

Determinants of Indonesian Economic Growth, 1965-1992

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The disparities between growth rates of different countries are only in part explainable by different rates of increase in the employment of the basic factors of production, i.e. capital and labor. The new growth theory positively links economic growth to increasing returns to scale, to human capital development, to dynamic spillover effects of the export sector and stresses the important role of institutions. The aim of our paper is to determine the growth factors for Indonesia through a time-series analysis based on cointegration and error-correction. The results show that human capital, investment, government consumption, imports and inflation enhance economic development in the long-run, while exports exert a strong positive influence on Indonesian growth in the short-term. Additionally, the trade and financial liberalization since the early eighties as well as exogenous technological change contribute positively to economic growth. (JEL Classifications: F14, O11, O47, O53)

I. Introduction

Theorists of economic growth have debated extensively the causes of wide variations in growth rates between different countries. The disparities between growth rates are only in part explainable by different rates of increase in the employment of the basic factors of production, i.e. capital and labor. In recent times we have seen the emergence of a new growth theory related to international trade (Grossman, Helpman, 1990; Lucas, 1988; Romer, 1986), which positively links economic growth to increasing returns to scale, to learning-by-doing effects of human capital and to dynamic spillover effects of the growth of the

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export sector. The important role of institutions, e.g. government, is underlined by Barro (1990). Various cross-country-studies have shed some light on the determining factors of economic growth, but there are certain shortcomings when interpreting these results for one specific country. Therefore, the aim of our paper is to determine the growth factors for Indonesia through a time-series analysis.

Indonesia is one of the most dynamic countries of Southeast Asia. During the last thirty years, the economy has grown—under the regime of President Suharto—at a real rate of 7% p.a. (1967-95). Though, its current per capita income level is still just above 1.000 US-\$. Up to the early 80s the country was an exporter of predominantly primary products (oil, gas, wood) and its industrialization and trade policies were inward-oriented. The significant drop of world prices for primary products led to a re-evaluation of these policies. Trade and subsequently financial liberalization were on the agenda since the early eighties. The export-led growth strategy was driven by a rapid expansion of light-industry production. The share of the oil sector dropped from 28% of GDP in 1980 to 11% in 1994. Even more significant is its decline as export commodity. Exports were dominated by oil & gas in the early eighties (70%), while today their relevance has shrunk to a mere 20% of all exports (Bank Indonesia 1996). This success of industrial diversification has been financed to a large part by the inflow of foreign capital. With a foreign indebtedness of more than 100 bn US-\$, Indonesia was the fourth largest debtor country in 1995. Fortunately, the burden of the indebtedness has been kept low by an exceptional export drive: the debt-service ratio declined since the early nineties to a manageable level of below 30% of total exports. Is this the main story behind Indonesia's rapid economic growth?

The paper proceeds as follows. Section II presents the theoretical arguments and the general empirical support of the various factors of economic growth. A time-series regression analysis based on recent econometric methods filters out the determinants of Indonesian growth for the period 1965-92 in Section III. It is shown that most macroeconomic time-series follow a nonstationary trend.¹ Therefore, the use of the commonly known *t*- and *F*-tests can lead to the false acceptance of spurious regression relationships. If theory tells us that these variables are cointegrated, cointegration analysis is a solution to this problem.

¹For such time-series only the first or higher difference represents a stationary process.

Otherwise, the detected relationship is merely empirical. On the one hand Engle and Granger (1987) proposed a two-step procedure by which tests for cointegration of variables—for the long-term relationships—are the basis for short-run error-correction-models.² Another way to tackle the problem of the nonstationarity of variables is the maximum-likelihood method of Johansen (1988). All parameters of the cointegration process are simultaneously estimated. In our case the Johansen estimates serve as the criterion for interpreting the results obtained by the Engle/Granger procedure. Since 9 out of 11 macroeconomic time-series for Indonesia are identified as being nonstationary, the implementation of cointegration for the regression analysis is justified. The final empirical results and interpretations for the case of Indonesia are summarized in Section IV and tentative conclusions are drawn.

II. Theoretical Arguments for Various Determinants of Economic Growth

Economic growth is the result of a variety of influencing factors, which growth theory can only approximate. Especially, in the long-run non-economic factors become important. Historically, the simple growth models were extended over time by giving up model restrictions and by supplementing new variables over time.

The representatives of neoclassical growth theory, Solow (1956) and Denison (1962), searched for the main growth determinants of industrial countries. Solow's model is based on the following assumptions: closed competitive market economy with identical rational economic subjects and a constant rate of technological change. For this kind of setting output depends on the level of capital stock, the volume of employed labor and the kind of technology. The introduction of an *exogenous* rate of technological change allows for an exogenously determined rate of economic growth. At the same time, other factors like savings and investment rate or the institutional framework are of minor influence for the long-term economic development. The theoretic-

²Cointegrated regressions uncover long-term relationship between nonstationary variables. Their error term is often described as an equilibrium *error* exhibiting a lower order of integration than the variables in levels. This equilibrium *error* is subsequently incorporated into an *Error-Correction Model* (with differenced variables), the ECM reflecting the short-run dynamics of the system.

cal and empirical shortcomings of the Solow model led to the development of new growth models, which *endogenize* the process of economic growth. Different economic systems with various institutional frameworks can generate different rates of economic growth. New growth theory comprises mainly the fields of (a) technological change, (b) the role of government, (c) trade policy and (d) human capital development. In an era of competitive international division of labor, single countries not only specialize according to their initial factor endowments. They can influence certain factors of growth themselves, e.g. their human capital development.

Based on these theoretical arguments various empirical studies tried to determine the significant factors of growth. Table 1 summarizes the results of 58 cross-country studies. However, this kind of empirical analysis inheres two major problems: (i) Too many relationships between economic growth and other variables seem to be significant (Renelt 1991, 17). (ii) Since the analysis is based on growth averages of variables, structural breaks of single time-series as well as country-specific conditions can not be considered to full extent. Therefore, the postulated correlation relationships can hardly be translated for specific countries and the causal direction of their effects remain unclear. Though, they provide a useful benchmark for distinguishing different factors of growth. To take these problems into account and based on recommendations by Colombatto (1990, 595) and Levine and Zervos (1993) we investigate the growth determinants for Indonesia with the help of a time-series analysis.

A. Labor

1) Population (POP)

Standard neoclassical growth theory implies that the growth rate of the labor force—as a *quantitative* measure—has a *positive* proportional effect on economic growth (Kormendi and Meguire 1985, 143). Because of data restrictions only the proxy population is available for our analysis. The effect may be less than one-for-one, e.g. if labor force growth does not keep pace with population growth.

2) Education (EDUC)

The educational level of a society serves as a proxy for the development of human capital—the *qualitative* measure of labor. Education increases the quality of the labor force, and therefore, the long-term production possibility curve shifts outward. An increase in the educa-

tional level has a *positive* effect on economic growth.

Arrow (1962) was the first to successfully endogenize an aspect of education, "learning-by-doing", into a growth model as a level effect. But growth effects themselves were not endogenized until the work of Romer (1986) and Lucas (1988). For the effects of human capital Lucas (1988) distinguishes between *internal* effects based on individually attachable educational investments and *external* effects, which cannot be attributed to a specific investment—e.g. learning-by-doing. He also assumes that the average level of human capital increases the productivity of other factors of production. Though, all benefit from this external effect, no individual decision for increasing its own human capital will have an significant effect on the general level of human capital (Lucas(1988, 18). Based on an estimation of per capita income of human capital by Denison (1962), Lucas calculated these external effects: A 10% increase of the average qualification of one's colleagues increases one's own labor productivity by 3.6% (Lucas 1990, 93-94).³

The data restrictions don't allow for a consideration of external effects of human capital. Similar to more recent empirical studies,⁴ we use total school enrollment in secondary schools as a proxy for the development of human capital in Indonesia.

B. Capital

Physical capital, the second factor of production in the classical production function, seems to be a much more important determinant of economic growth than neoclassical growth theory wants us to believe (Scott 1992, 629). An increase in investment not only raises the rate of economic growth, but also creates large positive external effects. In our case physical capital is approximated by gross domestic investment and foreign capital in form of net foreign direct investment and other capital flows. All proxies should have a *positive* effect on long-term growth.

1) Gross Domestic Investment (INV)

Scott (1992, 623-4) recommends the use of gross domestic invest-

³These calculations are for the United States. An estimation for a pool of 98 countries shows that the external effects are just one sixth of the above mentioned (Helliwell and Chung 1991, 9).

⁴Bakhuyzen (1991), Barro (1991), DeGregorio (1993), Edwards (1991) and Lee (1993).

TABLE 1

DETERMINANTS OF ECONOMIC GROWTH (INCOME VARIABLES: GDP OR GNP)

Growth Factors (positive/negative effects):	Number of Studies ¹			Theoretical Foundation by
	(+)	(n.s.)	(-)	
Labor				
- labor	25	4	-	Solow 1956, Denison 1962
- nonagricultural labor	1	2	-	
- population	8	6	3	
- human capital (schooling, education expenditures)	19	3	-	Arrow 1962, Schultz 1963
Capital				
- "initial" per capita income*	2	2	17	Baumol 1986
- relative per capita income*	-	-	2	
- gross domestic investment (total, share)	44	-	-	Solow 1956, Denison 1962
foreign direct investment / net capital influx	6	2	-	Michalopoulos and Jay 1973
domestic investment	3	-	-	Michalopoulos and Jay 1973
private investment	1	-	-	
public investment	-	1	-	
foreign debt	-	1	1	Chenery and Strout 1966
Foreign Trade				
- exports (total, share)	17	8	-	Chenery and Strout 1966
exports** (export share of GNP)	5	1	-	
manufacturing exports	5	-	-	
- imports	2	-	-	
- trade policy (proxies)				Krueger 1983
protection*	-	1	12	
"outward orientation"	5	-	-	
Economical and Institutional Framework				
- inflation rate	-	2	4	Stockman 1981, Fischer 1983
inflation: standard deviation*	-	1	2	von Hayek 1944, Friedman 1977
- money supply	1	-	-	Barro 1976, Lucas 1972
money supply: standard deviation*	-	-	2	
- GNP* (GDP*): standard deviation*	3	1	1	Sandmo 1970, Black 1979
- government expenditures	1	1	9	Bailey 1971, Buitert 1977
government budget surplus	1	-	-	
- structural change of sectors				Robinson 1971
nonagricultural sector	1	-	-	
share of urban population	1	-	-	
- exchange rate instability	-	-	2	Edwards 1988
- assets of financial system / GDP	1	-	-	

TABLE 1
CONTINUED

Growth Factors (positive/negative effects):	Number of Studies ¹			Theoretical Foundation by
	(+)	(n.s.)	(-)	
- dummy variables:				
Asian LDCs*	1	-	-	<i>von Hayek 1944, Friedman 1962</i>
individual freedom*	1	1	-	
member of OPEC*	2	-	-	
political instability*	-	-	7	

NOTE: This overview is based on 52 cross-country studies (listed in Piazolo (1994)) and studies by Barro and Lee (1993), Blomström et al. (1993), DeGregorio (1993), Easterly and Rebelo (1993), Lee (1993) and van de Klundert and van Schaik (1993).

n.s.: nonsignificant.

*: Variables can only be implemented in cross-country studies.

**: a variables growth rate.

ment as a first approximation of material investment. Aggregate net investment has certain theoretical and empirical disadvantages. For example, depreciation doesn't reduce the level of production directly. Besides, we have no data on annual depreciation rates at hand. The same caveat applies for not taking private and public investment separately into account.

2) Foreign Capital (FDI, CAP(log))

The two-gap model of Chenery and Strout (1966) shows that a capital-poor country can close its investment gap either through an inflow of foreign capital, or through increased export revenue. In principal, capital-poor developing countries offer higher rates of return on capital for foreign investors than developed countries. The influx of foreign exchange can increase the level of capital good imports i.e. foreign technology, thereby increasing investment. The *positive* effects of foreign capital inflow on economic growth largely depends on the efficient employment of credits, loans and direct investments. The debt crisis of developing countries in the early eighties can be attributed in many cases to the inefficient employment of foreign capital resources.

FDI's being invested directly as physical capital should have stronger positive effects via the transfer of international know-how than other

foreign capital (loans, credits), which may even be used for consumptive purposes. For Indonesia the largest inflows of net FDIs were registered in the periods of 1975-79 (2.7 bill US-\$) and 1987-92 (5 bill US-\$). On the other hand, during the period of inward-orientation (1965-82) foreign investment may not have been so productive as the internal market had been closed for international competition. Also, capital investments often take some time before becoming productive.

C. Foreign Trade

1) Exports (EX)

There are five reasons which underline the *positive* effects of export revenues on economic growth:

i) In countries with small domestic markets, exporting becomes an essential part of achieving scale economies. This tends to increase the profit opportunities through marginal cost reductions (Grossman and Helpman 1991, 243). Building capacity ahead of demand becomes advantageous: An example is South Korea where government planners during the seventies allocated a growing share of domestic and foreign resources through credit rationing and other measures to capital intensive industries like shipyards, iron, steel and chemical industries, as well as electronics (Sengupta 1991, 573).⁵

ii) Stronger exposure to international competition through higher exports increases the pressure on the export industries to keep costs low and provides an incentive for the development and production of new technologies, i.e. product innovations and efficient production processes (Emery 1967, 471).

iii) Theorists of the new growth theory are of the opinion that spillover effects of labor productivity due to externalities generated by exports are an important mechanism by which integration into the world economy can promote growth (Lucas 1990; Romer 1986). It seems plausible to suppose that the foreign contribution to the local stock of knowledge increases with the number of commercial interactions between domestic and foreign agents: (1) the larger the volume of trade, e.g. of exports, the greater will be the number of personal contacts between domestic and foreign individuals. These contacts may

⁵However, since even "rational" government planners cannot foresee the shape of a cost function, parts of the production expansion ahead of demand were a failure. Thus, major government interventions were lifted in the early eighties (Piazolo 1990, 78).

give rise to an exchange of information and may cause the agents from the less developed country to acquire novel perspectives of technical problems; (2) when domestic goods are exported, the foreign purchasing agents may suggest ways to improve the manufacturing process (Grossman and Helpman 1991, 166).

iv) Besides a positive knowledge externality, export growth is seen to have a stimulating influence on productivity of the economy as a whole via externalities arising from exporting on other sectors (Bhagwati 1978, 215). Furthermore, export production tends to concentrate investment in the most efficient sectors of the economy and therefore leads to a reallocation of resources according to the comparative advantage of a country (Emery 1967, 471).

v) Export expansion earns the necessary foreign exchange to overcome the foreign exchange bottleneck, enabling the country to increase imports, especially of capital goods and differentiated intermediate imports, often unavailable in developing countries (Chenery and Strout 1966). Additionally, foreign exchange increases the capability of a country to finance its debt service.

These arguments are the basis for the export-led growth hypothesis which has been widely discussed and empirically tested in *cross-country* context. Table 1 shows that most of the studies implementing export growth or export share support the export-led growth hypothesis.⁶ Though, for predominantly natural resource exporters like Indonesia such a growth strategy may be detrimental, as they were exposed to volatile world market prices and to declining terms of trade since the early 80s. This is especially the case, when there are no efforts to diversify the export base. However, Indonesia was able to diversify its export base towards manufacturing products rapidly.

2) Imports (IM)

The effect of imports on growth—financed either by export earnings or foreign capital—largely depends on the import structure, e.g. the share of consumer vs. investment goods. Between 1987-92 Indonesia imported for approx. 5% consumer goods and 15% petroleum products, while the rest consisted of capital goods, parts & accessories and intermediate goods. As the share of investment goods (85%) is relatively high, a *positive* impact of imports on growth can be expected.⁷

⁶Single-country studies for South Korea came to the same conclusion (Salvatore and Hatcher 1991; Sengupta 1991; Piazzolo 1994).

3) Trade Policy (TRADE)

The discussion over the advantages and disadvantages of international trade lead us back to Adam Smith and Friedrich List, the latter proposing the infant industry argument for "Less" Developed Countries—in his time: Germany. Prebisch (1950) and Singer (1950) recommended the strategy of import substitution as a mean for the industrialization of developing countries. Most of the LDCs implemented this strategy during the fifties. Because of inefficiencies in the allocation of factors of production and because of market limitations some countries, e.g. Korea, switched to a more open trade policy during the sixties. As a relatively neutral policy the outward oriented trade strategy makes use of the international comparative advantage of a country, without privileging export production (Balassa 1978, 181). In this case an outward oriented trade strategy has a *positive* effect on long-term economic growth. The general implications of the new growth theory, which endogenize trade policy instruments, are similar: Based on increased spillover effects and access to new technologies open trade relations foster growth (Romer 1990). Besides the descriptive arguments of the World Bank (1987), empirical studies using different "openness to trade" variables generally support the superiority of outward orientation,⁸ while showing the negative effects on growth of trade restrictions.⁹ Inward oriented or import substituting economies have a tendency to overvalue and misalign their real exchange rate; their growth impact being *negative* (Cottani et al. 1990, 74).

Since Indonesia's independence, the governments of Sukarno and Suharto emphasized the build-up of large-scale government-owned industrial enterprises behind high import barriers. The financing of these import-substitution policies was guaranteed by a steady and after the first oil-crisis of 1973 "exploding" inflow of petrodollars.¹⁰ After the sharp drop of the oil price in the early 80s, Indonesia's trade and industrial policy was liberalized with a stronger emphasis on its human capital resources, e.g. the support of labor intensive industrialization via an export perspective for industries like textiles, electronic

⁷Khan and Reinhart (1990) empirically underlined the positive effect of imports on growth.

⁸e.g. Edwards (1991), Roubini and Sala-i-Martin (1991).

⁹e.g. Lopez (1991), Lee (1993).

¹⁰Most of these enterprises were capital intensive, e.g. steel and petro-chemical industries (Hill 1993, 44; Noland 1990, 98-9).

equipment etc.. Significant trade and financial liberalization policies were initiated since 1983. Trade deregulation were mainly implemented through a series of almost annual packages whose main feature has been the reduction of the coverage of non-tariff barriers (NTB) on imports. The share of production protected by NTBs were reduced from 41% (1986) to 22% (1992); the opening up has been the greatest in manufacturing, from 68% to 31% (World Bank 1993, 64-5).¹¹ Within industrial production there is still a considerable trade bias against exports, although different trade deregulation packages were introduced since 1993 to raise competitiveness.¹² To incorporate the switch of the Indonesian trade policy from import substitution to export diversification, we introduce a dummy variable, 0 for the period of import substitution (1965-82) and 1 for export diversification (1983-92), to test the hypothesis of a *positive* influence of outward orientation on economic growth.

D. Economic and Institutional Framework

1) Inflation (INFL)

The Tobin-Mundell effect involves a shift away from real money balances toward real capital as a consequence of higher anticipated inflation. These adjustments in the portfolio of the economic subjects tend to lower real interest rates, which increases the rate of investment and has a *positive* effect on economic growth. The opposite effect emerges in a 'cash-in-advance' economy. In this case higher anticipated inflation *reduces* economic activity (Stockman 1981). Especially for developing countries, where market and financial structures are still quite rudimentary, the influence of money stock on real capital return is considerable. Also, these countries usually experience high inflation rates, often due to a political crisis. Fisher (1991, 5) even suggests to interpret the rate of inflation as an indicator for the capability of a government to keep the fluctuations of its economy under control. So, for

¹¹A different measure of protection is the Effective Rate of Protection, which is still high for Indonesian manufacturing industries: 52% in 1992. The comparative rates for Korea and Malaysia are 28% and 23% (World Bank 1993, 69-70). For Indonesian ERP in 1987 see Fane and Phillips (1991).

¹²They included: (i) a substantive reduction as well as elimination of import duties and NTBs; the Indonesian Government plans to lower the average import tariff rate according to the WTO agreement from 17% (1995) to 7% by the year 2003; (ii) a relaxation of customs procedures; (iii) a simplification of bureaucratic procedures for foreign investment.

LDCs there is no justification for a growth motivated inflationary policy. Empirical studies confirm the *negative* effect of inflation on economic growth.¹³ In contrast to Latin American countries, Indonesia has experienced only moderate rates of inflation, between 5% and 20%—at least since 1975.

2) Institutions, e.g. Government Consumption Expenditures (GOVCON)

The success of the four East-Asian tigers led to a controversial discussion about the relevance of institutions in fostering economic growth. The advocates of a *laissez-faire* policy are contradicted by successful interventionist governments. Generally, institutions are part of the framework for the economic activity of a nation. These institutions can either foster or hinder the process of economic growth (Ranis 1989). The homogeneity of a country and its cultural background play an important role, too. But the “correct” mix of the cultural and economic framework and the state of institutions seems to lead to economic and social development. New growth theory tries to endogenize these thoughts. To quantify the influence of institutions or political culture, we can only approximate them. In our case we will incorporate government consumption expenditures as a proxy variable.

The effects of government expenditures on economic growth are judged very differently by supply side and Keynesian economists. The latter attribute *positive* effects for government expenditures on economic growth. This positive effect is mainly valid for the investment share of government expenditures and the provision of public goods, e.g. infrastructure, legal framework, basic education and health-systems (Easterly 1991, 12). On the other hand strong government interventions through e.g. large government consumption expenditures distort the market and lead to an inefficient allocation of resources. This *negative* effect of large government consumption is theoretically confirmed by Otani and Villanueva (1989, 333) and Barro (1990). Barro's endogenous growth model implies negative growth effects for large shares of government expenditures only. Positive effects of government expenditures rely on the additional assumption that the government agencies

¹³Kormendi and Meguire (1985), Grier and Tullock (1989), Fisher (1991), DeGregorio (1993—for Latin America). Within a cross-country context, the econometric significance of the inverse relation between growth and inflation is due to countries with high rates of inflation, say at rates above 10-20% p.a.. For lower inflation rates, the relation becomes statistically non-significant (Barro 1995, 171).

act efficiently and without selfishness (Ehrlich 1990, 8). The latter condition being highly unlikely in the case of developing countries, as the government often finances so called "white elephants"—unproductive prestige objects. Indonesian government expenditures in per cent of GDP are below the 20% rate. In an international context, this is moderate.¹⁴ Some of the government industries can be characterized as prestige objects, like Krakatau Steel, IPTN (aircraft) and Pal (shipyard), though the absorption of financial resources by those strategic industries has been relatively limited.¹⁵ Empirically, in the case of the Asian developing countries only Grier and Tullock (1989) found a positively significant relationship. Otherwise the effect of government expenditures on growth has been negative.¹⁶

III. The Empirical Analysis

For the determination of Indonesian growth factors we base our regression model on a *single equation regression*. Most variables are in natural logs as economic time series tend to exhibit variation that increases in mean and dispersion in proportion to absolute level (Nelson and Plosser 1982, 141).¹⁷ As Indonesia has a rapidly changing economic structure, we should not be inclined to interpret this model as a production model.¹⁸ Though, this kind of regression model can help identifying the relevant factors of influence on the economic development of Indonesia.

One of the central requirements for applying this regression model is the stationarity of the regression variables. Empirical studies of macroeconomic time series show that these series usually represent growth

¹⁴While Korea, Taiwan and Thailand exhibit lower shares of government expenditures, Malaysia's share has been much higher than Indonesia's during the period 1989-94 (ADO 1995, Table A21).

¹⁵According to the Agency for Strategic Industries (BPIS) the government invested US-\$2.1 billion in the ten BPIS ventures during the years 1988-92 (Clifford 1993, 59).

¹⁶For Latin America: Grier and Tullock (1989); for 98 countries: Barro (1991) and Roubini and Sala-i-Martin (1991).

¹⁷The exception being the seemingly stationary variable inflation as well as net foreign direct investment and other capital inflow, both of which include net outflows (e.g. negative values) in their time series. Net outflows were recorded in 1966-68 and 1974 for FDI and for CAP in 1975.

¹⁸It is not a production model in a sense that the shares of each factor of production (e.g. capital, labor) remain constant over time.

processes and therefore are non-stationary around their mean. Two classes of non-stationarity can be distinguished: (i) Processes, which consist of a deterministic function of time (deterministic trend: e.g. β_t) and a *stationary* stochastic process (trend-stationary; Z_t). (ii) Time series, whose first or higher difference is stationary (difference-stationary). Additional to a possible deterministic function of time, these time series are overshadowed with one or more stochastic trends, i.e. Z_t is non-stationary. The following economic interpretation can be offered: a one-time shock or innovation has a persistent influence on the future course of this time series. If a d -time differentiation of a series is necessary to obtain stationarity, this series is called an integrated process of order d ; i.e. an $I(d)$ -process (Engle and Granger 1987, 252). Variables of a regression model, which incorporate a stochastic trend, lead to the problem that "... the usual techniques of regression analysis can result in highly misleading conclusions ..." (Stock and Watson 1988, 163). The marginal significance levels of the standard software packages for the t - and F -tests are not valid anymore. One possible solution for the problem of non-stationary variables is to use the first difference of each variable for the regression model. This transformation usually results in stationarity for the variables. Since "all information about potential long run relationships between the levels of economic variables is lost" (Hendry 1986, 201) and since a regression model in variable differences is misspecified without an appropriate error correction term, we apply the method of cointegration on the level of variables. The general requirement for applying the cointegration technique is to have variables of the same order of integration at hand, therefore the following three steps are necessary: (A) determination of the order of integration for each variable; (B) formulation of cointegration models; (C) construction of Error-Correction-Models.

A. Determination of the Order of Integration

The order of integration of a time series determines the number of differentiations to yield stationarity. For trending macroeconomic series it often can be shown that the non-stationarity is caused by a drift ($\beta \neq 0$) as well as a non-stationary noise component Z_t . Although, some of these $I(1)$ variables can be identified as trend-stationary, if one allows for a single shift of the trend coefficient (intercept) or a one-time change of the coefficient (slope change). As there is generally a near-observational equivalence of trend- and difference-stationary processes for a finite sample size, three tests for determining the order of integration

are applied: the Augmented Dickey-Fuller-Test (ADF), the Phillips-Perron-Test (PP) and the Perron-Break-Test. The power of these tests increases with the length of the period under consideration and not with the number of observations per se (Chapman and Perron 1991, 13). Therefore, the availability of annual data for the period of 1965 until 1992 only, does not lower the power of these tests. As various simulation studies show the superiority of the ADF-Test over PP-Tests under certain conditions and as the results of both tests are basically the same, we restrict ourselves in presenting only the results of the ADF-Test.¹⁹

We proceed as follows: First, the most general representation of a series including a deterministic trend is checked for its significance (column 2 in Table 2). Second, if the H_0 hypothesis of "trend = 0, ρ of X_{t-1} = 1 and constant $\neq 0$ " cannot be rejected, we test for the significance of the representation of the series without a drift (constant = 0, e.g. for inflation). Third, the difference of each series is checked for its stationarity and the final result is presented (column 4 and 5). One qualification has to be made, critical values are only available for a sample size of close to 100 observations (MacKinnon 1991). In the case of Indonesia 28 observations (1965-92) are at hand. Therefore, the inference from our results has to be made with reservation. The variables under consideration are defined in the appendix.

The ADF-Tests show that out of 11 different macroeconomic time series 9 represent simple processes integrated of order one. The variable—CAP in log and in level—is identified as being stationary or $I(0)$. All other variables except INFL ($I(1)$ without drift) are detected as $I(1)$ variables with a deterministic trend. As nine Indonesian macroeconomic time series are non-stationary, the reliance on cointegration for determining significant growth factors is justified to uncover long-term relationships between these variables empirically.

B. Formulation of Cointegration Models

Engle and Granger (1987) were first in developing the cointegration technique based on the following idea: Even though each time series on its own follows a non-stationary $I(1)$ process, various linear combinations between those variables may exist, which represent a new stationary process. The two main cointegration techniques, the two-step

¹⁹The Perron-Break-Test for the oil shock of 1973 or the start of liberalization in 1983 (slope and intercept) lead us to the same inference.

TABLE 2

UNIT ROOT TESTS FOR INDONESIAN TIME SERIES P.A. (1965-1992)
(AUGMENTED DICKEY-FULLER)¹

Variables in levels

H_0 : I(1)-process with drift (Trend = 0, $\rho = 1$, constant = any value)

H_1 : trend-stationary process

Variables in differences (Δ)

H_0 : I(1)-process without drift (constant = 0, $\rho = 1$)

H_1 : stationary process

Variables (log)	ADF-Test	Variables (Δ)	ADF-Test	Results
AC-Correction ²	$t - \rho (x_{t-1})$	AC-Correction ²	$t - \rho (x_{t-1})$	
GDP	-1.14	Δ GDP	-4.39***	I(1)
POP	-2.64	Δ POP	-4.81***	I(1)
EDUC	-0.80	Δ EDUC	-4.60***	I(1)
INV	-1.79	Δ INV	-6.61***	I(1)
FDI (log = 0)	-2.06	Δ FDI (1)	-5.23***	I(1)
CAP (log = 0)	-3.83**	Δ CAP (2)	-5.11***	I(0)
CAPlog	-3.52*	Δ CAPlog (2)	-5.08***	I(0)
IM (1)	-1.94	Δ IM	-3.01**	I(1)
EX	-0.98	Δ EX	-3.59**	I(1)
GOVCON (1)	-1.09	Δ GOVCON	-19.60***	I(1)
INFL (log = 0, 1)	-2.37 ³	Δ INFL (1)	-6.99***	I(1) without drift
critical values	90%: -3.23		90%: -2.63	
(n < 100)	95%: -3.59		95%: -2.98	
	99%: -4.34		99%: -3.71	

Note: 1. The calculations are based on RATS-routines of Würth (1992).

2. The autocorrelation-lag-correction being null, if not otherwise mentioned in the brackets.

3. For *Inflation*: H_0 : I(1)-process without drift (constant = 0)
critical values: 90% -2.63 95% -2.98 99% -3.71.

*: indicates that the H_0 -Hypothesis has been rejected at the 10% significance level.

** indicates that the H_0 -Hypothesis has been rejected at the 5% significance level.

***: indicates that the H_0 -Hypothesis has been rejected at the 1% significance level.

procedure of Engle and Granger (1987) and the maximum-likelihood procedure of Johansen (1988), are applied.

The Engle and Granger (1987) procedure has three attributes that make it the most popular cointegration technique: (1) the applicability of OLS with GDP as dependent variables; (2) the cointegration parame-

ters can be estimated separately from the dynamics of the process; (3) the favorable asymptotic characteristics of this procedure; i.e. superconsistency as well as the variance minimizing estimation of the cointegration vector. At the same time three major drawbacks have to be noted: (1) the small sample attributes are quite discouraging, e.g. the estimator might exhibit a considerable bias; (2) the estimation of the cointegrating vector relies heavily on the predetermined selection of the dependent variable. This drawback is less important in our case, as theory determines the selection of the dependent variable, i.e. economic output. (3) Especially for the multivariate case several cointegrating relationships might exist; the use of single equation techniques imports bias, nuisance parameter dependencies, and loses optimality. These drawbacks are the reason why we expand this analysis by introducing a cointegration method that simultaneously looks at all variables.

The *maximum-likelihood procedure of Johansen (1988)* is the criterion to find out if the cointegrating vectors based on Engle and Granger are part of the larger cointegration space. The advantage of this procedure is its unequivocal estimation of several cointegration relationships simultaneously. The often arbitrary standardization of the dependent variable in the Engle and Granger case can be circumvented. But there are also two drawbacks: (1) The short-term dynamics of a system and the significance of single variables cannot be modeled like in the case of Error-Correction. (2) The economic interpretation of a multivariate cointegration model is quite difficult (Juselius 1991, 5). The problem of interpretation can be reduced by testing only models for cointegration, which have been found significant in the single equation case. With the help of the maximum-likelihood procedure it is checked, if the cointegration relationships based on Engle and Granger (ADF- and PP-Test) are part of the general r -dimensional cointegration space.

The Trace-Test—if not otherwise mentioned in the tables—is carried through with one-time lagged variables and a constant. Since the matrix of cointegrating vectors has a rank of higher than one for all reported cases, we present in Table 3 to 6 only those long-run equilibrium model specifications, which are close to the coefficient estimations of the single equation model. In this case GDP has to be standardized to represent the “dependent” variable. Four different combination of variables were found to be cointegrated. They break up the minute an additional variable is incorporated; i.e. they represent tightly specified models.

Two general findings are reported: (a) For the OLS regression analysis

TABLE 3
COINTEGRATION TESTS FOR INDONESIAN SERIES P.A. (1965-1992)¹
(MODEL 1)

Test Statistic				Cointegration Vector					
Johansen Trace Test ²									
r=< 0	r=<1	r=<2	r=<3	GDP	INV	IM	GOVCON	TRADE	INFL
182.62***	112.56***	62.10***	29.36*	-1	0.27	0.17	0.20	0.28	0.001
[Third cointegration vector]									
Engle-Granger Test									
ADF ³									
dependent variable				t-a					
GDP				-5.47*	0.018	0.061	0.098	-0.016	0.0003
(AC-Correction = 1, dd)									
2) critical values (95 %)				3) critical values					
r=<0	r=<1	r=<2	r=<3	90 %	95 %	99 %			
94.1	68.5	47.2	29.7	-5.33	-5.79	-6.77			

Note: The calculations are based on RATS-routines of Würth (1992).

*: indicates that the H_0 -Hypothesis has been rejected at the 10% significance level.

**: indicates that the H_0 -Hypothesis has been rejected at the 5% significance level.

***: indicates that the H_0 -Hypothesis has been rejected at the 1% significance level.

dd: "detrended version".

of the Engle and Granger procedure a time trend is found to be significant. Since the time trend can be interpreted as a proxy variable for technical development, there seems to be a significant exogenous technical progress over time. (b) Though, none of the cointegration relations based on single equation regressions can be exactly represented with the same sign and a similar coefficient by one of the cointegration vectors of the Johansen procedure, the magnitude of the differences is small.

For all four of the model specifications the government expenditure variable (GOVCON) is found to exert a significant and comparatively large positive effect on economic growth. The only other variable influencing growth to a large positive extent in all specifications is gross domestic investment (INV). The two other investment variables focusing on foreign capital inflows, both exert small positive effects in the maximum likelihood specification. Model 2 suggests that there seems to be some substitution effect of INV and CAP(log); domestic investment

TABLE 4
COINTEGRATION TESTS FOR INDONESIAN SERIES P.A. (1965-1992)¹
(MODEL 2)

Test Statistic				Cointegration Vector					
Johansen Trace Test ²									
r=< 0	r=<1	r=<2	r=<3	GDP	POP	INV	IM	GOVCON	CAPlog
189.20***	107.44***	49.85**	25.12	-1	2.65	-0.008	0.15	0.002	0.007
Engle-Granger Test									
ADF ³									
dependent variable			t-a						
GDP			-5.51*	0.014	0.009	0.097	0.024	-0.011	
(AC-Correction = 1, dd)									
2) critical values (95 %)				3) critical values					
r=<0	r=<1	r=<2	r=<3	90%		95%		99%	
94.1	68.5	47.2	29.7	-5.36		-5.83		-6.83	

Note: The calculations are based on RATS-routines of Würth (1992).

*: indicates that the *Ho*-Hypothesis has been rejected at the 10% significance level.

**: indicates that the *Ho*-Hypothesis has been rejected at the 5% significance level.

***: indicates that the *Ho*-Hypothesis has been rejected at the 1% significance level.

dd: "detrended version".

turning negative with a small magnitude when other capital inflows are included in the specification. The rate of inflation (INFL) is positively correlated with growth in three specifications, but its coefficient is very small. Of the trade variables available, only imports (IM) emerge with a considerable positive influence on economic growth in three of the four models. On the other hand, exports (EX) seem to exert a small negative effect on growth in the long-run, while the trade and financial liberalization policies since the early 80s (TRADE) pushed the economy on a higher growth path. Both human capital variables (POP, EDUC) influence the economy positively in the long-run. Surprisingly, this is much more the case for the quantitative variable, population.

C. Construction of Error-Correction-Models (ECM)

After having determined the equilibrium factors of Indonesian economic growth for the period 1965-92, we can now incorporate the estimated "equilibrium error" u_t of the single equation regression model—representing the long-run relationship—into an Error-Correction-Model

TABLE 5
 COINTEGRATION TESTS FOR INDONESIAN SERIES P.A. (1965-1992)¹
 (MODEL 3)

Test Statistic				Cointegration Vector					
Johansen Trace Test ²									
r=< 0	r=<1	r=<2	r=<3	GDP	INV	EX	GOVCON	INFL	FDI
155.78***	109.57***	68.12***	35.49**	-1	0.51	-0.09	0.18	0.003	0.001
				{Third cointegration vector}					
Engle-Granger Test									
ADF ³									
dependent variable				t-a					
GDP				-4.68	0.03	0.06	0.08	0.0003-0.00001	
(AC-Correction = 1, dd)									
2) critical values (95 %)				3) critical values					
r=<0	r=<1	r=<2	r=<3	90%		95%		99%	
94.1	68.5	47.2	29.7	-5.31		-5.76		-6.72	

Note: The calculations are based on RATS-routines of Würth (1992).

*: indicates that the H_0 -Hypothesis has been rejected at the 10% significance level.

**: indicates that the H_0 -Hypothesis has been rejected at the 5% significance level.

***: indicates that the H_0 -Hypothesis has been rejected at the 1% significance level.

dd: "detrended version".

to analyze the short-term relationships between the various variables.²⁰

For all four of the cointegration model specifications an ECM is derived by excluding all insignificant lagged variables (at maximum four lags). Table 7 presents the four ECMs, with t -values in brackets. No lag of the lagged dependent variable was found to be significant. Interestingly, no dynamic short-term ECM can be found, which incorporates all of the variables included in the long-term cointegration relationships. So, their influence on economic growth differs in the long- and short-run. Although, the long-term effects are jointly captured by the highly significant Error-Correction term (ERR), which exerts the largest influence on growth measured by its regression coefficient. Most of the short-term adjustments occur within a year. Similar to the case of Korea, the constant (proxy for technical change) is highly significant

²⁰The equilibrium error is taken from Engle and Granger's two step procedure.

TABLE 6
COINTEGRATION TESTS FOR INDONESIAN SERIES P.A. (1946-1990)¹
(MODEL 4)

Test Statistic				Cointegration Vector					
Johansen Trace Test ²									
r=< 0	r=<1	r=<2	r=<3	GDP	INV	IM	GOVCON	INFL	EDUC
155.27***	99.46***	52.03**	26.71	-1	0.45	-0.09	0.28	0.0004	0.09
Engle-Granger Test									
ADF ³									
dependent variable			t-a						
GDP			-5.21						
(AC-Correction = 1, dd)									
2) critical values (95 %)				3) critical values					
r=<0	r=<1	r=<2	r=<3	90%		95%		99%	
94.1	68.5	47.2	29.7	-5.33		-5.79		-6.77	

Note: The calculations are based on RATS-routines of Würth (1992).

*: indicates that the *Ho*-Hypothesis has been rejected at the 10% significance level.

**: indicates that the *Ho*-Hypothesis has been rejected at the 5% significance level.

***: indicates that the *Ho*-Hypothesis has been rejected at the 1% significance level.

dd: "detrended version".

(Piazzolo 1994). Most of the variance is explained by these Error-Correction specifications (high \bar{R}^2) and autocorrelation (Durbin-Watson test statistic) is almost nonexistent.²¹ Of all four specifications, model 2_{ECM} explaining 83% of the variance fits the data best.

Besides government consumption expenditures and inflation, two blocks of variables—foreign capital and trade—dominate the short-term dynamics of the four ECMs. In contrast to its long-run relationship with economic growth, exports exert a strong positive influence on GDP. The same is true for imports. Interestingly, model 3_{ECM} shows that trade liberalization seems to have a small negative effect on growth in the short-run, i.e. the import substitution of the sixties and seventies exerted a positive influence—supporting the infant industry argument and its theory of building up new industries behind temporary tariff walls. Of the foreign capital inflows, other capital (CAPlog) exerts

²¹ADF unit root test show that the error term of each ECM is stationary.

TABLE 7
ERROR CORRECTION MODELS FOR INDONESIA

Cointegration relationship (1) between GDP, INV, IM, GOVCON, TRADE, INFL	
$\Delta GDP_t =$	-0.59 ERR_{t-1}
	(18.6)
$\bar{R}^2 = 0.63$	
NOBS = 26 (1967-1992)	
Cointegration relationship (2) between GDP, POP, INV, IM, GOVCON, CAPlog	
$\Delta GDP_t =$	0.05
	(20.7)
$\bar{R}^2 = 0.82$	
NOBS = 26 (1967 - 1992)	
Cointegration relationship (3) between GDP, INV, EX, GOVCON, INFL, FDI	
$\Delta GDP_t =$	0.07
	(15.9)
$\bar{R}^2 = 0.74$	
NOBS = 26 (1967 - 1992)	
Cointegration relationship (4) between GDP, INV, IM, GOVCON, INFL, EDUC	
$\Delta GDP_t =$	0.06
	(18.5)
$\bar{R}^2 = 0.49$	
NOBS = 26 (1967 - 1992)	

Note: *t*-statistic in brackets

NOBS: Number of Observations"

DW: Durbin-Watson test statistic

a positive effect in the short-run, while foreign direct investment influenced growth at a very small magnitude negatively. A just as small positive effect on growth resulted from inflation. The only variable significantly influencing GDP depending on its lag structure is government consumption expenditure. As for the long-run, government expenditures had an immediate positive impact on growth, while in the short-run GOVCON with a lag of one period exerted a negative influence in all specifications except for model 2_{ECM}. The difference may be due to cyclical factors.

IV. The Determinants of Indonesian Economic Growth —The Story and the Implications

In contrast to most empirical studies on economic growth of developing countries so far, our study is a single-country case based on time series analysis. By implementing different cointegration techniques—Engle and Granger's two-step procedure and Johansen's maximum-likelihood procedure—we try to distinguish between long-term, "equilibrium" relationships and the short-run dynamics of a system of variables. The set of variables at hand includes some macroeconomic series, which are theoretically derived from implications of the new growth theory. They are the following variables: proxies for education, trade policy, government expenditure as well as foreign capital. The story of Indonesian economic development for the period 1965-92 goes as follows:

For both of the classical factors of production, labor and capital, the econometric analysis strongly reflects the implications of the theory of economic growth. The influence of labor, in its quantitative (population) and qualitative (education) dimension, is positive in the long-run. The growth effect is especially large for population, reflecting the importance of labor-intensive production as a means to develop the country.

According to traditional growth theory investment influences long-term growth positively. Our study supports this notion as well as the positive effect of foreign capital inflow by net foreign direct investment and other capital. These foreign resources were used complementary and efficiently in the long-run, closing the investment gap. Interestingly, the short-term effects of FDIs seem to be small and detrimental to growth, maybe reflecting the problem of net FDIs or the notion that FDIs flow into a country with a long-term view on industrial production.

Due to its abundant natural resources (oil, gas and wood) Indonesia has been relatively world market oriented. In the long-run this is empirically not reflected in an appraisal of a successful export-led growth strategy. Even though, the short-term effects of exports are strongly positive. On the other hand, imports and trade liberalization since the early eighties influenced economic growth significantly positive over the long-run. As imports have to be financed by foreign capital inflows or export earnings there may be a substitution effect between imports and exports in the cointegration analysis at work. Also, real export earning declined after the oil price drop of 1982 from 24.8 bn US-\$ to 16 bn US-\$ in 1986 before increasing steadily since 1987 to 52.7 bn US-\$ in 1995. By then Indonesia had successfully diversified its export base. At the same time the volatility in imports was less extensive.

Because Indonesia experienced rather moderate rates of inflation, the short- as well as the long-term effects on economic growth are positive. Our results confirm the theoretical implications of the Tobin-Mundell effect and contradict the empirical findings of a negative impact of inflation on growth by Kormendi and Meguire (1985), Grier and Tullock (1989), Fischer (1991). But, as the positive influence on growth has been very small in size, it underlines the recent findings of Barro (1995). For countries with inflation rates below 20% no statistically significant negative influence of inflation on growth was reported. Also, the small positive impact may be due to cyclical factors.

Government consumption expenditure was found to exert a strong positive effect on economic growth especially in the long-run. Supporting the conjecture of Ranis (1989), this positive effect may account for the relative homogeneity of the Indonesian society²² as well as the relative efficiency of its interventionist government in providing public goods, while the share of government consumption (in % of GDP) is comparatively low. Our result supports the finding for Asian countries of Grier and Tullock (1989).

Interestingly, the time trend—often interpreted as the proxy for exogenous technological change—is strongly significant. The positive spill-over effects of the worldwide technological development seem to be especially important for a country like Indonesia that has enjoyed a

²²The relative homogeneity of Indonesia is confined to the population of the main islands, e.g. Bali, Java and Sumatra. Less than 4% are of Chinese decent and almost 90% are Muslim.

constant inflow of foreign capital, i.e. foreign know-how.

In general, our results support the empirical findings of most cross-country studies. Though, Indonesian specific features like the trade liberalization dummy were incorporated within our time series analysis and found to be statistically significant. Also, Indonesian economic growth is more investment than trade or export driven, which supports the recent findings of Rodrik (1995) for South Korea and Taiwan.

What are the *implications* of the Indonesian growth story?

(1) The two major factors of economic growth, capital and labor, exerted a strong positive effect on Indonesian economic growth. This is especially true for gross domestic investment, which has been above 30% of GDP during the last ten years. High savings and investment ratios should be kept in mind for future economic policy.

(2) Indonesia has been very successful in promoting labor-intensive industrialization during the last 30 years, coupled with export orientation since the early eighties. As Indonesia becomes a more mature society it has to promote the qualitative dimension of labor, education, more strongly. The example of South Korea shows that the positive effects on economic growth does not have to take very long to trickle down (Piazolo 1994). At the same time a broader higher education is the prerequisite for a drive to a more human capital intensive technological industrialization.²³

(3) To undertake this next industrialization phase, the touch to world markets should never be lost. It underlines the importance of foreign capital, trade and financial liberalization as well as only temporary tariff protection for new infant industries. Only outward-orientation guarantees positive external effects of worldwide technological change for the Indonesian economy, i.e. forcing manufacturing industries to become (or to stay) internationally competitive.

²³During the last ten years high-tech industries like ships, aircrafts, steel were initiated by the minister of research and technology, Habibie. His ambitious policy strategy has been labeled "Habibienomics" by the press.

Appendix

Data Sources of the Indonesian Variables

Variables	Definition and Data Source
GDP	real Gross Domestic Product ¹
EDUC	Total Secondary Students enrolled ²
POP	Total Population ¹
INV	real Gross Fixed Capital Formation ¹
CAP	real net Other Capital Inflow ¹
FDI	real net Foreign Direct Investment ¹
EX	real Exports of goods and services ¹
IM	real Imports of goods and services ¹
GOVCON	real Government Consumption ¹
INFL	Rate of Inflation based on GDP-deflator (1985=100) ¹
TRADE	Trade Orientation Dummy Import Substitution (0): 1965-1982 Export Diversification (1): 1983-1992

Note: 1. International Financial Statistics, Yearbook, IMF; own calculations.

2. Statistical Yearbook for Asia and the Pacific, United Nations, Paris.

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