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A Cointegration Analysis of Public Debt Service and GDP in Indonesia

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ABSTRACT

This paper analyzed long term and short term relationships between public debt service and GDP in Indonesia by applying cointegration analysis of time series model from 1980 - 2005. These relationships used an extended production function model that measured GDP as a function of debt service, capital stock, labor and human capital in which all data are represented by constant local currency unit, Rupiah. The result show that Indonesia faces a debt overhang problem in the long run since increasing the public external debt service slows economic growth. One percent increases in debt service, elasticity of GDP will decrease by 0.13 percent. Labor and capital stock are the main variables to support GDP in the long run period. Moreover, elasticity of GDP to human capital shows relatively small by 0.08 percent. The results of the short run equation show that the change of capital stock is a significant variable in boosting economic growth. However, the variable of external debt repayment showed insignificant in relation to depressing GDP. It means that during the short run period Indonesia may not face debt overhang phenomenon.

Keywords : Public Dept Service, GDP, Capital Stock, Human Capital

1. INTRODUCTION

Since the Old Order (Orde lama) Indonesia has used foreign borrowing to finance development. Indonesia utilized foreign debt due to lack of resources during the first period of 1966. Foreign borrowing reached USD 2,015 million in the mid 1960s, while export earning was only USD 679 million, but need to service its debt. The country became deeply indebted by 1966, and the Government ran a large budget deficit by printing money. As a consequence, annual inflation increased dramatically from about 51 percent in 1961 to 635 percent in 1966.This situation forced the government to begin discussion with creditors about a moratorium on Indonesian foreign debt. The discussion focused on rescheduling foreign borrowing under the Paris Club initiative[1]. In 1969/1970 fiscal year, nearly 80 percent of development budget was financed through foreign aid (Hill, 1996).

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During the oil boom years of the 1970s and 1980s, economic conditions improved and the government gained revenue from oil earnings. However, stock of foreign borrowing in these periods jumped to more than USD 4 billion by the end of the 1970s and increased by almost five times to USD 20.9 billion in 1980. Declining oil prices in the first half of 1980s resulted in the rapid accumulation of debt. Both total debt and its proportion of GDP approximately doubled between 1980 and 1986. In 1980, percentage of total external debt on GDP increased from 26.8 percent to 53.6 percent in 1986.

In the late 1980s and mid 1990s, during Indonesia's economic boom, foreign debt incurred by state-owned and private enterprises also increased. The investment climate was conducive to borrowing, and supported by political stability. The economy grew at an average of 7-8 percent annually, attracting foreign investors. However, higher domestic interest rates forced local investors to look for other alternative resources from abroad. Therefore, private debt increased significantly at this period. The debt service ratio in the 1980s, especially in 1988 and 1989 still rose to an average 39.9 percent but then declined as rapid export growth take hold. There are very few accurate data on private debt in the 1990s, especially that with a short-term maturity (Hill, 1996).

When the Asian financial crisis surfaced in mid 1997, external debt increased significantly from more than USD 136 billion in 1997 to more than USD 151 billion in 1998 mainly due to a lot depreciation of Rupiah. In terms of repayment of debt, after paying more than USD 21.5 billion in 1996, from 1997 to 2002, the external debt service burden decreased modestly. From 1970 to 1996 GDP increased significantly and then dropped dramatically in 1999 due to the massive impact of the Asian crisis. The ratio external debt over GDP during Asian crises 1998 and 1999 achieved the highest level on average more than 130 percent per GDP. However, debt service ratio during 2000 to 2003 increased slightly from 24.6 percent to 28 percent. Share of private debt to total external debt after year 2000 declined slightly. In 2004 and 2005, share of public external debt on total debt was bigger than share of private external debt (Table 1). Total external debt outstanding declines from 137 billion USD in 2004 to 125.3 billion USD in 2006.

Table 1
External Debt Outstanding (million USD)

		Share of	Private				Share of	
Period	Government	Government Debt To	Financial Institution		Non financial		private debt	Total
		Total Debt	Bank	Non Bank	Institution	Sub Total	To Total	
		(%)					(%)	
2001	71,377	53.6	6,649	1,064	53,983	61,696	46.4	133,073
2002	74,661	56.8	4,870	2,772	49,040	56,682	43.2	131,343
2003	81,666	60.3	4,316	3,221	46,198	53,735	39.7	135,401
2004	82,725	60.4	3,909	4,306	46,084	54,299	39.6	137,024
2005	80,072	61.3	4,057	2,329	44,194	50,580	38.7	130,652
2006	74,126	59.2	3,918	1,755	45,458	51,132	40.8	125,258

Source: *Central Bank of Indonesia and Authors estimation.*

Increase in external debt creates problems since whenever a country has debt accumulation, a high proportion of public expenditure and foreign exchange earnings are absorbed by the debt burden with heavy opportunity costs. Furthermore, inclining of external debt may have negative effects on investment through debt overhang and credit-rationing (Eduardo, 1989). Similarly, external debt service (in contrast to the total debt stock) can also potentially affect growth by crowding out private investment or changing the composition of public spending (Clements et al. 2003). Referring to these facts and the channel in which debt

repayment affects economic growth in Indonesia, the objective of this paper is straight to investigate the relationship between GDP and public debt service and to analyze whether or not the debt overhang phenomenon has occurred in Indonesia.

The paper is divided into seven sections. The first part is introduction. Section two presents definition and characteristics of the debt overhang in Indonesia. Section three provides a description of the theoretical and empirical study. Section four explains data and variables. The following section specifies the model and hypothesis. Section six describes the results. Finally, section seven presents the conclusion.

2. DEFINITION OF DEBT OVERHANG IN INDONESIA

Many studies employ external debt stock (in contrast to external debt service) to analyze the impact of debt variable on economic growth. Some direct and indirect channels may describe the relationship between external debt and growth through debt overhang hypothesis, increases domestic interest rate and downturn economy activities that influence of decreasing profitability. This study defines debt overhang as a situation in which external debt service (in contrast to debt stock) may potentially affect growth by crowding out private investment or changing the composition of public spending. The mechanism is as follows: higher debt service can raise the government's interest bill and budget deficit, reducing public saving; this, in turn, may either raise interest rates or crowd out credit available for private investment, finally dampening economic growth (Clements et al. 2003). Higher debt service payments can also have adverse effects on the composition of public spending by squeezing the pool of resources available for infrastructure and human capital spending, with negative effects on growth (Sachs, 1989). The characteristics of debt overhang may be described as altering the composition of public spending (education expenditure) and increasing interest rates leading to crowd out private investment and finally reducing GDP.

From1982 to 1989, external debt service increased from 22,052 billion Rp to 81,736 billion Rp. However, education expenditure declined in the same period from 11,255 billion Rp to 7,904 billion Rp. Domestic interest rate inclined three times from 6 percent in 1982 to around 18 percent in 1989. During the period 1982-1989, public spending, represented by education expenditure, decreased as the domestic interest rate increased. The Interest rate jumped dramatically from 17 percent in 1990 to 39 percent in 1998 due to the Asian crisis. After the crisis, the domestic interest rate has been table at around 12 percent. This shows that if utilization of debt focused on consumption activities rather than activities enhancing export, it might discourage economic growth[2]. Afxentiou and Serletis (1996) argued that foreign loans may contribute to development when the borrower uses them exclusively to finance capital imports. They concluded that developing countries that faced difficulties of debt servicing in the 1970s used foreign loans primarily to finance balance of payment deficits and popular government welfare programs.

During the period of 1980 to 2005, debt service ratio: the ratio of debt service of initial and interest payment over GDP, is an average 28.9 percent. This means more than one quarter of income went to service the debt. The ratio of total external debt over GDP shows an average 58.3 percent during these period. This value is more than the 'safe' level of debt suggested by IMF and the World Bank. IMF defines a sustainable medium term is in the range of 35-42 percent of GDP (IMF, 2005)[3] and 20 percent for Debt Service Ratio (DSR)[4] (WB&IMF,2006). In 1970 total external debt was 4.5 billion USD. It increased almost five times in the 1980s. Debt crises in the 1980s and declining oil prices in the first half of the 1980s resulted in the rapid accumulation of debt. Total debt and its proportion of GDP approximately doubled between 1980 and 1986. During the period 1982-1986, falling oil prices, rising external debt and decline in economic growth in 1982 signaled an end to a decade of oil-financed growth and abundance. During this period, ratio debt over GDP and ratio debt service payment over export showed 38.8 percent and 24.5 percent respectively. Indonesia began to face debt overhang (heavy debt burden) in this period. Perhaps the

most difficult period of debt management was 1986-1987 when there was a large current account deficit and rapid appreciation of the yen, in which currency some 40 percent of Indonesia's debt was denominated (Hill, 2000). In the 1990s, total external debt increased by almost USD 70 billion, reaching more than USD 144 billion in 2000. In the 1990s to 1997, before the Asian crises, the ratio of debt over GDP and Debt Service Ratio (DSR) reached an even higher level than during the early 1980s. When the Asian crises hit in 1997, the situation further worsened.

3. LITERATURE AND EMPIRICAL REVIEW

3.1 Theoretical Analysis of External Debt and Economic Growth

The theoretical reviews that analyze the relationship between the stock of external debt and economic growth primarily focused on the effect of debt overhang. Krugman (1988) defines debt overhang as situation in which the expected repayment on external debt falls short of contractual value of debt. If a country's debt level is expected to exceed the country's repayment ability with some probability in the future, expected debt service is likely to be an increasing function of the country's output level. Thus, some of the returns from investing in the domestic economy are effectively "taxed away" by existing foreign creditors. Investment by domestic and foreign investors is discouraged and economic growth is also slowed. In other words, Krugman hypothesis states that debt overhang is partly due to the burden of foreign debt and that investment will be slow resulting in poor growth performance.

Other theoretical literature indicate that external borrowing has a positive impact on investment and growth up to a certain critical value; beyond this threshold level, however, its impact is adverse. Pattillo et al. (2002) finds strong support for a non linier laffer curve between external debt and economic growth. They use a large panel data of 93 developing countries over the period 1969-1998. They find that the average impact of external debt on per capita GDP growth turn into negative for net present value of debt level above 160-170 percent of export and 35-40 percent of GDP.

Cunningham (1993) investigated the relationship between economic growth and external debt service in heavily indebted countries during the period 1971 -1986 by classifying debt servicing as a primary factor of production. Cunningham (1993) used extended standard production function model to analyze the association between economic growth and external debt burden and argued that the debt service can be considered in the production function due to its effects on the productivity of labor and capital in a manner similar to the inclusion of exports in the production function. In cases where the nation has a significant debt burden, debt servicing will affect how labor and capital are employed in the production function. In other words, when any benefits arising from productivity accrue to foreign creditors rather than domestic investors, it adversely affects both capital and labor productivity and finally reduces economic growth.

3.2 Empirical Reviews

Various empirical reviews found mixed literature support for the "debt overhang" hypothesis. Borensztein (1990), Geiger (1990), Cunningham (1993), Despande (1997), Chowdhury (2001), find evidence and support the debt overhang hypothesis. Afxentiou and Serletis (1996) investigated the impact of debt indicators among four groups of countries to per capita GNP. Using an ordinary least square (OLS) framework they investigated the relationship between per capita GNP and debt during the period 1970 - 1990 for 55 developing countries facing debt servicing difficulties. They found that per capita GNP had a negative significant on debt. It meant that debt overhang happened for severely indebted low income countries and severely indebted middle income countries. Fosu (1999) also finds support for the debt overhang hypothesis by analyzing thirty five sub-

Saharan African countries. In contrast, Hansen (2001) find that inclusion three additional explanatory variables (the budget balance, inflation and openness), lead to rejection of any statistically significance negative effect of external debt on growth. The sample countries are 54 developing countries (including 14 HIPCs). Savvides (1992) finds that the ratio of debt to GNP has no statistically significance effect on growth. Djikstra and Hermes (2001) also find that debt overhang hypothesis is in conclusive.

Studies using variable of external debt service (in contrast to the total debt stock) can also potentially affect growth by crowding out private investment or changing the composition of public spending. The mechanism is higher debt service can raise the government's interest bill and budget deficit, reducing public saving; this, in turn, may either gain interest rates or crowd out credit available for the private investment, and finally dampening economic growth. Higher debt service payments can also have adverse effects on the composition of public spending by squeezing the pool of resources available for infrastructure and human capital spending, with negative effects on growth (Sachs, 1989). This effect arises because highly indebted poor countries tend to frequently switch resources, including foreign aid and other foreign exchange resources to keep off pressing debt service obligations particularly debt owed to multilateral institutions (Iyoha, 1999). In contrast, Fosu (1999) finds no such relationship between debt service and growth for countries in sub Saharan countries. Pattillo et al. (2002) also find no statistically significant relationship between debt service and growth.

Relatively a few empirical studies concerned on external debt service (instead of total external debt stock) for single country analysis using time series data. Karagol (2002) and Wijeweera et al. (2005) investigated the relationship between external debt service and GNP by applying extended production function model. Karagol (2002) found a long run relationship exists between GNP and debt burden and accepted the debt overhang hypothesis in Turkey. However, in the case of Sri Lanka, Wijeweera et al. (2005) found conversely that external debt affected GNP positively in the long run equation and negatively in the short run. Both studies followed the model of Cunningham (1993). Study by Mere (2001) and Isa Audu (2004) investigate relationship between external debt service and growth for Kenya and Nigeria respectively. Both studies find that external debt service has a negative effect on growth. Therefore those studies conclude that debt overhang phenomenon happened to these countries. Some selected studies that analyzed the effect of external debt on growth is shown in this paper differs from the existing debt-growth literature in several points.

First all monetary unit of variables is local currency unit (Rupiah) that reflect real situation in Indonesia mainly to capture and observe the risk of exchange rate and interest rate fluctuation. Second, this study uses GDP instead of GNP since GDP better reflects the independent productive capacity of the country (Cordella, et.al 2005). Third, many empirical studies have used cross sectional analysis to investigate relationship between economic growth and debt. However, there are few studies using time series data to investigate growth - debt relationship in an individual country. Since developing countries differ significantly in terms of economic and political environment, organizations and institutions, they may face different debt burden issues due to their different stages of development. Therefore impact of debt service payment may vary across. Forth, this study uses cointegration and error correction model analysis that explain long term and short term equation. The advantages of applying cointegration analysis are that it shows long term effects of equation and short run dynamic effects. Moreover, using error correction terms (ECT), the model may be more valuable since ECT is an adjustment speed from long term effect in one year deviation. This is useful for policy makers when external shocks occur in the model.

4. DATA AND VARIABLES DESCRIPTION

The empirical analysis of this study uses data for Indonesia that cover the period 1980 to 2005. Data sources are taken from Ministry of Finance of Indonesia, World Development

Indicators published by the World Bank and Key Indicators published by Asian Development Bank. Almost all monetary units of variables are local currency unit of Rupiah, while labor is expressed by number of people.

Gross Domestic Product (GDP) is a dependent variable, whereas, capital stock, labor force, human capital and debt service are determinant factors of GDP. Variable of income is represented by real GDP at 2000 constant prices since GDP better reflects the independent productive capacity of the country (Cordella, 2005). Previous studies conducted by Karagol (2002) and Wijeeweera (2005) used GNP instead of GDP. Capital stock is represented by real fixed capital stock. GDP and fix capital stock are taken from World Development Indicators (WDI) published by the World Bank. Labor force is defined as employed people. Total people engaged in jobs are extracted from various issues of key indicators published by Asian Development Bank (ADB). Human capital is represented by education expenditure per year. Human capital is important to boost the economy since this variable includes general skills and ability of labor to carry out a particular job. Figures for education expenditure are taken from various issues of financial notes of state budget (APBN), Ministry of Finance. Public debt service is defined by government external debt repayment including interest rate and initial payment. This data is extracted from the World Development Indicator. All variables are deflated by GDP deflator 2000. Descriptive statistics for all variables are provided in Table 2

Table 2
Summary Statistics

Variable	Units	Observation	Mean	Standard Deviation	Minimum	Maximum
GDP	LCU (Bill Rp)	1980-2005	1,080,000	399,701	495,000	1,750,000
Debt Service	LCU (Bill Rp)	1980-2005	41,882	19,676	7,636	74,975
Capital Stock	LCU (Bill Rp)	1980-2005	240,000	100,000	99,900	431,000
Human capital	LCU (Bill Rp)	1980-2005	9,363	2,661	3,376	16,387
Labor	Person (million)	1980-2005	77,257	13,034	51,553	94,948

Source: *Author's calculation*

In order to employ local currency unit (Rupiah), the monetary unit of USD is converted into Rupiah by average exchange rate per year. For instance, since the monetary unit of fixed capital stock is USD, it is converted into Rupiah. After converting into local currency, the variable is depleted by GDP deflator. Variable of GDP is available on local currency unit and at constant price. Education expenditure is in local currency unit, directly deflated by GDP deflator.

5. MODEL SPECIFICATION AND HYPOTHESIS

To investigate the association between GDP and external debt service in Indonesia, this study will employ the extended model of production function originally applied by Cunningham (1993)[5] using cross country data. However, there is a few single country analyses that applying extended production function model using time series data. Studies by Karagol (2002)[6] that covered data of Turkey, and Wijeweera et al. (2005)[7] that covered data of Sri Lanka employed another determinant variable i.e. education expenditure representing human capital in the model. Karagol's suggested that education expenditure may not be an appropriate proxy for human capital. In contrast, in the case of Sri Lanka, the results suggested that education expenditure may have been an appropriate proxy for human capital.

Cunningham's (1993) presumed that the production function only consist of physical capital, labor and debt service. The model assumes that there is no human capital. Romer

(1996) investigated that physical capital is important for the production function but the human capital is vital. Human capital consists of skill, abilities, knowledge of particular workers, therefore this study insert variable of human capital that represented by education expenditure. The model of this study will be:

$$Y = F(K, L, HK, DS). \quad (1)$$

Where Y, K, L, HK and DS are real GDP, fixed capital stock, labor, human capital and debt service respectively. By applying natural logs (written as L), the model is:

$$LY=a+\alpha LK+\beta LL+\gamma LHK+\phi LDS+\varepsilon \quad (2)$$

Before constructing the system model, it is important to check the univariate time series of variables by using a unit roots test. This check is important to estimate whether variables are stationary. Here we check unit roots of variables by adopting the Augmented Dickey Fuller (ADF) (1979) test as follows (equation 3)

$$\Delta Y_t = \text{constant} + \partial Y_{t-1} + T + \sum_{s=1}^{n} \partial 1 \Delta Y_{t-s} + \varepsilon_t \quad (3)$$

Where Yt is the relevant time series, is the residual term and T is time trend. The null hypothesis is that the variables under estimation will have unit root, against the alternative hypothesis is that it does not.

After checking univariate of all time series variables, now we can test cointegration among these four variables (GDP, capital stock, labor force, human capital and debt service). The purpose of the cointegration test is to determine whether a group of non-stationary series are cointegrated or not.

Engle and Granger (1987) pointed out that a linear combination of two or more non-stationary series may be stationary. If such a stationary linear combination exists, the non-stationary time series are said to be *cointegrated*. The stationary linear combination is called the *cointegrating equation* and may be interpreted as a long-run equilibrium relationship among the variables.

This paper will adopt the method of investigation of cointegration developed by Johansen (1988) and applied by Johansen and Juselius (1990). This method depends on direct investigation of cointegration in the vector autoregressive (VAR) representation and produces maximum likelihood estimators of the unconstrained cointegration vector, but it allows one to explicitly test for number of cointegration vectors. Johansen cointegration test assumes that cointegration equation has a linier trend (equation 4)

$$LY=\alpha LK+\beta LL+\gamma LHK+\phi LDS+Trend \quad (4)$$

If there is an equilibrium or cointegration relationship among non stationary variables, there has to be an error correction representation (Engle & Granger, 1987) which illustrates the dynamic convergence of the system to the long-run equilibrium. A precondition for the existence of cointegration is that all the variables are integrated of the same order. If this is fulfilled, then the residuals from the long run estimates can be used as the error correction term (ECT) to explain the short run dynamic. The error correction variable in a short run dynamic relationship indicates the proportion of the disequilibrium from one period that is adjusted in the next period.

The detailed Error Correction Model (ECM) for short-run adjustments is given below (equation 5)

$$\Delta LY_t = \alpha_0 + \sum \alpha_1 \Delta LY_{t-i} + \sum \alpha_2 \Delta LK_{t-i} + \sum \alpha_3 \Delta LL_{t-i} + \sum \alpha_2 \Delta LHK_{t-i} + \sum \alpha_4 \Delta LDS_{t-i} + \sum \alpha_5 ECT_{t-i} + \varepsilon_t \quad (5)$$

where LY, LK, LL, LHK and LDS are defined as log Real GDP, log capital stock, log labor, log human capital and log debt service respectively. ECT_{t-1} is the time-lag error correction term, Δ symbolizes the change in variables (the first difference of the variables), and the indices ($_{t, t-i}$) denote the time period of the variables (Engle & Granger, 1987).

This empirical intends to deal with the following four hypotheses:

i. Capital stock is the existing supply of physical goods that are useful in the production function. Capital that involves buildings, machinery, equipment and inventory are used in the production process. Therefore, we predict that capital stock has a positive relationship with GDP
ii. Definition of labor is the number of employed people. This study expects that labor force will have a positive coefficient with GDP.
iii. Human capital accumulation is believed to promote higher growth by improving labor through particular knowledge, skill, and ability. Therefore this study decides that effect of human capital, represented by education expenditure, will influence a significant positive on economic growth.
iv. Studies by Cunningham (1993), Afxentiou (1993), and Karagol (2002) show that when a country has substantial debt service payment, the manner in which labor force and capital stock are exploited in the production process is switched to obligate paying the debt. In other words, when foreign creditors rather than domestic investors gain from the rise in productivity, increase of capital and labor force will be discouraged. This study expects that debt service has a negative effect on GDP in the long run and short run. A negative effect of debt service lead to the debt overhang problem.

6. EMPIRICAL RESULT

6.1 Unit Root Test

Standard procedure in the time series literature suggest researcher to check for unit roots in each series before estimating any equations. If unit root is exist in any variable, then that particular series is considered to be non-stationary. Estimation based on non-stationary variables may lead to spurious results with high R^2 and *t* statistics, but without any coherent economic meaning and inconsistent parameter estimator (Pyndick, 1998).

The Augmented Dicky Fuller (ADF) test for estimating unit roots was applied in this study8. Since the ADF unit root testing technique is well established in the literature, the details are not discussed further. The result of ADF testing can be seen in Table 3.

Table 3
Result of ADFTest for Nonstationarity

Variables	ADF test in	level	ADF test in first difference (delta)	
	Calculated	Lags	Calculated	Lags
LY	-1.41	1	-2.86*)	1
LK	-2.17	1	-3.85***)	1
LL	-0.71	1	-3.33**)	1
LHK	-2.56	1	-4.09***)	1
LDS	-1.96	1	-2.891**)	1

Source: *Author calculation.*
Critical Value:
ADF Statistic for levels at 1% (***), 5%(**) and 10% (*)significance are -4.39, - 3.61, -3.24 (with trend) respectively
ADF statistic for first difference at 1%(***) ,5% (**) and 10% (*) significance are - 3.75, -2.99, and -2.64 (without trend) respectively

6.2 COINTEGRATION ANALYSIS AND LONG RUN EQUATION

Equation 4 has long run relationship equation since the order of integration in every variable (GDP, capital stock, labor, human capital and debt service) are equal and that of residual is stationary in level[9] (Mukherjee, and Engle and Granger). Then this study applies the Johansen and Juliesus (1990) maximum likelihood method to investigate whether there is more than single cointegration relationship. Looking at the trace statistics and maximum eigenvalue statistic shows that there is one cointegration relationship (Table 4)

Table 4
Testing of Cointegration

Hypothesized No. of Cointegration equations	Eigenvalue	Trace Statistic	Max-Eigen Statistic	1 Percent Critical Value
None **	0.88	116.66	51.72	96.58
At most 1	0.74	64.95	32.28	70.05
At most 2	0.46	32.67	14.91	48.45
At most 3	0.39	17.75	11.90	30.45
At most 4	0.22	5.85	5.85	16.26

**) denotes rejection of the hypothesis at the 1% level
Trace test indicates 1 cointegrating equation(s) at the 1% level

Some interesting results were obtained by applying the Johansen co-integration test. Among the variables, GDP, external debt service ratio, capital stock, labor and human capital have a long run relationship. All determinant variables are significant and consistent with what we expected in hypotheses. Debt service ratio has a significant negative effect on economic growth implying that debt overhang occurs in the long run period. Capital stock has a positive significant effect on GDP. Labor and human capitals show a positive significant on GDP. The calculation of long run equation result can be seen below:

$$\text{Log (LY)} = 0.465\text{Log(K)}+1.678\text{Log(LL)}+0.08\text{Log(HK)}-0.125\text{Log(DS)}-0.007\text{Trend}$$

$$(19.411^{***})\ (6.905^{***})\ (3.975^{***})\ (-7.062^{***})\ (-1.481)$$

Notes: 1) The asterisks (*), (**) and (***) indicate statistical significance at the 10%, 5% and 1% significance level, respectively.

2) The critical value at 1% significance level is 2.575, 5% level 1.960 and 10% is 1.645 (two-tail)

Our results show that elasticity of income to external public debt service is 0.13. It means that when one percent increases in debt service, GDP will reduce by 0.13 percent. This result is labeled the debt overhang hypothesis. The negative sign of debt service in the long run is plausible since the utilization of foreign debt may generate GDP through improvement of physical capital and non physical capital (capital stock and human capital). In the long run, the utilization of foreign borrowing may generate output by improvement of capital and human capital that attached in those variables. However, the country has to obligate the principal and interest payment that leading to reduce GDP.

Karagol's (2002) study of Turkey economy showed that overhang occurs because the variable of debt service has significantly negative with very little elasticity. Study by Mere (2001) and Isa Audu (2004) proved that debt overhang hypothesis exist for country Kenya and Nigeria respectively. In Wijeweera's (2005) study analyzing Sri Lanka's debt payment, the result shows that debt service has a negatively relationship with GNP, but the coefficient

is not significant. Therefore Sri Lanka does not face debt overhang phenomenon.

Debt overhang hypothesis argues that when foreign debt becomes excessive; actual payment to creditors becomes linked to the economic performance of the debtor country. Therefore potential increases in debt payment depress the return to productive investment and discourage capital formation. Moreover, greater percentage of reserves (foreign currency) goes to pay the debt make it difficult the country to continue large infrastructure, new projects and old investments. Krugman (1988) argues that a very high debt burden is as a future tax on the return to capital. The heavy debt burden means that the government will have to increase taxes in the future to finance the high debt service payments. That increase in taxes means a lower after-tax return on capital and reduced incentive to invest. Lower investment leads to slower growth.

Moreover, among the variables considered, labor and capital stock contributed most to boosting the economy during the period of study. Labor contributed higher elasticity, 1.68 percent, than other determinant variables. This is plausible because the population of Indonesia is huge. Total population in 1980 was around 148 million people, and it increased to more than 218 million in 2004, reflecting an average population growth of 1.6 percent per year during the period 1980- 2004. Moreover, in our model increasing one percent of capital stock, GDP improves by almost 0.47 percent. However, human capital contributes a little to supporting economy. One percent increase in this variable, raises GDP by less then 0.08 percent. This too is plausible since Indonesia's labor force is mostly unskilled, thus unlikely to greatly improve the level of output.

6.3 SHORT RUN DYNAMIC EQUATION

Analysis of short run dynamic equation has two important objectives. Firstly, it can be used to investigate whether the impact of any external debt burden are permanent or temporary. If responses are significant only in the short run, the effect of changes in external debt payment is temporary. However, if the response are significant both in short run and long run, it can be said that changes of external debt burden are permanent. Finally, the Error Correction Model (ECM) provides information about the speed of adjustment in response to a deviation from the long run equilibrium, which could be useful for policy analysis.

Table 5
Estimation of Short Run Dynamic Dependent Variable: ΔLK

Independent Variables	Coefficient	t-statistic
Constant	0.028	3.718
ΔLK***)	0.31	6.88
ΔLL	0.209	0.892
ΔLHK	0.015	0.798
ΔLDS	0.01	0.44
ECT_{T-1}	-0.144	-0.745

Notes: 1) The asterisks (*), (**) and (***) indicate statistical significance at the 10%, 5% and 1% significance level, respectively.

2) The critical value at 1% significance level is 2.575, 5% level 1.960 and 10% is 1.64 (two-tail).
Source: Author's calculation

The results of the short run dynamic equation are presented in table 5. The change of DS is found a positive relationship with the change of GDP. However, the sign is not significant. Capital stock and labor force have consistent signs as expected. However, only capital stock is statistically significant. Human capital is also consistent with hypothesis. It

contributes the lowest compared with other determinant variables. The positive sign of GDP on the ratio of debt service repayment over export is plausible since during the short run period, 1 to 5 year, the impact of utilization of foreign debt is shown by a positive sign of physical and non physical capital (capital stocks and human capital) that may boost the economy. Similarly, the debt repayment may also a positive relationship on output in the short run due to countries obligation of paying the principal and interest payment.

More specific, capital stock is statistically significant at one percent significance level. Increasing elasticity of the change of capital stock by one percent, the change of elasticity of GDP will increase by 0.31 percent. In the short run, physical capital is the most important item to generate national output. The impact of physical capital stock is permanently since in the short run and long run, capital stock has a positive significant on GDP.

The label of debt overhang hypothesis happened only in the period of long run. In the short run, the impact of debt service is insignificant. Therefore there is room for Indonesia to minimize the total external debt and avoid heavy debt burden through effectively usage of external debt that may create more investment.

7. CONCLUSION

The objective of this study was to analyze the long run and short run relationship between public external debt service and GDP in Indonesia during 1980 - 2005. The results show that gross domestic product, debt service, capital stock, labor force and human capital inputs have a long run equilibrium relationship. The ratio between external debt service showed a significant negative relationship with GDP in the long run period. This is labeled as an acceptance of debt overhang hypothesis.

Elasticity of income to external public debt payments is 0.13. It means that when one percent increases in debt service, GDP will reduce by 0.13 percent. Among determinant variables, labor is the highest contribution of economic growth. Meanwhile, increasing one percent of capital stock, GDP will increase by almost 0.47 percent. However, human capital contributes a quite small effect on GDP. Increasing one percent of human capital, GDP will improve by 0.08 percent.

In the short run period tests, the results showed that the external debt service is a positive insignificant effect on income. Capital stock, labor and human capital variables had consistent sign as was expected. However, only capital stock was statistically significant. Increasing the change of capital stock one percent appears to have resulted in an increase of GDP by 0.31 percent. The short run test confirms the importance of capital investment to generate national output.

The positive sign of debt service in short run and a negative sign of debt service in the long run is plausible since the utilization of foreign debt may generate GDP through improvement of physical capital and non physical capital (capital stock and human capital). In the short run, capital stock and human capital will increase. In the same time, the country also has to repay the debt that lead to a positive impact on GDP. In the long run, the utilization of foreign borrowing may generate output by improvement of capital and human capital that attached in those variables. However, the country has to obligate the principal and interest payment that leading to reduce GDP.

The findings above mainly have two policies implication:

(i) The government of Indonesia should adopt more prudent policies in borrowing money from external sources. The choice of lowest cost of borrowing (low interest rate and long repayment period and grace period) should be considered when Government proposes to take on borrowing from creditors in order to minimize the repayment of debt in the long

run.

(ii) The government may reduce debt service payment by strengthening total export in the long and short run period and finally lead to foreign reserves improvement.

Single country research analyses may be improved by considering new independent variables that have similar effects as the export and debt service variables investigated in this study as future research agenda.

NOTES:

1. The principal of the debt was rescheduled for repayment in 30 equal installments over 30 years at zero interest rate.

2. The real issue is whether funds from foreign borrowing are being used productively. There has been insufficient analysis apart from the focus on the "mega projects" which surfaced in the 1990-1992 period and some of the "high tech" investment projects of Minister Habibie (Hill, 2000).

3. This range was derived by assessing the public debt level from three angles:

Vulnerability to financial crisis: Looking at a sample of fourteen emerging market countries for the past twenty years and using the early warning signals approach, the analysis indicates that Indonesia's debt/GDP threshold for being "safe" from a currency crisis is about 42 percent of GDP

Debt overhang: The theoretical rationale implies that a higher debt ratio would lead to higher future tax burden and lower investor expectations for net returns, which in turn would lead to lower investment and growth. A panel regression of growth on the debt to-GDP ratio after controlling for other factors affecting growth suggest that an increase in the debt ratio above 38 percent of GDP would lead to a lower growth rate.

Stochastic debt sustainability: This approach assumes that public debt is sustainable if the debt-to-GDP ratio would remain constant or decline in the medium term. The results indicate that Indonesia's debt would have to be 35 percent of GDP or less in the medium term.

4. The World Bank set up an indicative debt burden threshold that depends on country's policies and institutions measured by Country Policy and Institutional Assessment (CPIA). Since Indonesia is categorized at the level of 'Medium Policy', the debt burden threshold (debt services in percent of exports) under DSF (Debt Sustainability Framework) was 20 (World Bank & IMF, 2006). Debt Service Ratio (DSR) is defined as the ratio of external debt-service payments of principal and interest to exports of goods and services for any one year. The debt-service-to exports ratio is a possible indicator of debt sustainability since it indicates how much of a country's export revenue will be used up in servicing its debt and thus, also, how vulnerable the payment of debt service obligations is to an unexpected fall in export proceeds (External Debt Statistic, Guide for Compilers and User, IMF, 2003).

5. Cunningham (1993) used the variable of economic growth as the percentage change in real gross domestic product. The variable of capital is defined by the ratio of real gross domestic investment to real GDP. Labor is defined by the percentage change of population. Debt burden is the rate of change in the ratio of long term debt service on public and publicly guaranteed debt to the exports of good and services, denoted in dollars.

6. Karagol (2002) deflated all financial data (GNP, capital stock, and human capital and

debt service) to 1987 millions Turkey liras (The State Institute Statistics Turkey). External debt service includes interest payments and repayment of long and short terms.

7. Wijeweera, et al, (2005) used all monetary data of GNP, capital, human capital and debt service in million USD, whereas the variable of labor is expressed by thousands.

8. Checking each variable (LY, LK, LL, LHK and LDS) through visual assessment confirmed that all variables are not stationary at all in levels but stationary in first differences. Therefore, we checked all variables by applying the ADF test. The results showed that hypothesis of unit roots in variables of LY, LK, LL, LHK and LDS are not rejected at 1% or 5% significance levels. However the first difference of each variables (dLY, dLK, dLL, dLHK, and dLDS) is significant.

9 Residuals were checked to the test the integration in level (IU=0), following Engle and Granger (1988). The results show that residual (e) is stationary. Augmented Dickey Fuller test statistic is -4.75. It is significant at the 1% significance level.

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