 | 1 |
| 1986 | -36.28 | 28.20 | 2.26 | 10.99 | 5.80 | -23.76 | 46.40 | 57.11 | 0 | 0 | 0 | 1 |
| 1987 | -11.89 | 31.30 | 2.17 | 9.43 | 9.30 | 0.29 | 48.20 | 57.51 | 0 | 0 | 0 | 1 |
| 1988 | 4.07 | 31.50 | 2.08 | 8.98 | 8.00 | 4.71 | 48.10 | 58.70 | 0 | 0 | 0 | 1 |
| 1989 | 3.99 | 35.10 | 2.02 | 9.39 | 6.40 | -6.62 | 45.60 | 59.94 | 0 | 0 | 0 | 1 |
| 1990 | -6.58 | 36.10 | 0.19 | 8.99 | 7.80 | -13.20 | 44.00 | 61.22 | 0 | 0 | 0 | 1 |
| 1991 | 0.44 | 35.50 | 1.06 | 9.13 | 9.40 | -4.19 | 43.50 | 62.55 | 0 | 0 | 0 | 1 |
| 1992 | 5.25 | 35.80 | 1.71 | 9.52 | 7.50 | 10.53 | 43.50 | 63.93 | 0 | 0 | 0 | 1 |
| 1993 | 2.50 | 29.50 | 1.68 | 9.02 | 9.70 | 4.40 | 44.90 | 65.36 | 0 | 0 | 0 | 1 |
| 1994 | -4.57 | 31.10 | 1.65 | 8.11 | 8.50 | -3.65 | 48.20 | 65.81 | 0 | 0 | 0 | 1 |
| 1995 | -0.82 | 31.90 | 2.13 | 7.83 | 9.40 | -10.74 | 51.50 | 66.27 | 0 | 0 | 0 | 1 |
| 1996 | 6.79 | 30.70 | 1.06 | 7.57 | 8.00 | 3.81 | 55.70 | 66.60 | 0 | 0 | 0 | 1 |
| 1997 | -43.66 | 31.80 | 1.55 | 6.84 | 6.70 | 10.46 | | 66.93 | 0 | 0 | 0 | 1 |
| 1998 | -52.89 | 35.30 | 2.28 | 4.34 | 57.60 | 39.40 | | 67.27 | 0 | 0 | 0 | 1 |
| 1999 | 13.74 | 11.60 | 2.37 | 6.56 | 20.50 | 13.46 | | 67.61 | 0 | 0 | 0 | 1 |
| 2000 | -18.41 | 17.90 | 0.59 | 7.03 | 3.70 | -8.57 | | 67.96 | 0 | 0 | 0 | 1 |