TIME SERIES EVIDENCE ON EDUCATION AND ECONOMIC GROWTH IN INDONESIA

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Abstract

This paper analyzes the main sources of economic growth in Indonesia with emphasizes on education role in fostering the growth during the New Order Government. To arrive at conclusive results, it employs rigorous econometric techniques and Error Correction Models that consider structural adjustments in the economy. The study finds that physical capital and secondary education, particularly through the Universal Secondary Education Program, give the highest contribution to economic growth. It is also suggested that the negative effect of primary education on the long-run growth is mainly due to over-supply and excess-demand for the graduates following the structural changes in the economy.

Keywords: Education, human capital, economic growth, error correction model
JEL classification numbers: I25, O15, O43, O53, C22

Abstrak

Makalah ini menganalisis sumber utama pertumbuhan ekonomi di Indonesia dengan menekankan pada peran pendidikan dalam mendorong pertumbuhan selama masa Pemerintahan Orde Baru. Untuk sampai pada kesimpulan akhir, artikel ini menggunakan teknik ekonometrik dengan aplikasi Model Koreksi Kesalahan yang mempertimbangkan penyesuaian struktural dalam perekonomian. Studi ini menemukan bahwa modal fisik dan pendidikan menengah, terutama melalui Program Pendidikan Menengah Umum, memberikan kontribusi terbesar bagi pertumbuhan ekonomi. Penelitian ini juga menyarankan bahwa dampak negatif dari pendidikan dasar terhadap pertumbuhan ekonomi jangka panjang terutama dikarenakan adanya kelebihan penawaran dan kelebihan permintaan untuk lulusan dengan adanya perubahan struktural dalam perekonomian.

Keywords: Pendidikan, sumber daya manusia, pertumbuhan ekonomi, model koreksi kesalahan
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INTRODUCTION

Human capital is believed to play a significant role in economic growth. Cross-country researches show that education increases labour skills and knowledge as well as gives a significant contribution to technological progress and diffusion of technique in modern productions. It also improves labour mobility towards more productive sectors. Those factors will eventually lead to higher productivity and economic growth (See, among others, Nelson and Phelps, 1966; Lucas, 1988; Romer, 1990; Mankiw, 1992; Richardson, 1997; Cohen and Soto, 2007; Kohli, 2009; and Fleisher et al., 2010). However, some research also found that education might not as significant as it is believed (see Benhabib and Spiegel, 1994 and Temple, 1999). They believe that capital and labour are the main engines of growth, while human capital is just 'extension' of the role of labour in the growth process. Thus, education effects on economic growth seem to be somewhat mixed.

The mixed results are also found for the specific case of Indonesia, especially during the New Order and Transition Governments period of 1960-2000. A study by Bayhaqi (2000) that uses the average years of schooling as human capital proxy finds that education contributes little to economic growth during the period. In contrast, Kawuryan (2001) suggests that educational changes, especially reflected by secondary education enrolment ratio, do matter for the economic growth of the country. McMahon (1998) also finds that primary and secondary education give significant positive contribution to the growth of East Asian countries including Indonesia.

Given the background, this paper attempts to determine the sources of economic growth in Indonesia for the 1960-2000 periods by using the Error Correction Models. The 1960-2000 periods is chosen as this is an important period marked by various 'independent'[1] educational policies under the New Order Government and before the post-crisis education reforms. In addition to analyze the role of education in stimulating economic growth, this study also investigates the type of education and education policies that gives the highest contribution to the growth.

To address the issues, this paper is organized as follow. Introduction and literature review are presented in Section 1 and 2, followed by methodology section that discusses data sources and model specifications in Section 3. Empirical results and discussion/analysis are discussed in section 4 and 5. Brief conclusion is drawn in the last section.

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[1] After the 1997/1998 economic crisis and transition to the Reformed Government (2000-now), there are many changes in education policies. One of the important changes is that the education policies are strongly linked to countrywide poverty reduction policies, which somewhat make it less independent as compared to the previous periods under the New Order Government (1960-2000).

Review of Relevant Papers

This section reviews economic literature on economic growth, in particular the literature that incorporates human capital factors in the model. It then descriptively explains the stages of Indonesian economic growth during the 1960-2000 periods in attempts to understand its pattern as well as the presumable roles of education role for the Indonesian economic growth.

The Role of Education in Economic Growth

Economic literature suggests that education, which reflects human capital, plays a significant role in a rapid economic growth. Even though earlier works by neoclassical economist did not pay much attention to human capital, later works seem to point out that human capital is an essential determinant of productivity growth (See, among others, Nelson and Phelps, 1966, Lucas, 1988, Romer, 1990, Mankiw 1992, Richardson, 1997, Cohen and Soto, 2007, Kohli, 2009 and Fleisher et al. 2010).

In the neoclassical growth model pioneered by the work of Robert Solow (1956), no special role is given to human capital. Instead, human capital is integrated in a term called "Solow residual" which explain economic growth determinant other than capital and labour. Yet, by adding accumulation of human capital factor, the augmented Solow model found that human capital indeed plays a significant role in economic growth. In addition to that, it is suggested that the accumulation of physical capital will have a greater impacts on income when human capital stock is taken into account (Mankiw et al., 1992).

In contrast, the endogenous growth models give central position to human capital Uzawa (1965) and Lucas (1988) for example, suggest that sustainable growth is only possible through the accumulation of human capital over time. Romer (1990) finds that human capital stocks give a significant contribution to technological pro-

gress which eventually leads to higher productivity growth. Moreover, Richardson (1997) argues that education might facilitate technological advance and diffusion of technique as well as improve labour mobility towards more productive sectors. Similar findings are confirmed by recent empirical works in various countries (Cohen and Soto, 2007; Fleisher et al., 2010; and Kohli, 2009).

Nevertheless, some studies find that human capital might not as significant as it is believed. Benhabib and Spiegel (1994), for example, find that the change in education is not a determinant of economic growth. Caselli et al. (1996) also suggests that no robust evidence supporting the view that investing in human capital necessarily produces output and growth. Furthermore, Soderbom (2003) contends that human capital has a small and not statistically significant causal effect on the level of output. Therefore, they believe that the main engines of growth are still capital and labour factor. Given these differences, Temple (1999) concludes that the empirical evidence to support the role of education for growth is surprisingly mixed.

There are many possible reasons behind the difference. First, it is possible that the differences are resulted from varied human capital proxies and data quality (including the measurement errors) used by the researched. These depend partly on the source underlying the human capital data and the availability of the data series. We discuss these issues further in the model specification and appendix sections. Second, it might be because of different methodology and time frame in the analysis. And finally, different perspectives regarding the sources of economic growth will definitely influence the models used in the research.

Indonesian Economic Growth Performance, 1960-2000

In general, Indonesian real GDP per capita increased gradually during the 1960-2000 periods from nearly zero growth in 1960s to an average of 5 per cent growth in 1990s. Yet it decreased after the 1998 crisis. Table 1 shows that as the Indonesian economy transformed into a more industrialized economy, agriculture share in GDP decreased while manufacture share increased consistently with investment escalation. Social indicator such as education also shows the same pattern.

Table 1: Indicators of Economic Development in Indonesia, 1960-2000

Indicators	Mid 1960s	Early 1990s	Year 2000
1. Real GDP/capita			
Growth (%)	±0	±5	3-4
1991 USD	190 (1965)	610(1991)	3637 (1996 USD)
2. Shares of GDP			
Agriculture	53	19	16
Manufacture industry	8	21	26
3. Employment (%agriculture)	73(1961)	50(1990)	42
4. Investment (GDI as % of GDP)	8	35	16.1
5. Inflation (%)	306.80(1965)	7.80(1990)	3.7
6. Debt (USD billion)	2.4	84	144
7. Education			
No schooling	68.1	18.9	9.66
Tertiary education	0.1	1.6	3.3

Sources: Hill (2000) and Jalal and Mustapha (2001).

The changes described above closely related to major economic trends and policy changes, including education policies, during the period where the New Order Government in place. Based on these trends, Hill (2000) classifies the Indonesian economic growth episodes from 1960 to 2000 into six periods. First, instability period (1960-1966) which is characterized by political instability where communist and military groups inspired coup against the government. In this period, the country also confronted with the neighbour country Malaysia. As the result, among others, budget deficit went up to 63 per cent in 1965 and hyper inflation of more than 1100 per cent occurred in 1966. Hence the Indonesian economy contracted during the period.

Second, rehabilitation and recovery period (1967-1970) started by the fall of the presidency from Soekarno to Soeharto in 1966. This also marks the beginning of the "New Order" Government era. Under the new government, concerns were emphasized on efforts to reduce hyper inflation into a controllable rate, to re-established ties with the international (especially 'Western') donor communities and to rehabilitate physical infrastructure. The efforts were quite successful. For example, inflation decreased dramatically from 1136 per cent in 1966 to only 12.3 per cent in 1970. The country also received various foreign aid, mainly though IGGI/CGI (Inter-Government Group on Indonesia/Consultative Group on Indonesia). [2] Combined with domestic stability, the economy expanded significantly and at annual average rate of 6.6 per cent in the period.

Third, Indonesia enjoyed a remarkable economic growth with an annual real GDP growth rate of 7.7 per cent during what is called as the rapid growth period (1971-1981). The rise is largely resulted from massive windfall revenue gains as international oil prices quadrupled in late 1973. The revenues were used to conduct various development projects most notably in projects in (basic) infrastructure, agriculture and education. In particular, the government used the oil revenue to expand education especially rural primary school (Jones, 1994). However, in 1972 the rice prices doubled and accordingly triggered significant inflationary pressures. In late 1974, the inflation rate reached 40 per cent. The government then devaluated domestic currency in November 1978, not only to reduce inflation but also to improve the non-oil sector competitiveness in anticipating the fall of international oil prices.

Fourth, adjustment to lower oil prices period (1982-1986) which signalled the end of the oil-financed growth period. The government responses to the changes were generally prompt and effective, as it quickly cut back on expenditure, cancelled some large projects, devaluated rupiah in April 1983, and reformed the tax, customs, and banking system (Hill, 2000). However, it continued giving priority to industrial sector development, especially what so called strategic sector. The government also continued their education policies and achieved universal primary education in the 1980s. The achievement was assisted by slower growth of the primary school age population due to the successful Family Planning program. In turn this necessitated expansion of high school, vocational and tertiary education to meet the needs of the booming manufacturing and construction industries (Jones, 1994) including for the strategic sectors. The policies resulted in 4 per cent annual growth rate.

Fifth, liberalization and recovery period occurred in 1987-1996. As oil prices fell very sharply in 1986, the government postponed many projects in the industrial

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[2] From 1967 to 1991, most aid was coordinated through the Inter-Governmental Group on Indonesia (IGGI) founded and chaired by the Netherlands. Since 1992, however, without the Netherlands the organization has been known as the Consultative Group on Indonesia (CGI).

sector and continued its efforts to liberalize financial sector through the October 1988 Financial and Banking Deregulation Package. It also started giving priority to small business sector financing (Cole and Slade, 1996). Furthermore, trade sector also liberalized through tariffs cut. The series of reforms boost industrial and commercial trading sectors export and import. Development of other sectors, including in education, were relatively stagnant – in the sense that the policies were mainly continuing the policies in the previous period - due to emphasize on the structural transformation. The transformation toward industrialization indeed led to a higher economic growth. The first half of the period (1987 to 1992) recorded an annual growth rate of average 6.7 per cent, but by the second half of 1995 there were signs that the economy was in danger of overheating following rising inflation, a widening current account deficit in the balance of payments, and booming investment in property sector.

Finally, crisis and recovery period from 1997 up to now marked a remarkable change in the economy. Following massive currency depreciation in East Asian region in 1997, rupiah value fell dramatically by 600 per cent, inflation reached 57.6 per cent and the economy reached its nadir point by experiencing a negative 14.6 per cent growth in 1998/1999. Although the government responded quickly by tightening monetary and fiscal policies, the weaknesses of its fundamental economics could not stop it from depression. Political instability also increased as people showed their unsatisfactory to the authority. On top of that, President Soeharto was forced to r e-sign from his presidency in May 1998. This marked the transition period, before the Reform Government was elected in 2000s.

Given the aforementioned stages of economic growth in Indonesia, it is clear that the role of education sector is quite crucial. In general, development in education is mostly consistent with the economic growth patterns,

although in some period interest groups coloured policy making in the sector[3]. Initial development of education infrastructure can be found during the oil boom period, marked by the government policy to expand educations for all through the universal primary education program. It successful encouraged the government in making primary education compulsory in 1984 which lead to universal primary education by the end of 1980s. In 1994, mainly in response to huge labour force demand following Indonesian economic transformation toward a more industrialized economy, it also encouraged and made secondary education compulsory. Initially, the universal secondary education was targeted to be accomplished in 2004 (Purwadi and Muljoatmodjo, 2000). Nevertheless, until recently the target was yet to be achieved primarily due to the economic crises that badly hit the country (Welch, 2007).

METHODS

Given the background in the previous sections, this section proceeds to empirically investigate the role of education or human capital in economic growth for the specific case of Indonesia during the New Order Government period (1960-2000). Therefore, this section discusses models specifications, econometric procedures to estimate the models, the reasons for choosing them as well as the data descriptions.

To arrive at conclusive results, this study employs the Cobb-Douglas production function. There are several reasons for choosing the model specification. First, literature suggests that the Cobb-Douglas

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[3] A clear example can be seen from the education expansion program during the instability period. In the period where the communist party was powerful, many schools were established to attract public attention and create cadres needed. Consequently, when the old regime is replaced by the New Order government, many schools were closed down to prevent further influence from the communist party (MOEC 1996) besides the facts that economic grew reasonably well in the second period (Hill 2000).

production function provides a relatively accurate description of the economy. Seond, it offers simplicity in many ways. For example, the model can be easily augmented into a model with multivariable inputs. I can also be transformed into various specifications such as logarithm and translog forms which are easy to work with algebraically. Third, once transformed into the right specification, the model provides rich economic interpretations, including elasticity, share coefficient, speed of convergence, etc. Finally, the fact that many recent theoretical works on economic growth has been successfully done using the model encouraged us to use it too.

Using the standard Cobb-Douglas production function, production at time t is given by:

$$Y(t) = AK(t)^{\alpha} L(t)^{\beta} \qquad (1)$$

$$Y(t) = AK(t)^{\alpha} L(t)^{\beta} HC(t)^{\gamma} \qquad (2)$$

where Y is output, A is the level of technology, K is capital stock, L is labour, and HC is human capital stock. In a simple neoclassical model, capital and labour are the main sources of growth while technology is assumed to be constant. Human capital is assumed integrated in the technology term. However, recent works give more attention to human capital role by explicitly incorporating it in the production function as described by Equation (2).

Transforming the model into logarithm form gives a nice linear production function depicted by Equation (3) and (4):

$$\ln(Y) = c + \alpha\ln(K) + \beta\ln(L) + e \qquad (3)$$

$$\ln(Y) = c + \alpha\ln(K) + \beta\ln(L) \\ + \gamma\ln(HC) \qquad (4)$$

In the equations, the coefficients tell us the proportion of inputs used in the production. However, given the logarithmic model, each coefficient could also be inter-

preted as short run elasticity of the factors. Furthermore, the model provides us with relative sign of the variables that predict the relationships between the dependent and independent variables.

With these specifications, one might easily think to estimate Equation (3) and (4) by using ordinary least square (OLS) methods. However, macroeconomic time series usually non-stationary and contain unit root while time series econometric method requires the series to be stationary. Thus, OLS regression might lead to spurious regression. To avoid that, before running the regression, we have to test the stationarity of each variable.

There are several ways to test data stationary. Informally, one can look at the graphs and see whether the series have a particular trend or not. However, the approach does not satisfactory in many cases. Thus, we should do formal test such as Dickey Fuller (DF) and Augmented Dickey Fuller (ADF) tests.

Consider Equations (5) and (6). To test the stationary with the ADF procedure, we test the null hypothesis that $\gamma=0$ in Equation (6). If $\gamma=0$ then the series does contain unit root. If both y_t and z_t in Equation (5) are non-stationary, then OLS regression will be spurious.

$$y_t = a_0 + a_1 z_t + \varepsilon_t \qquad (5)$$

$$\Delta y_t = \gamma\, y_{t-1} + \varepsilon_t \; ; \gamma = a_1 - 1. \qquad (6)$$

However, in multivariate context, it is quite possible to have a linear combination of integrated variables that is stationary and be in the same order. If such relationship existed, the variables are said to be cointegrated in order k and thereby a cointegration model can be used. In this case, long run equilibrium can be achieved. Any error or deviation from the equilibrium values is only temporary in nature and in the long run variables will convergence to their long run level. Furthermore, it is also pos-

sible to capture short run dynamic by rearranging the cointegration model into the Error Correction Model (ECM). In the ECM, the short run dynamic of variables in the system are influences by the deviation or error from equilibrium.

Following Engle-Granger (1987) approach, if cointegration existed in order one, then residual from the equilibrium regression in Equation (5) must be stationary. Again, the test can be done by ADF procedure. Results of the test should be compared to the critical value with McKinnon (1993) critical values for cointegration test. If the residual is stationary then relationship as in Equation (7) does exist. This Equation is the general formula of ECM.

$$\Delta y_t = \alpha_1 + \alpha_y \, (y_{t-1} - \beta_1 \, z_{t-1}) + \Sigma \, \alpha_{11} \, (i) \, \Delta y_{t-1} + \Sigma \, \alpha_{12} \, (i) \, \Delta z_{t-1} + \varepsilon_{yt} \qquad (7)$$

In addition to that, it is also possible that the economy experiences structural changes that affect overall growth performances. In this case, stability or structural break test needs to be done. Following Perron (1989), one way to do that is by adding dummy variables to represent the changes into a simple AR (1) Equation and check the significance. If the dummy is found to be significant, or in other word the series found to be stationary, then we can incorporate the variables into the estimated ECM.

$$y_t = a_0 + a_1 \, y_{t-1} + a_2 \, t + a_3 \, dum + a_4 \, \Delta y_{t-1} + \varepsilon_{yt} \qquad (8)$$

Finally, after considering the above specifications, the basic empirical production function model is constructed for the case of Indonesia (assuming one lag and will be tested later).

$$\Delta(Y/L)_t = \; c + a_1 \Delta ln(K/L)_t + a_2 \Delta ln(HC)_t + a_3 ln(Y/L)_{t-1} + a_4 ln(K/L)_{t-1} + a_5 ln(HC)_{t-1} + a_6 \Delta ln(Y/L)_{t-1} + a_7 \Delta ln(K/L)_{t-1} + a_8 \Delta ln(HC)_{t-1} + \varepsilon_{yt} \qquad (9)$$

Notes that (Y/L) is real *GDP* per worker, (K/L) is capital per labour, *HC* is human capital and ε is error measurement term. Structural adjustment factors including openness and dummy variables for oil boom era and economic crisis are tested and will be included if found to be significant.

The data are obtained from various sources (see Table 2). Real *GDP* data is obtained from the ADB Key Indicators (2003) and World Tables (2004). Capital stock and labour figure come from Central Bank of Indonesia/Statistics Indonesia (2004) and Van der Eng (2002) respectively, in which the latter generated the series from Statistics Indonesia census and intra-census. Human capital stocks are obtained from the data set of the Centre for International Development (CID) Harvard University and calculated based on Barro-Lee methodology (2001). The data are annual and covered the period of 1960-2000.

It is worth to note that there are several issues in measuring stock figures for time series estimation purpose, including methods to quantify the relationships between variables and data quality. First, while flow variable figures are easy to get from various statistical tables, series of stock variables can only be measured by proxy. This paper uses the physical and human capital stocks figures calculated based on Perpetual Inventory Method (PIM) which is believed to be superior and used in many studies. With this method, physical capital stock is measured from the accumulation of gross fixed capital formation for certain periods by considering its service life, retirement values and depreciation (Yudanto et al., 2004). Meanwhile, human capital stock is measured based on results of census or survey observations on education attainment as benchmark stock and new school entrants as flows that are added to the stock with an appropriate time lag (Barro and Lee, 2000).

Table 2: Data Series and Sources

Variables	Data Sources
Real *GDP* (1993=100)	World Tables 2004, ADB Key Indicators 2003
Capital stock (1993=100)	Central Bank of Indonesia/Statistics Indonesia, 2004
Labour employed/employment	Van der Eng, 2002
Human capital proxy: primary and secondary education attainment	Calculated based on Barro-Lee dataset,CDI, 2000
Openness	World Tables 2004

Source: Data estimation.

Second, regarding data quality, we use the capital stock estimation by Central Bank of Indonesia. The data is judged to be highly reliable since it uses high quality[4] gross fixed capital formation figures constructed by Statistics Indonesia study in 2001. Other than that, the series are also superior to other preceding studies on Indonesian capital stock reported by Keuning (1988, 1991), Statistics Indonesia (1995) and Timmer (1999).[5] The data coverage is 1960-2002 periods (42 years) which are enough for time series estimation which are intended to investigate the long run equilibrium of the data.

The human capital stock series quality is harder to be judged. The main reason is that there are many ways to quantify the relationship between educational attainment and economic and social outcomes. So far, we found that the most reliable figure is the dataset from Barro and Lee (2000)[6]. Following the Perpetual Inventory Methods, they constructed current flows of the population aged 15 and over

that are added to the benchmark stocks. The formulas for attainment ratios are:

$$h_{1,t} = H_{1,t} / L_t = h_{1,t-5} [1-(L15_t / L_t)] + (L15_t / L_t)* (PRI_{t-5} - SEC_t) \qquad (10)$$

$$H_{1,t} = H_{1,t-5} (1-\delta_t) + L15_t * (PRI_{t-5} - SEC_t) \qquad (11)$$

$$h_{2,t} = H_{2,t} / L_t = h_{2,t-5} [1-(L15_t / L_t)] + (L15_t / L_t)* SEC_t - (L20_t / L_t) *HIGH_t \qquad (12)$$

$$H_{2,t} = H_{2,t-5} (1-\delta_t) + L15_t * SEC_t - L20_t * HIGH_t \qquad (13)$$

$$\delta_t = (L15_t + L_{t-5} - L_t)/ L_{t-5} \qquad (14)$$

where $h_{j,t}$ is the attainment ratios; $H_{j,t}$ is the number of persons aged 15 and over for whom j is the highest level of schooling attained where $j = 1$ = primary education and $j = 2$ = secondary education.[7] The variables *PRI*, *SEC* and *HIGH* are the enrolment ratios for primary, secondary and higher schools respectively. The enrolment ratios are the gross ratios adjusted for school repeaters. Meanwhile, δ_t is the mortality rate for persons aged 15 and over which is assumed to be independent of the level of schooling attained.

The raw dataset is available in the CID website, so we can calculate the attainment ratios based on above formulations. However, the data is available for 5 years period interval started in 1960 to

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[4] The indications are good result of various validity tests. The test shows that the gross fixed capital formation series could estimate GDP significantly. Moreover, the series variability could be explained significantly by financial investment variables.

[5] Tested by Yudanto et al. (2004).

[6] Krueger and Lindahl (2001) estimated that the reliability of the Barro-Lee data performs reasonably well. In addition to that, the paper dataset have been used in many previous cross-country studies. Social Science Citation Index for example, reported that up to February 2000, the dataset (1993 and 1996 paper) have been cited at least 90 times.

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[7] Primary and secondary education are chosen based on common fact that in developing counties they contributed more on growth than higher education.

2000. Thus, in generating the time series data we employ interpolation method by using exponential growth.

For *SEC* series, we do not have many problems. The stocks show steadily increased trend overtime. However, for PRI variable, the formula seems to generate an underestimate proxy. It can be seen obviously from large fluctuations between 1985 and 1990 where attainment falls by approximately 30 per cent. As this is a stock variable and the attainment for primary education in developing countries is already reasonably high, the decrease seems to be invalid. Thus, for primary school attainment ratios we use proxy from Kawuryan (2001) at the International Institute of Social History which are also constructed based on Barro-Lee methodology but uses Indonesian Labour Force Survey (Sakernas) data.

RESULTS DISCUSSION

Previous section has clearly described the estimations steps. Next, in this section we present the empirical results of the procedures and key regression results for various production functions specifications, including (i) the model with capital and labour only as factors of production, (ii) the models with additional human capital, and (iii) the model with additional human capital and structural adjustments variables. The regression estimates suggest that while effective capital and secondary education are the most important source of growth in the economy, the share of labour decreases considerably as human capital accumulation and structural adjustment factors included in the specifications.

Stationary and Cointegration Testing

Using the ADF test, all variables are found stationary at first difference, except primary education which is stationary at second difference (Table 3)[8]. Thus, there is a strong indication that the variables are integrated in order one. However, formal test will be conducted to see the existence of cointegration relationship.

Based on the results, five models are estimated in this paper. By examining the stationary of the residuals, four out of five models are found to be cointegrated in order one (Table 4). Hence, the ECM can be estimated.[9]

Table 3: Augmented Dickey Fuller Test for Unit Root

Variables	ADF Test Results*	
	Levels	First Difference
log (*RGDP*/Labour)	-1.701415	-3.668414**
log (Capital/Labour)	0.544459	-3.615653**
log Primary Education	-2.363321	-1.666836
log Secondary Education	-1.563029	2.651693***
log Openness	-1.392498	-3.634931**
Step dummy 1974 (oil boom)	-1.404879	-4.358899*
Step dummy 1998 (crisis)	-0.162221	-4.358899*

Notes: The hypothesis is rejected at 1% (*), 5% (**) and 10% (***) respectively, except for primary education which is stationary at second difference. The Equations assume one lag and include a constant.
Source: Data estimation.

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[8] The non-stationary pattern for this series is perhaps due to the nature of the series, which is generated from interpolation procedures.
[9] Note that the model which does not cointegrated in order one is the one with primary education only as human capital proxy. Later on, the regression result also finds that the variable is not significant in influencing economic growth. It is suspected that the nature of the variable is a reason for this result.

Table 4: Cointegration Tests

Models of Production Functions	ADF Test (Level, Lag 1)
With effective capital	-3.792324**
With effective capital, primary, and secondary education	-2.868688***
With effective capital and primary education	-1.969082
With effective capital and secondary education	-3.178679**
With effective capital, secondary education, openness, & dummy	-3.116395***

Note: Stars (*) indicated that the hypothesis is rejected at 5% (**) and 10% (***) respectively, except for model with primary education only as the human capital proxy (stationary at second difference and 1% level of significance).
Source: Data estimation.

Error Correction Models

Following results of the cointegration tests, there are four Error Correction Models estimated in this study. The regression estimates are presented in Table 5. In model one, production function is assumed to be dependent on capital and labour only as the sources of economic growth. While the variables are highly significant and the signs are of expected direction, the model is rather poor with R-squared only 51 per cent. The share coefficients in this model are almost equally 50 per cent for both factors.

Model two augments the production function with human capital factors. The proxies used are primary and secondary education attainment ratios. The inclusion reduces capital and labour contribution significantly, from approximately 50 per cent each to 37 per cent and 27 per cent respectively. Yet they still have the expected signs. Secondary education gives a positive contribution to growth with long run elasticity of 22 per cent. However, the result suggests that primary education has negative correlation with long term growth although the magnitude is not significant. Thus, in the subsequent model we drop this variable.

As primary education factor is dropped, in the third model labour share increases considerably from 27 per cent to 43 per cent. These figures are close to its original shares without human capital addition. Likewise, coefficient of secondary

education increases moderately to 26 per cent. These outcomes indicate that labour and primary education might have particular relation in the economy. In contrast, capital share is lower in this model. Yet the share of 31 per cent closes to the worldwide result for capital share.

Finally, in the last model structural adjustment factors are incorporated by adding the openness variable to capture the economic increasing openness to the world market and the dummies for the 1974 oil boom and the 1998 economic crisis. The results are improved and fitness of the model rises from less than 70 per cent in previous models to more than 90 per cent with this specification. All factors, except dummy for oil boom, have the predicted signs. In addition to that, labour share drop to 12 per cent while capital and secondary education shares only change slightly as shown in Table 5.

To summarize, the regression results verify our main hypotheses. First, capital, labour and human capital are the main sources of economic growth in the Indonesian economy during the New Order Government period. These are shown by their relative shares in the production functions. Second, in contrast to the impact of economic crises, secondary education influences the growth positively as reflected from the coefficients of each variable. However, primary education and oil boom dummies show negative correlations with

the growth although the results are insignificant for the former. Third, effective capital gives the highest contributions to the economy and the share is approximately consistent with worldwide result ($\alpha \equiv 1/3$). Fourth, the contribution of labour varied with the addition of explanatory variables. The more explanatory variables included, the lower its share.

Table 5: Key Regression Estimates (Dependent Variable: Δ Log *RDGP*)

Independent Variables	Model 1	Model 2	Model 3	Model 4
Constant	0.163781	0.329175	0.036429	0.145145
	0.054356	0.831917	0.074856	0.221674
Δlog (Capital/Labour)	1.127779	0.964776	0.956511	0.296831
	0.227748	0.263634	0.233678	0.305811
Δlog Primary Education	n.a	-0.10089	n.a	n.a
		0.4369		
Δlog Secondary Education	n.a	0.059835	0.061737	-0.07116
		0.119216	0.145033	0.113012
Δlog Openness	n.a	n.a	n.a	0.009575
				0.067336
log *RGDP* (-1)	-0.28675	-0.51878*	-0.51318*	-0.73444*
	0.102388	0.169333	0.135226	0.214775
log Capital/Labour(-1)	0.142078	0.189552***	0.161025*	0.256197***
	0.051534	0.107498	0.049641	0.141979
log Primary Education (-1)	n.a	-0.07208	n.a	n.a
		0.224536		
log Secondary Education (-1)	n.a	0.114542**	0.132287**	0.176401**
		0.044576	0.057382	0.064466
log Openness (-1)	n.a	n.a	n.a	0.029409
				0.092317
Δlog *RGDP* (-1)	0.159975*	0.255514	0.263116	0.028965
	0.159562	0.169525	0.167567	0.234594
Δlog Capital/Labour(-1)	-0.94466*	-0.90491	0.94216	0.52126
	0.265062	0.252067	0.264132	0.238522
Δlog Secondary Education(-1)	n.a	n.a	0.035903	n.a
			0.166007	
Δlog Openness(-1)	n.a	n.a	n.a	0.005544
				0.090576
Step dummy 1974 (oil boom)	n.a	n.a	n.a	-0.04757***
				0.024106
Step dummy 1998 (crisis)	n.a	n.a	n.a	-0.13898*
				0.030427
LR elasticity				
LR elasticity of effective capital	0.50	0.37	0.31	0.35
LR elasticity of primary education		-0.14		
LR elasticity of secondary education		0.22	0.26	0.24
LR elasticity of labour	0.50	0.27	0.43	0.12
R^2	0.602893	0.682468	0.69119	0.903439
Adjusted R-squared	0.510235	0.564864	0.560539	0.801197
Sum squared resid	0.023369	0.018686	0.018173	0.00522
Durbin-Watson stat	1.975113	2.040059	2.046007	2.387859
F-statistic	6.506627	5.803079	5.290373	8.83632
Observations	38	38	38	36

Notes: Several lags are assumed foe some variables. Figures in brackets are standard errors. Level of significance are 1% (*), 5% (**), and 10% (***) respectively. Complete estimation result is available from the authors upon a written request.
Source: Data estimation.

This section analyses the main sources of economic growth in Indonesia for 1960-2000 period, most notably the education role in it as implied from the estimation results. In general, the results suggest that capital and secondary education gives the highest contribution to economic growth in Indonesia 1960-2000, meanwhile labour share tends to vary significantly with addition of education and structural adjustments variables.

First, the physical capital role is clearly significant during the period although some fluctuation occurred following structural changes in the economy. Before 1970, growth was slow mainly due to lower savings rate and non-existence of capital market. However, given financial and trade reforms conducted, more sources for capital formations are available and thereby investment increases considerably. For example, foreign direct investment (FDI) increased dramatically from 1.3 billion dollar in 1967-1976 to 20.6 billion dollar in 1987-1996 periods. At the same time, gross fixed capital formation also jump from 29 billion dollar to 385.8 billion dollar (Van der Eng 2002). Thus, investment was started higher in this liberalization period which eventually boosts economic growth in the entire period.

Second, labour force grew rapidly and its number almost triple at the end of 2000. According to Van der eng (2002), this acceleration was largely due to (i) rapid population growth, (ii) cohorts of people born during baby boom period reached working age, (iii) increased life expectancy, and (iv) increased female activities. In addition to that, increased labour mobility across region and industries also explain the importance of labour force in the economic growth. This finding is consistent with the work of the Indonesian Central Bank (Yudanto et. al., 2004) which finds that labour share is greater than capital share in standard Cobb-Douglas production function with only capital and labour.

However, this result tends to be bias from omitted variables problem as indicated by lower R^2 value in the corresponding model in the study.

Third, as labour share might be poor estimated by the standard model, inclusion of human capital improves the model and indicates a positive highly significance role of secondary education. However, primary education was surprisingly influenced the growth negatively. It is argued that these results are closely related with the economy and labour market structure. As the economy moved toward liberalization, the labour market demanded more educated workers with higher education levels (Jones, 1994).

Figure 1 provides an overview of educational achievements in terms of attainment ratio. Both primary and secondary education attainments increase gradually. However, after 1980s, primary education grew relatively stable while secondary education was fluctuating and only rise slightly after 1994. These changes presumably brought by the policy changes in Indonesian education, most notably in financing education. The 1993 Government Mandate states that education is not the responsibility of government only, but also the community and parents. However, as income distribution was still largely dispersed at that time, many people could not enjoy education as much as they wanted. Thus, as clearly shown in Table 6, there had been significant cut of education budget from 1990 to 2000 which intuitively lead to the lower growth of educational attainments.

In addition to that, the negative effect of primary education on long run growth is suggested to be the consequences of government policy which shifted educational investment focus to secondary education following the success of universal primary education program in 1984 and the labour market demand for more skilled labour. These results are consistent with the finding of Jones (1994).
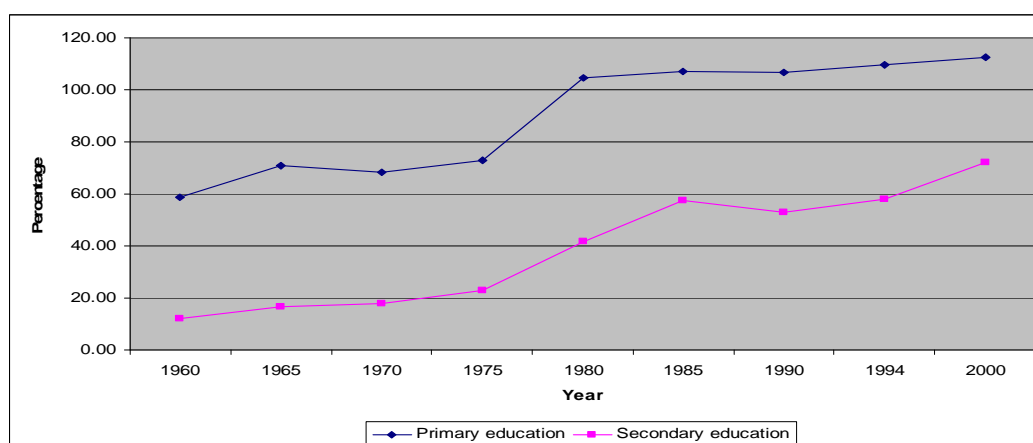
Source: Data calculation.

Figure 1: Trend in Education Gross Enrolment Ratios, 1960-2000

Table 6: Public Education Expenditure

Year	% of *GDP*	% of budget
1975	2.7	13.1
1986	1.15	14.21
1990	0.9	4.3
2000	0.93	5.37

Source: Calculated from ADB statictics.

Table 7: Growth of Labour Force Structure According to Educational Levels

Highest level of education	Percentage of Labour Force (%)	
	1980-1985	1986-1994
No schooling	-0.27	-0.41
Primary school drop-outs	-0.09	-0.23
Primary school graduates	0.30	0.10
General lower secondary	0.42	0.50

Source: Calculated from MOEC (1996) data.

Previously, in early 1970s demand for more educated farmers was high. This is in line with the government policies to foster development agricultural sector and basic infrastructure facilities. Supported by massive oil revenue in 1973, government constructed the large school expansion program in 1973-1978. This program led to dramatic changes in education and labour market: an increase of 0.25 to 0.40 years of education (schooling years), a 12 per cent increase of the probability that affected child would complete primary school, an increase of 3-5.4 per cent in wages, and economics return to education of 6.8-10.6 per cent (Duflo, 2001).

This success encouraged the New Order Government to move towards secondary education improvement and reduced allocation to primary education. However, as many unskilled labours had been available in the labour market while industry needed more skilled labour, primarily due to priorities in developing the strategic sectors and accelerate transformation into industrialized country described in the previous section, less and less primary schools graduates employed in the labour market (Table 7). Thus, in the long run it affects growth negatively even though in the initial period it was highly significant.

In contrast, the positive effect of secondary education development is off

expected result. In fact, in East Asia secondary education is regarded as a foundation for the successful export-oriented strategy (McMahon, 1998). In Indonesia, after universal primary education had been successfully achieved in mid 1980s, the government expanded its education initiative to The Universal Nine Year Basic Education Program in 1994. This initiative was consistent with labour market demand for more skilled labour (Table 7). Thus, in conclusion, it is secondary education that plays positive significant share to growth through its contribution in the changing labour market and economic structure toward a more industrialized economy of Indonesia during the 1960-2000 periods.

Finally, while dummy variable for crisis period found to be highly significant and of expected sign, dummy variable for oil boom is less significant and has negative sign. As illustrated in section 2, the crisis period induced remarkable changes in the Indonesian economy. Following massive currency depreciation in 1997, rupiah value fell dramatically by 600 per cent (from approximately Rp 2,500/USD into Rp 17,000/USD in January 1998), inflation reached 57.6 per cent. Consequently, the economy reached its nadir point by experiencing a negative 14.6 per cent growth in 1998/1999. In addition to that, the stock markets collapsed and many local companies faced increasing number of bankruptcy. The banking system was also in serious trouble during peak of the crises. Although the government responded quickly by tightening monetary and fiscal policies, the weakness of its fundamental economics could not stop the economy from depression.

CONCLUSION

This paper analyzes the main sources of economic growth in Indonesia with emphasizes on education role in fostering the growth during the New Order Government period of 1960-2000. To arrive at conclusive results, it employs econometric techniques and Error Correction Model that consider structural adjustments in the economy.

The study notes several important findings. First, physical capital and secondary education give the highest contribution to economic growth in Indonesian during the period. It is also argued that secondary education development is strongly encouraged by government policies focused on the sector most notably The Universal Secondary Education Program in 1994. Second, it is suggested that primary education affects growth negatively in the long run due to over-supply and decrease demand for the graduates following the structural changes from agricultural into industrial based in the economy. Finally, economic crisis in 1998 has lower the economic growth although its shows improvement in the later years.

It is worth to note that results of this paper must consider the model's assumptions explained earlier. Nevertheless, it is expected that findings of this study could contribute toward more understanding and appreciation regarding the impacts of educational policies on the Indonesian economic growth.

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