# Exports and Economic Growth in Indonesia: A Causality Approach based on Multi-Variate Error Correction Model

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## Abstract

Empirical findings testing the linkage of exports and economic growth have been mixed and inconclusive. This paper attempts to re-examine the exports and economic growth nexus in Indonesia during the period of 1971 to 2008. In contrast to cross-country study, the paper investigates such relationship in a time series framework using a vector autoregressive (VAR) model by employing other related important variables. The paper also proposes a distinction to previous studies by the inclusion of variable of intermediate imports. The tests on the long-run and short-run relationship between exports and economic growth are conducted. Based on finding of causality analysis conducted in VECM system, this paper concludes that exports and economic growth exhibits bi-directional causal structure, which is ELG in long-run and GLE in short-run. Despite of some empirical evidence of ELG in precedent studies, we find a supporting evidence of ELG merely in the long-run for our dataset of Indonesia. These findings indicate the significance of both exports and economic growth to economy of Indonesia as indicated in GIRF analysis. In addition, we found no supporting evidence of positive causality from intermediate imports to GDP per capita.

Journal of Economic Literature classification codes: C32; F43; O11

## 1. Introduction

A large number of empirical studies have been devoted during the last two decades to scrutinize the role of exports on economic growth, using either cross countries or time series data, on the ground of inquiry whether an outward oriented or export promotion (EP) policy is preferable to an inward-oriented trade policy. These studies even

had their amplification, as in particular, the successful economic performance of the so-called "High Performing Asian Economies" (HPAEs) lent support to the idea that export promotion can be an effective development strategy. Such those remarkable performance of HPAEs indeed has renewed interest of studies in the export and economic growth[1] and often, exports by previous empirical studies is excessively claimed as the "engine of growth".[2] Although several studies have demonstrated the theoretical economic relationship between trade and economic growth, disagreement still persists regarding the causal direction and magnitude of the effects (Bhagwati, 1978; Edwards, 1998). The vast majority of this literature focuses on the causal effect of exports on economic growth. Some researchers argue that causality flows from exports to economic growth and denotes this as the export-led growth (ELG) hypothesis. The others find that reverse causal flow runs from economic growth to exports, which is term growth-led exports (GLE) hypothesis. The third alternative of such causal link derived from some other empirical studies is that, exports and economic growth reinforces each other or bi-directional. This might be the case when such empirical studies embarked on employing important relevant variables, such as imports.

Most studies on the effect of exports on economic growth have mostly employed bivariate causal model and ignored the contribution of imports. However, some recent studies have shown that without controlling for imports, any observed causal link between exports and economic growth might be spurious and thus misleading (Esfahani, 1991; Riezman *et al.*, 1996; Thangavelu and Rajaguru, 2004). As strongly argued by Rodrik (1999), imports may play a very significant role to long-run economic growth since significant export growth is usually associated with rapid import growth. Furthermore, the export-growth analyses that exclude imports may be subject to the classic problem of omitted variable that may mask or overstated the impact dynamics between exports and economic growth.

In addition, earlier studies employing cross-countries analysis were criticized for their simplified assumption of similar economic structure and level of technology used throughout countries studied. As more data become available, more recent analyses have focused on single country using time series study (Awokuse, 2005) and dug deeper on country's specifics. In regards of Indonesia as the biggest country in ASEAN in terms of GDP size, this might be interesting since as argued by Perkins and Syrquin (1989) that, a bigger country may have a less reliance to foreign markets so that test for exports-led growth hypothesis is worth to examine.

This purpose of this study is to investigate the causal relationship between exports and economic growth in Indonesia within an integrated framework that explores the role of both exports and imports. This study proposes contribution to the literature in several ways. First, in contrast to most previous cross-countries studies in ELG, this study focuses on individual country study of Indonesia employing the traditional neoclassical growth model by estimating an augmented production function that explicitly tests for the effect of both exports and imports of intermediate goods on economic growth.[3] We include real exports and imports as two of endogenous variables in the cointegrated vector autoregression (VAR) model. Such modeling framework also makes it possible to test for both ELG and import-led growth (ILG) hypothesis in Indonesia. Second, the study also adopts recent time series methodology by specifying causal model based on vector error correction models (Toda and Phillips, 1993). In addition to testing for Granger causality between exports, imports and economic growth, such behavior in the long run could also be investigated through cointegration and impulse response function analyses. Third, as a supplement analysis to provide a clear explanation on changes in growth pattern in related to export and economic growth during 1971 to 2008, a decomposition analysis of GDP growth will be conducted.

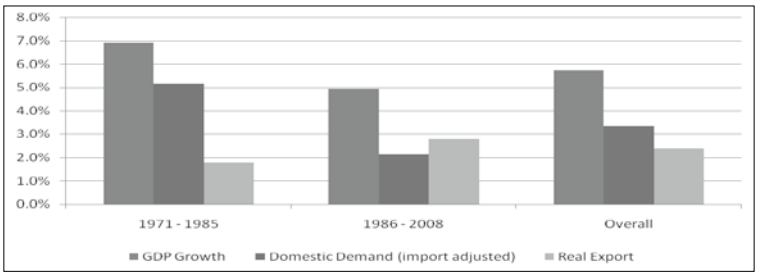
The rest of paper is organized as follows. Section II provides profile of Indonesia economy at glance, emphasizing on the pattern of GDP growth and industrialization process and the changing in economic structure during period of observation. For the purpose of providing explanation on changes in growth pattern during 1971 to 2008, we employ a demand-side decomposition analysis of GDP growth, whose mechanics is described in appendix. Section III reviews literature related to exports, imports and economic growth. Section IV explains the data and methodology used in this

study, and section V presents empirical results and discussions. The last section includes some concluding remarks.

## 2. The Economy of Indonesia from 1971 to 2008 at glance

The main question in the export-growth debate is whether outward orienting trade policy is preferable to inward orienting trade policy in stimulating economic growth. Most the previous studies merely focus on empirical testing. Nevertheless, a thorough knowledge of country-specific historical and institutional policies is necessary for accurate analysis and interpretation of observational data.

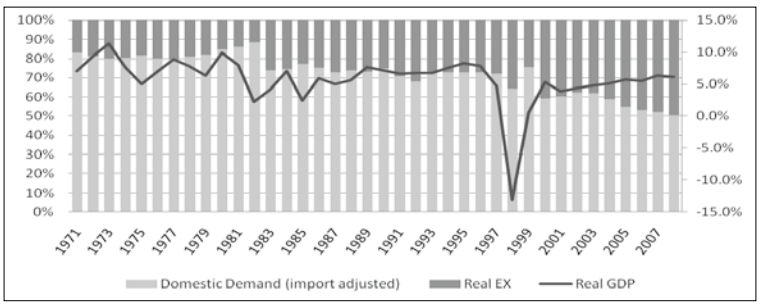
Few countries have experienced reversals in economic fortune as dramatic as those of Indonesia. Started from 1970, after suffering from deep economic crisis triggered by heavy political turbulence over the 1960s period, Indonesia embarked on new development strategy emphasizing on economic development as the main priority. In general, the economic structure was dominated by primary sector (including agriculture) with a minuscule proportion of industry sector. The economy was mostly fueled by exports of natural resource intensive (NRI) particularly petroleum exports (75% of merchandise exports and 66.67% of government revenue) reaping benefit from quadrupled world oil price. She recorded 6.9% of real GDP growth during 1971 – 1985, which reached its peaks of 11.3% in 1973. Like in first development phase of most developing countries, the industrialization strategy adopted during this period was Import Substitution Industrialization (ISI) strategy marked by heavy protection focusing to serve for domestic market. Tariffs were increased, but more importantly the government embarked on heavy industrialization program underpinned by increased resort to protection measures and petroleum exports. Generally speaking, the majority view had it that Indonesia's industrialization policy for import substitution was implemented simultaneously and in parallel with the oil boom that began in 1973.[4] Certainly, there is no question that the oil boom had spurred the import substitution policy. Such a strategy persisted for about a decade. The fall in oil prices in the period of 1982 – 86 wiped out the gains to Indonesia from oil boom in mid 70s. This weakened oil prices significantly reduced export earnings, budget revenues as well as her balance of payment. During 1980-85, GDP grew by 4.76% per annum –slower than the 8.94% during period 1975-80. In response to this condition, the government undertook some required actions, one of which was by embarking on a series of major reforms including trade liberalization.[5] Until the end of ISI era, share of manufactures exports to total exports were remain negligible at 11%.[6] Decomposition analysis of GDP growth (2000=100) during 1971 – 1985 indicated GDP grew at 6.9% p.a. on average, which is mainly contributed by growth in domestic demand or *seemingly* domestic demand-led growth (figure 1).




Source: Authors' calculation based on World Development Indicators 2009

**Figure 1:** Contribution of Expenditure Components to GDP Growth 1971 – 2008

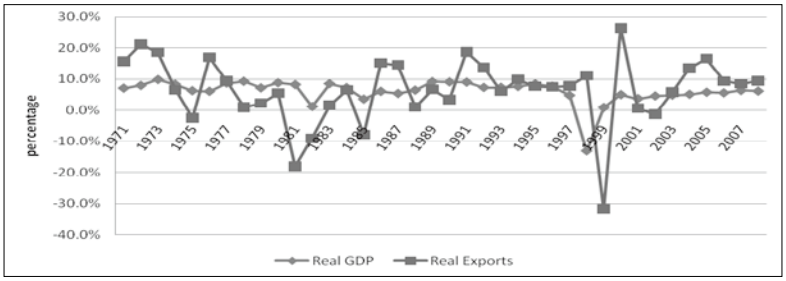
The era of outward-oriented or EP strategy in Indonesia was embarked on 1985. During this period, the Indonesian economy began to feel the impact of the rapid increase in foreign direct investment, owing to the bold and decisive series of liberal economic reforms introduced from the mid-1980s onward (including exchange rate management, which was including two large nominal depreciations, in 1983 and 1986; prudent fiscal policy; comprehensive tax reform; a more open posture towards foreign investment; and financial deregulation including in banking sector).[7] The private sector and exports became the main engine of the development of the manufacturing sector for the first time ever. Exports of manufactures grew five-fold over 9 years from that of 1985 owing to a string of liberalization packages on trade and investment, including the relaxation of restrictions on foreign investment, tariff cuts and the abolition of non-tariff trade barriers such as import restrictions unleashed by government. Companies designated as export-oriented firms on the basis of the export ratios of products were accorded preferential treatment in the equity ratio of foreign capital, operations in bonded export processing zones and procurement of raw materials. The government also restored the drawback system, under which import tariffs imposed on raw materials and parts are refunded when finished products are exported. During this EP era, in average, growth of GDP was dominated by real exports or *seemingly* export-led growth.[8] The combination of those macroeconomic policies and microeconomic measures were contributing to 6.6% GDP growth on average of 1986 – 1997 with more balance proportion of shares of domestic demand (66.3%) and real exports (33.7%) than that of ISI era. Yet, the existence of Asian economic crisis in 1998 and its long recovery process in Indonesia result in slowing GDP growth at 4.9% on average of 1986 to 2008.




Source: Authors' calculation based on World Development Indicators 2009

**Figure 2:** Growth of Real GDP and Share of Expenditure Components in GDP 1971 – 2008

Asian 1998 economic crisis was indeed detrimental to Indonesia GDP leading to contraction on GDP growth of 13.13%, the sharpest among the four crisis-affected East Asian economies.[9] The economy started to decline precipitously in the fourth quarter of 1997, and recorded negative growth over 13.13% (or 14.32% in per capita terms) in 1998 (figure 2). The expenditure accounts were dominated by the sharp decline in investment after 1998, and the rising share of consumption during long recovery period after 2000. The latter was an effective social cushion during the crisis. In exports sector, there was a competitive boost in exports performance especially primary exports due to the sharp depreciation in exchange rate.




Source: World Development Indicators 2009, calculated

**Figure 3:** Growth of Real Output and Exports (2000=100) 1971 – 2008

In the case of Indonesia, exports expansion can be a catalyst for output growth directly as a component of aggregate output, and its share to GDP has been increasing throughout period. During period of observation, export contribution rose significantly implying its growing significance to Indonesia's GDP (figure 1 and 2). From 1986 to 1997 right before Asian crisis, GDP grew 6.6% on average with the share of exports to GDP rose significantly to 33.7% from level of 25.7% during ISI era. On average, from 1986 to 2008, exports became the major engines of growth contributed to 56.5% of GDP growth of 4.9%, with share of manufacturing exports in total exports is closed to 65% in 2008.[10] In general, an increase in foreign demand for domestic exportable can have a positive impact on overall growth in output via increase in employment and income in exportable sector and provide foreign exchange which is critical to import capital and intermediate goods that in turn raise capital formation and thus stimulate output growth.

However, despite of its slump during Asian 1998 economic crisis, real GDP growth record is far more modest compared to growth of real exports over 38 years of observation (figure 3). Based on such casual inspection, one might raise an inquiry whether exports play a significant role as an engine of growth. Therefore, it is important to more formally investigate the linkage between exports and economic growth in Indonesia, as well as their causal structure.

## 3. Exports and Economic Growth

### 3.1. Theoretical framework

The export-led growth hypothesis implies that an increase in export would lead to an increase in economic growth due to potential positive externalities derived from exposure to foreign market. From model of Keynesian identity of aggregate output, the growth of exports can be attributed to GDP growth. Awokuse (2008) posited that an increase in foreign demand for domestic exportable products can cause an overall growth in output via an increase employment and income in the exportable sectors.[11] Furthermore, expanded exports can provide foreign exchange which is critical to imports capital and intermediate goods that in turn raise capital formation beneficial for meeting expansion of domestic production and thus stimulate output growth (Balassa, 1978; Esfahani, 1991; Rodrik, 1999). In general, foreign exchange is very important to developing countries for reducing input gap in development needs. Exports are more efficient to development needs than foreign debt since the latter is subject to adverse shock of currency that may lead to debt default (ADB, 2005). In less direct manner, exports can positively contribute to economic growth through various ways. First, an increase in exports could promote specialization in the production of export commodities that in turn may increase the productivity of the export sector. This productivity change could lead to an increase in economic growth. Second, exports expansion may result efficient resource allocation since it brings incentives for domestic resource allocation closer to international opportunity costs. Hence, it becomes closer to what will generally produce

efficient outcome (Bhagwati, 1988). Also, it induces reallocation of resources from the relatively inefficient non-trade sector to the higher productive export sector (Balassa, 1978). Third, exports that are based on comparative advantage would allow the exploitation of economic of scale leading to increase in economic growth consecutively. Export growth allows firms to take advantage of economies of scale that are external in the non export sector but internal to the overall economy. This argument, of course, is based on proposition that world markets are certainly larger than domestic markets allowing for optimal scale to be achieved while increasing returns may take place with access to world market. Four, such exports expansion benefitted from international market is also allowing for greater capacity utilization exploiting increasing foreign demand in world markets. Five, exports may also give access to advanced technologies, learning-by-doing gains and better management practices (Tsen, 2006) and stimulation of technological improvement in the economy due to foreign market competition (Helpman and Krugman, 1985) that hence, lead to more innovation. In addition, the export-led growth hypothesis could be seen as part of the product and industry life-cycle hypothesis (Tsen, 2006). This hypothesis describes economic growth as a cycle that begins with exports of commodities.

Although exports are important for economic growth, the causal link between them is not necessarily unidirectional as growth in output can also influence exports expansion, or growth-led (GLE) hypothesis. Theoretical justifications for reverse causation from growth to exports have long been discussed in development literature. Kaldor (1967) argues economic growth via increased productivity that in turn translating into reduced unit cost is expected to act as a stimulus to export expansion. Jung and Marshall (1985) point out that internal growth mechanism better explains export growth rather than the reverse. Bhagwati (1988) postulates an idea that the GLE hypothesis is likely, unless antitrade bias results from the economic growth-induced supply and demand. Neoclassical trade theory supports these notions, as it suggests that other factors aside from exports are responsible for economic growth. Not surprisingly, such insight is more amplified when the fact that size of economy may play a significant role in determining country's dependency to world market as mentioned previously. Economic growth leads to enhancement of skills and technology, with this increased efficiency creating a comparative advantage for the country that facilitates exports. Venables (1996) further points out that in new trade theory, the market structure and output expansion may trigger significant changes in exports through a process of "cumulative causation". In addition, market failure with subsequent government intervention may also effects to the growth-led hypothesis (Giles and Williams, 2000a, 2000b). Thangavelu and Rajaguru (2004) emphasize that, recent research by Clerides *et al.* (1998) find little evidence of technological spillovers from exporting activities on domestic firms. In fact, they do find efficient firms self selecting into the export markets. In this case one would expect causality from economic growth to exports.

A feedback causal (bi-directional) relationship between exports and economic growth might also be the case. Helpman and Krugman (1985) argue exports may rise from realization of economies of scale due to productivity gains. Exports expansion may further enable cost reductions, which in turn may result in further productivity gains. Bhagwati (1988) also points out that an increase in trade will generate more income, which in turn leads to more trade. Nonetheless, there is potential for no-causal relationship as well between exports and economic growth. This is a plausible case when the growth paths of the two time series are determined by other unrelated variables such as investment in the economy (Giles and Williams, 2000a; 2000b). Thus, to overcome the endogeneity problem, Edwards (1998) suggest time series analysis to study the impact of exports on economic growth.

### 3.2. Review of the empirical literature

The export-growth nexus has been an interesting issue of considerable research in the last two decades. Yet, the empirical evidence on such matter is rather diverse and still being subject of debate. Awokuse (2008) indicates that, since trade theory does not provide definitive guidance on the causal relationship between trade and output growth, the debate is usually informed by inferences based on anecdotal intuition and empirical analyses.

A large number of empirical studies have been devoted during the last two decades to scrutinize the role of exports on economic growth or ELG hypothesis, using either cross countries or time series data, on the ground of inquiry whether an export-led outward orienting policy is preferable to an inward orienting trade policy. The early studies on this issue scrutinized such relationship based on the simple correlation coefficient between export growth and economic growth.[12] These studies generally concluded that there is strong support in favor of ELG hypothesis or there is a causative direction running from exports to economic growth based on the fact that export growth and economic growth are highly correlated. The main shortcoming of this group of studies is that such a high degree of positive correlation between the two variables was used as a base to support evidence of ELG hypothesis.

The second group of studies took the approach of whether exports are driving output by estimating output growth regression based on the neoclassical growth accounting techniques of production function analysis, including exports or growth of exports as an additional explanatory variable.[13] The scholars in this group studies based their conclusion of the evidence of ELG hypothesis on the ground that firstly, the value of coefficient of export growth variable in the growth accounting equation exhibits highly significant positive correlation; and secondly, there is a significant improvement in the coefficient of determination in line with the inclusion of export growth variable in the regression equation. The criticism on this group of studies is based on methodological issue that, in general, they make *a priori* assumption that export growth causes output growth and do not consider the direction of causality between the two variables.

The third group of studies had their emphasis on the causality between exports growth and economic growth. This approach has been conducted in a number of studies designed to assess whether or not individual countries show evidence for ELG hypothesis using Granger or Sims tests of causal structure.[14] The recent development in causality test allows scholars to examine both short- and long-run causality between exports and economic growth. Some of them are presented as follows. Awokuse (2003) found empirical support for ELG hypothesis for Canada running both in short-run and long-run. Specific result of Thangavelu and Rajaguru (2004) using Granger causality in VAR model for selected Asian countries found empirical evidence of GLE causality in long run as well as in short-run, and no evidence of ELG running either on short run or long-run for Indonesia. In addition, they found supporting evidence of positive causal structure of imports to economic growth. The result of Mahadevan and Suardi (2008) supported evidence of ELG both in short- and long-run for Japan; bi-directional causality between exports and growth both in short- and long run for Korea; GLE and bi-directional in short-run long run, respectively for Taiwan; and only GLE in long-run for Hong Kong.

The major limitation of these causality test results is that the Granger or Sims test used in these studies are only valid if the original series are not cointegrated. Therefore one must check for cointegrating properties of original export and output series before using Granger or Sims tests. Furthermore, this group studies mostly employed bivariate Granger causality test, which failed to consider other relevant determinants of economic growth, such as imports. Riezman *et. al.* (1996), Esfahani (1991); and Thangavelu and Rajaguru (2004) all argue that any observed causal link between exports and economic growth may be spurious and thus the interpretation can be misleading since the omission of plausible important variable (imports) may mask or overstated the impact dynamics between exports and economic growth.

In addition to such criticisms already mentioned above, particular following insights are worth to consider in scrutinizing ELG hypothesis. First, earlier studies over a cross-section of countries were criticized for their restrictive assumption of parameter constancy across different countries (Awokuse, 2005). This assumption is not always plausible because it implies similar economic structure for diverse set of countries as well as other important determinants such as similar trade policy across countries observed. As more data become available, more recent analyses have focused on single country studies using time series modeling techniques (Marin, 1992; Awokuse, 2003; 2005). Second, Sheehey

(1990) argues that most previous causal link studies in exports and economic growth suffered from improper definition of export expansion and economic growth used in the analyses since exports are components of economic output in GDP accounting identity. The same argument also pointed out by Greenaway and Sapsford (1994), which define such problem is due to the endogeneity of the export growth within an output growth equation. Therefore, any export-growth study which does not consider the endogenous nature of the growth process may be subject to simultaneity and specification bias. Islam (1998) further argues that improper definition of export expansion and economic growth will result the inevitable high correlation between export and output growth that merely becomes a statistical artifact.[15] Third, previous empirical studies have focused on the HPAEs and other developing economies, and most of them are smaller in economic size, so the question is that whether export-led growth model is valid in a large developing economy. As pointed out by Perkins and Syrquin (1989), there are some differences between large and small economy in adopting the export-led growth model, namely, (i) the larger the size of one country, the stronger the pressure on developing agriculture instead of foreign trade; (ii) the larger nations tend to have less dependency to overseas market for gaining economic efficiency; and (iii) the larger the economies will have more variety of goods and services as well as a relatively more abundant resources thereby a lower requirement for trading with other nations.

## 4. Empirical Model and Data

### 4.1. The data

The analysis used in this study covers annual time series of 1971 to 2008 or 37 observations,[16] which should be sufficient to capture the long- and short-run correlation between exports and economic growth while controlling for imports in the model. As indicated in Thangavelu and Rajaguru (2005) and others, shorter sample periods in multivariate VAR might be acceptable since it provides additional observations on the long-run fluctuations.[17] The data set consists of observation for GDP per capita (GDPC), gross capital formation (GCF) or investment as a proxy for capital (K), labor (L), exports (X), and intermediate imports (IM). All data set, except imports of intermediate goods, are taken from *World Development Indicators* CD-ROM. Data of imports of intermediate goods, (in USD) is obtained from *Statistical Yearbook of Indonesia* in various years and is converted to Indonesia rupiah (IDR) using exchange rate in period average obtained from IMF-*International Financial Statistics*. All variables are in natural logarithms. All data, except labor, are deflated using appropriate deflator for each variable to obtain real values in IDR (2000=100). Note that to avoid misspecification in exports-growth definition argued by Sheehey (1990), this study employs GDP per capita to represent economic growth, which was also used in previous studies.[18]

### 4.2. The model

Early empirical formulations tried to capture the causal link between exports and economic growth by incorporating exports into the aggregate production function (Balassa, 1978; Feder, 1982; Kavoussi, 1984; Moschos, 1989). We expand on the growth equation by employing other important variables such as exports and imports in multivariate time series model. We also include Asian 1998 economic crisis as dummy variable to capture the effect of such economic crisis to the explained variables in VAR model. Therefore, the aggregate production can be expressed in VAR as:

$$S_t = A_0 + A_1 \sum_{j=1}^{p} S_{t-j} + \delta DC_{98} + \varepsilon_t \qquad (1)$$

where *St* is a *5 x 1* vector of non-stationary *I*(1) variables of GDP per capita, investment, labor, exports, and imports. $A_0$ is a *5 x 1* dimensional vector of constants. $A_1$ is *5 x 5* matrices of estimable parameters. δ is a *5 x 1* dimensional vector

of parameter of $DC_{98}$. $DC_{98}$ is dummy variable of Asia crisis 1998, treated as exogenous with condition during crisis = 1, zero for others. $\varepsilon_t$ is vector of independent and identically distributed error terms with white noise properties $N(0,\sigma^2)$. The causal linkage between exports and output growth is a long-run behavioral relationship that requires appropriate estimation techniques and properties for long-run equilibrium. Therefore, it is necessary to first test for data properties and cointegration, prior to Granger causality analysis.

### 4.3. Unit root test

**Table 1:** Augmented Dickey-Fuller Unit Root Test

| No. | Variable | *Augmented Dickey-Fuller Test* | | | |
|---|---|---|---|---|---|
| | | *Level* | | *First Difference* | |
| | | t- statistics | Prob | t- statistics | Prob |
| 1 | GDPC | -2.22257 | 0.2020 | -4.19229 | 0.00230 ** |
| 2 | GCF | -2.84873 | 0.0613 | -3.94880 | 0.00430 ** |
| 3 | L | -0.88556 | 0.7817 | -6.01160 | 0.00000 ** |
| 4 | X | -0.41782 | 0.8957 | -6.50852 | 0.00000 ** |
| 5 | IM | -2.52044 | 0.1189 | -5.21783 | 0.00010 ** |

*Notes*: ** denotes rejection the null hypothesis of unit roots for ADF test at 5% significance level with 2.945842 critical value

All variables are tested for stationarity before estimating the VAR model. Stationary test of the variable was established by employing Augmented Dickey-Fuller (ADF) test. ADF test corrects for higher order serial correlation by adding lagged differenced terms to the right-hand side variables. Mackinnon's critical values were utilized to test for the significance of the coefficient of the lagged variables. ADF test were first conducted on the levels of GDP per capita ($GDPC_t$), investment ($GCF_t$), labor ($L_t$), exports ($X_t$), and imports ($IM_t$). The results of this test at the levels indicated that all the series were non-stationary at the 5% level of significance, thus lead to test at first differences, which indicated all variables are stationary and integrated of order one or $I(1)$. The results of this ADF test at the levels and first differences are presented in table 1.

### 4.4. Cointegration test

In order to capture the dynamics relationship among the observed variables, their cointegration relationship was tested through a multivariate cointegration methodology proposed by Johansen (1990) and Johansen and Juselius (1991). Since the cointegration and error correction model are fairly common and well-documented elsewhere (Engle and Granger, 1987; Johansen and Juselius, 1990; Johansen, 1991), only a brief overview is explained here. Johansen (1991) modeled time series as a reduced rank regression in which they computed the maximum likelihood estimates in the multivariate cointegration model with Gaussian errors. The advantage of this technique is that it allows one to draw a conclusion about the number of cointegrating relationship among observed variables. Since all the data series in the model were integrated processes of order one or $I(1)$, the linear combination (cointegrating vectors) of one or more of these series may exhibit a long-run relationship. The maximum eigenvalue test and trace test was employed to establish the number of cointegrating vectors, and the results are presented in table 2. The optimal lag length ($p$) is determined using Schwartz Information Criterion (SIC), which indicates an optimal lag length of one year. The results of trace test and maximum eigenvalue test both indicate that, there is a one cointegrating vector at 5% level of significance.

This means that, there exists a long-run (equilibrium) relationship between exports and economic growth. According to Granger's representation theorem (Engel and Granger, 1987), such a cointegrated system can be expressed and estimated as an error correction model (ECM).

**Table 2:** Johansen Cointegration Test Results

| Eigenvalue | $H_0$ | *Trace* | | $L_{max}$ | |
|---|---|---|---|---|---|
| | | Stat | 5% CV | *Stat* | 5% CV |
| 0.72535 | r=0 | 91.58252* | 69.81889 | 46.52117* | 33.87687 |
| 0.50011 | r≤1 | 45.06134 | 47.85613 | 24.96104 | 27.58434 |
| 0.29560 | r≤2 | 20.10031 | 29.79707 | 12.61446 | 21.13162 |
| 0.15935 | r≤3 | 7.48585 | 15.49471 | 6.24882 | 14.26460 |
| 0.03378 | r≤4 | 1.23703 | 3.84147 | 1.23703 | 3.84147 |

*Notes*: * denotes rejection the null hypothesis of cointegration rank at the 5% significance.
*The critical values at 5% level of significance of the test are taken from Osterwald-Lenum*

**4.5. Multivariate Granger causality and error correction modeling**

Since all the variables are cointegrated a proper VAR framework to examine the dynamic relationship between variables must include an ECM (Granger, 1988). It must be highlighted that cointegration is a property of long-run equilibrium, and Granger causality is a short-run phenomena. In this case, the Granger causality in a cointegrated system involves an estimation of the cointegration relationship and followed by testing for non-causality in an ECM framework. The VECM with cointegration rank *r* for model used in the current study can be expressed as:

$$\Delta S_t = B_0 + \Pi S_{t-1} + \sum_{j=1}^{p} \Gamma_j \Delta S_{t-j} + \delta DC_{98} + \upsilon_t \qquad (2)$$

where Δ is the difference operator. *St* is a *5 x 1* vector of non-stationary *I*(1) variables of $GDPC_t$, $GCF_t$, $L_t$, $X_t$, and $IM_t$. $B_0$ is a *5 x 1* dimensional vector of constants and δ is a *5 x 1* dimensional vector of parameter of dummy variable. $DC_{98}$ is Asia 1998 economic crisis dummy variable, which is treated as exogenous with condition during crisis equal to 1, others are zero. Π is the long-run matrix that determines the number of cointegrating vectors, that consist of $\alpha$ and $\beta'$ representing speed of adjustment towards long run equilibrium and long run parameter, respectively. Γ is the vector of parameters that represents the short-term relationship. $\upsilon_t$ is vector of independent and identically distributed error terms with white noise properties $N(0,\sigma^2)$.

Using an ECM framework one may determine the direction of causation between observed variables while providing estimates on both long-run and short-run pattern. Cointegration provides information about long-run relationship among variables while Granger causality tests provide information on short-run dynamics. In above VECM framework, $\Delta GDPC_t$, $\Delta GCF_t$, $\Delta L_t$, $\Delta X_t$, and $\Delta IM_t$ are influenced by both long-term error correction terms contained in Π and short-term difference lagged variables of $\Delta GDPC_{t-j}$, $\Delta GCF_{t-j}$, $\Delta L_{t-j}$, $\Delta X_{t-j}$, and $\Delta IM_{t-j}$. Using ECM, the coefficient matrix Π reintroduce the long run information in the levels of the variables that is lost in first differencing, and thus provide an additional channel for detecting causal linkages. Furthermore, the standard Granger causal structure can be examined by testing the joint significance of the coefficient matrix. Hence, by using an ECM framework, one can test causal relationship between exports, imports and economic growth through two potential channels. Awokuse (2008)

further argued that for each variable in the system, at least one channel of causality is active: either in the short-run though the joint test of lagged differences or through a statistically significant lagged ECT. In spirit of Thangavelu and Rajaguru (2004), the long-run causality between variables are determined by the joint significance of the respecting cointegrating vectors ($\beta$) and the error correction coefficient ($\alpha$). The Wald test statistics ($\chi^2$) was employed to establish the short-run causality between two variables. The direction of the short-run causality was established by the sign of the sum of the estimated coefficient $\Gamma_j$ in the VEC model.

However, just like most standard VAR, the individual coefficient of an ECM is sometimes difficult to interpret. According to Lutkepohl and Reimers (1992), impulse response function (IRF) can also be utilized to summarize the relationship between variables in a cointegrated system. Riezman *et al.* (1996) points out after the detection of causal pattern, the magnitude of the causal structure could be scrutinized by analysis of IRF or forecast error variance decompositions (FEVD). To ensure that the vector ECM innovations are not correlated contemporaneously, the generalized impulse response function (GIRF) proposed by Koop *et al.* (1996) and Pesaran and Shin (1998), was used in the study to identify the structure of VAR innovation.

Awokuse (2008) emphasizes the preference of GIRF approach to application of Choleski factorization of the reduced form error covariance matrix due to its invariance to ordering of the variables. He further argues that such approach is preferable especially when the residual covariance is non diagonal, which makes it to be less either subjective or arbitrary, as theory does not always yield a clear identifying causal structure.

## 5. Empirical results and discussion

### 5.1. Long-run and short-run relationship between exports, imports and GDP per capita

Results of cointegration tests in presented in table 2 previously indicating there exists a long-run (equilibrium) relationship between exports and economic growth, and such long-run relationship (cointegrating equation) can be expressed as follows:

$$\begin{array}{lcl} \textbf{GDPC} & = & \textbf{– 6.782 + 0.340 GCF *** + 0.170 L** + 0.275 X*** 0.042 IM + ε} \\ & & \quad [9.66955] \quad [2.07228] \quad [8.15423] \quad [\ 1.08309] \end{array}$$

Notes: numbers in parentheses are *t*-statistics
*** and ** denote significant at 1% and 5% level of significance, respectively.

This equation represents the long-term elasticity among variables implying that there are 0.34 percent, 0.17 percent, and 0.275 percent positive change in GDP per capita due to one percent change in investment, labor and exports, respectively. On the other hand, if there is a one percent increase in imports of intermediate goods, it will reduce 0.042 percent of GDP per capita in the long run. These results, except imports of intermediate goods, are significant at 5% level of significance. Based on these cointegration test and results of cointegrating equation we can safely conclude that, there is positive relationship between exports and GDP per capita, and negative relationship between intermediate imports and GDP per capita in the long run.

The results of relationships among variables in long- and short-run can be expressed in VECM (1) form as follows:

$$\begin{bmatrix}\Delta GDPC\\ \Delta GCF\\ \Delta L\\ \Delta X\\ \Delta IM\end{bmatrix}=\begin{bmatrix}0.045\\ 0.081\\ 0.034\\ -0.038\\ -0.017\end{bmatrix}+\begin{bmatrix}\mathbf{-0.131*}\\ \mathbf{-0.326}\\ \mathbf{0.005}\\ \mathbf{1.118*}\\ \mathbf{0.291}\end{bmatrix}\begin{bmatrix}1.000 & -0.340* & -0.170* & -0.275* & 0.042\end{bmatrix}\begin{bmatrix}GDPC_{t-1}\\ GCF_{t-1}\\ L_{t-1}\\ X_{t-1}\\ IM_{t-1}\end{bmatrix}$$

$$+\begin{bmatrix}0.137 & 0.021 & -0.230 & 0.032 & -0.036*\\ 0.94* & 0.159 & -0.965 & -0.017 & -0.230\\ -0.245* & 0.035 & -0.019 & -0.015 & 0.003\\ 1.092* & 0.285 & 1.158 & -0.073 & -0.016\\ 2.601* & 0.759* & 0.692 & -0.050 & 0.039\end{bmatrix}\begin{bmatrix}\Delta GDPC_{t-1}\\ \Delta GCF_{t-1}\\ \Delta L_{t-1}\\ \Delta X_{t-1}\\ \Delta IM_{t-1}\end{bmatrix}+\begin{bmatrix}-0.196*\\ -0.551*\\ -0.018\\ 0.068\\ 0.275*\end{bmatrix}DC_{98}$$

Notes: * denotes significant at least at 10% level of significance
numbers in bold represent coefficient of error correction term ($\alpha$)

These results suggest that there is negative relationship between intermediate imports an economic growth in short run, but no evidence of ELG hypothesis in short run. The coefficient of error correction term (ECT) with GDPC as dependent variable is statistically significant at 5% level of significance and its sign is negative (correct) implying that there is a mechanism to converge such short-run dynamics into long-run equilibrium. Meanwhile, GDP per capita contributes positively to intermediate imports**,** which is significant at 1% level of significance. The adjustment parameter coefficient is 0.131, implying that 13.1% shocks will be converged towards long-run equilibrium in first period. In short run, GDPC has a positive relationship with growth of exports, and its ECT coefficient is statistically significant, yet the sign is positive (not correct) implying that the shock occurs merely in short run. Dummy coefficient of Asian 1998 economic crisis is negative and statistically significant at 1% level of significance implying that Asian 1998 economic crisis is significantly detrimental to GDP per capita. All of those findings seem to be in accordance with theoretical basis.

**5.2. Causality results**

Table 3 presents the results of the test of the joint significance of the lagged difference variables and the error correction terms using $\chi^2$-statistics[19] and *t* statistics, respectively. For the sake of consistency with the purpose of current study, the analysis of such results only emphasizes on causality nexus among economic growth, exports and imports. The results show that, error correction term for cointegrating equation with GDP per capita as a dependent variable is significant at 5% level of significance, implying that there exists a long-run causality running from exports and imports to GDP per capita. Intermediate import also exhibits an evidence of Granger causality to GDP per capita in short-run. However, there is no evidence for Granger causality running from exports to GDP per capita in short run.

Meanwhile, coefficient of error correction term with exports as dependent variable is statistically significant, yet the sign is positive (not correct). This finding is in accordance with result of cointegration test implying that only one cointegration equation running in the long run. However, there is a unidirectional causality running from GDP per capita to exports (or GLE) in short-run and no evidence for otherwise. This result of causality confirms findings of Ahmad and Harnhirun (1996) and Thangavelu and Rajaguru (2004). Interestingly, there is an evidence of bi-directional causality between imports and economic growth in short-run.

Based on above results we can construct a summary of causal relationship among GDPC, exports and intermediate imports representing long-run and short-run causality as presented in table 4 accordingly. These results indicate that, first, the result of the joint significance of the respecting cointegrating vectors ($\beta$) and the error correction coefficient ($\alpha$) confirmed that exports positively contributed to economic growth in long-run supporting ELG

**Table 3:** Multivariate Granger Causality Test based on VECM

| | **Dependent variables** | | | | |
|---|---|---|---|---|---|
| **Independent variables** | GDPC | Investment | Labor | Exports | Imports |
| GDPC | - | 3.9806** (0.0460) | 5.186** (0.0228) | **2.8810*** **(0.0896)** | **5.2974**** **(0.0214)** |
| Investment | 0.2669 (0.6054) | - | 0.9890 (0.3200) | 1.8193 (0.1774) | 4.1737** (0.0411) |
| Labor | 1.0266 (0.3110) | 1.2973 (0.2547) | - | 1.0008 (0.3171) | 0.1159 (0.7335) |
| Exports | **1.4500** **(0.2285)** | 0.0293 (0.8641) | 0.4445 (0.5049) | - | 0.0435 **(0.8349)** |
| Imports | **4.9582**** **(0.0260)** | 14.715*** (0.0001) | 0.0366 (0.8484) | **0.0391** (0.8432) | - |
| ECT | **[-2.015]**** | [-1.333] | [ 0.102] | **[ 3.560]***** | [ 0.496] |

Notes: above values are $\chi^2$ statistics
numbers in parentheses are value of probability
numbers in parentheses of ECT are *t*-statistics
*,**,*** denote significant at 10%, 5% and 1% level of significance, respectively.

hypothesis. However, there is no evidence for such causal link running in short-run. In fact, it is economic growth that plays a significant positive role in contributing to growth of exports or GLE hypothesis in short-run. Thus, in overall, we can safely conclude that exports and economic growth exhibit a feedback relationship running ELG in long-run and GLE in short-run. Second, imports of intermediates play a significant role in determining economic growth both in long- and short-run, which is negative throughout. Meanwhile, there is a positive role of economic growth that determines growth of imports of capital and intermediate goods in short-run.

**Table 4:** Short- and Long-run Causality in VECM – GDPC, Exports, and Imports

| | X → GDPC | GDPC → X | IM → GDPC | GDPC → IM |
|---|---|---|---|---|
| Overall | O | O | O | O |
| Long-run | positive | - | negative | - |
| Short-run | - | positive | negative | positive |

O indicates the presence of at least one Granger causal link

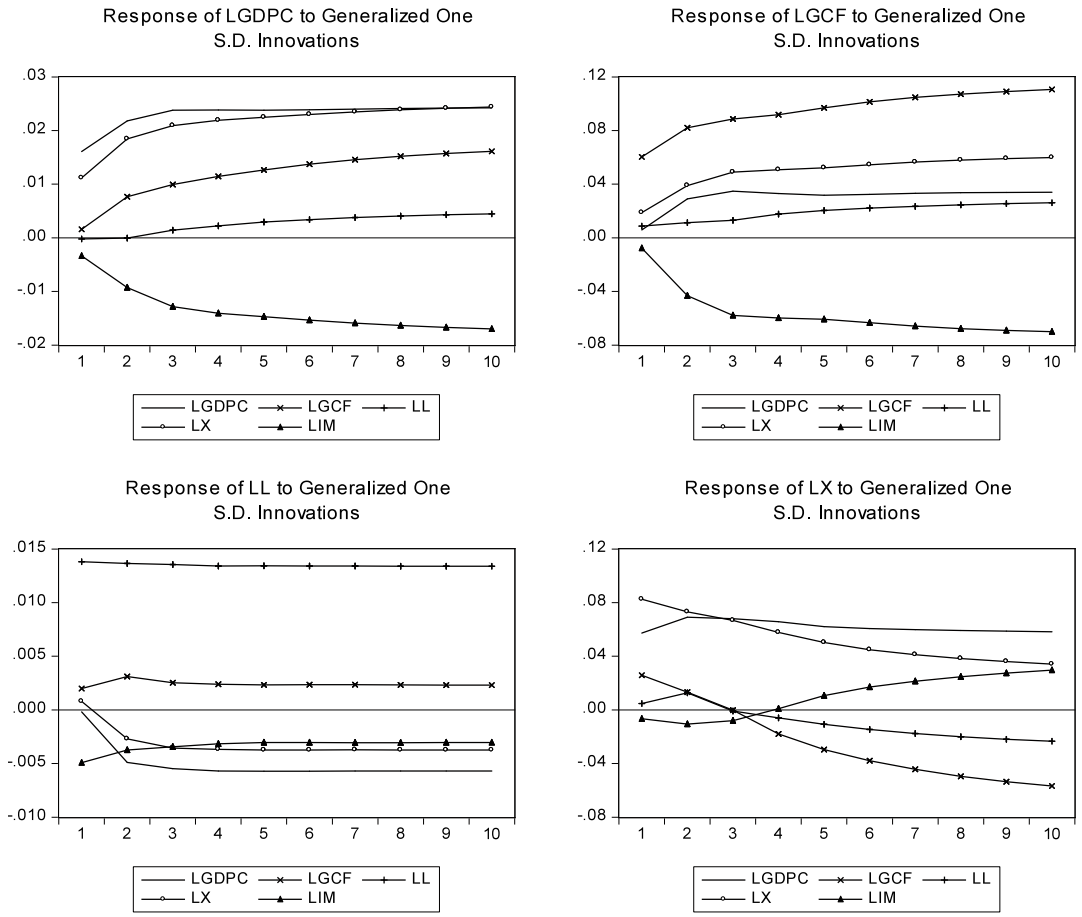
### 5.3. Generalized impulse response function

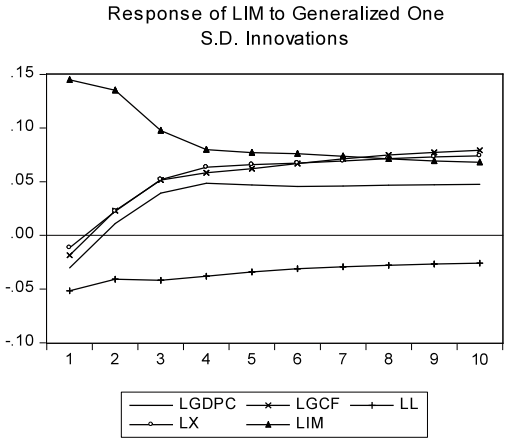
Those causal analyses can be extended to provide more insight into how shocks to exports and imports affect economic growth, *vice versa*, by examining impulse response function. An impulse response function traces the effect of a one-time shock to one innovation on current and future values of endogenous variables. For completeness, impulse responses are provided for each of the five variables in the system. Nevertheless, the emphasis is only placed on the

relationship between the variables of interest in the study, namely exports, imports and GDP per capita. The simulation in the GIRF covers 10 years in order to reflect a typical business cycle and ensure adequate time for tracing the effect of innovations on variables in the system, as presented in figures 4.

First panel of figure 4 contains the response of GDP per capita. It can be seen that a positive shock to real exports resulted in positive response of GDPC. In order to examine for reverse causal structure from GDP to exports, the responses of exports and imports are reported in fourth panel. The result indicates that export responds positively to a positive shock in GDPC growth throughout period. The findings from first and fourth panel provide no strong supporting evidence of merely ELG hypothesis in Indonesia between exports and economic growth. In fact, they exhibit evidence of a positive feedback causal-effect (bi-directional) between exports and GDP per capita runs at all horizons. This is in accordance with earlier conclusion for a bi-directional relationship between exports and economic growth.

**Figure 4:** Generalized impulse responses to one SE innovation in ECMs






This bi-directional relationship is plausibly true for the case of developing country whose domestic market is significant like Indonesia. This implies that the producers may have flexibility to shift production from domestic market to foreign market, and *vice versa*. Thus, both foreign and domestic demand may have positive impact for production of tradeables. The following reasons are (a) export sector may have significant impact to fuel the economy when domestic demand is shrinking. As pointed out by Aswicahyono and Pangestu (2000) and Hill (2007), Indonesia economic condition especially in recovery process during crisis has been dependent on the growth of the export sector since domestic demand was collapsed led manufacturers to shift sales from domestic to export markets; (b) exports enable domestic production to achieve economies of scale and to obtain foreign exchange to finance imports for consumption and production of tradables. As domestic consumption increases, it stimulates domestic production and thus, economic growth. Moreover, an increase in domestic production would lead to an increase in the capability of domestic producers to increase their exports (Tsen, 2006); (c) results of GDP decomposition analysis indicated there were changes in growth pattern during period of observation, which is *seemingly* domestic demand-led growth during ISI strategy, while dominated by real exports or *seemingly* export-led growth under EP era (figure 1).

Intermediate imports also exhibits bi-directional relationship running negatively from intermediate imports to GDP per capita. From first panel, the response of GDPC to a shock of imports is negative throughout period. Meanwhile, intermediate imports have an initial small negative response to GDP per capita shock that becomes positive after second period as indicated in fifth panel. This evidence is consistent with our earlier findings from Granger causality test, which provided evidence supporting bi-directional relationship between imports and economic growth. It is worth to note, in contrast with study of Thangavelu and Rajaguru (2005) who concluded imports tend to have a significant positive effect on productivity growth (ILG) for most of the Asian countries under study, this paper does not support one channel through which trade may rise the standard of living, since we found no supporting evidence of positive causality from intermediate imports to GDP per capita. Nevertheless, such finding is in accordance with part of their results, which did not find any ILG for Japan.

In addition, the relationship between exports and imports are also examined using GIRF analysis. In fourth panel, a negative shock to imports of intermediate goods resulted in an initial "small" negative, response from growth of real exports, which become positive after four years. On the other hand, the response of imports of intermediate goods to a shock in exports is relatively larger a positive throughout as indicated in fifth panel. This is plausibly due to the significant role of intermediate imports component in exports product structure, which is also argued by Aswicahyono and Pangestu (2000). This is especially true for exports of more technology- and capital-intensive commodities such

as food-processed; electronics (including semiconductors); and automotive and parts). Data from Statistical Yearbook of Indonesia 2008 indicates that the average of import value registered to US$ 41,942.1 million annually for the last ten year. Import of raw material/auxiliary goods registered to US$ 32,236.1 million, and import of capital goods was US$ 6,250.7 million. This means that they respectively contributed 76.78 percent, and 14.96 percent of total imports. In these period, import raw material/auxiliary goods and import of capital goods had a positively growth amounted by 8.92 percent and 7.71 percent annually. Consistent with our previous finding of negative causality from intermediate imports to GDP per capita, such reliance on imported inputs in long-run may be detrimental to economic growth in Indonesia if such intermediate imports too much consume country's foreign reserves. This might be worst if simultaneously, there is not any expansion in exports value generated from increasing exports volume or favorable exports commodity prices as well as an expansion in country's exports market.

## 6. Concluding remarks

In this paper we review the ELG hypothesis in Indonesia using a neoclassical growth modeling framework and multivariate cointegrated VAR methods. The analyses focused on dynamic causal relationship between GDP per capita, exports, intermediate imports, capital, and the labor force. Given the results of unit root test, the Johansen's multivariate cointegration test was conducted and it suggested the existence of a long-run equilibrium relationship between variables in the system. This leads to the inclusion of ECM framework in which Granger non causality tests are taken. Based on finding of cointegration test, exports and imports positively and negatively contribute to long-term economic growth, respectively. The result of the joint significance of the respecting cointegrating vectors and the ECT further confirmed that exports positively contributed to economic growth supporting ELG hypothesis in long-run. However, result from Granger causality test on VECM suggested growth-led exports (GLE) causal structure in short run. From these findings, we can safely conclude that exports and economic growth exhibit a feedback relationship running ELG in long-run and GLE in short-run. The result of GIRF reinforced the conclusion of Granger causality analysis which provided support for bi-directional causal structure between exports and economic growth. In related to import and growth, intermediate imports also exhibits bi-directional relationship with GDP per capita. This evidence confirms the importance of imports of capital and raw material goods in production of tradeables as well as in exports product structure in Indonesia.

For the policy implications, it is worth to note that although there are some empirical evidences in precedent studies, we find a supporting evidence of ELG merely in the long-run for our dataset of Indonesia, while confirming an evidence of GLE in short-run. Our findings indicate the significance of both exports and economic growth to the economy of Indonesia as indicated in GIRF analysis. Therefore, a balance emphasis on the role of exports as well as the importance of domestic market can be important for successful and sustained economic development. Despite of its benefits, the intermediate imports should be well managed. This is because, in long-run, the highly dependence on imported inputs may be detrimental to economic growth in Indonesia if such intermediate imports are too much consuming country's foreign reserves. Therefore, the government should be able to induce more export revenues by promoting competitive export sectors as well as encouraging exporters to enhance exports market. In addition, in spirit of Aswicahyono and Pangestu (2000), it is suggested that government of Indonesia should continue the ideal strategy for reducing tariff levels that affect core inputs and components used in export production. It can be simultaneously enhanced by providing the right incentives for the development of an efficient and viable domestic support industry.

Generally, finding in this study may shed some lights in conforming Perkins and Syrquin (1989) arguments that, a bigger country may have a less reliance to foreign markets. However, this analysis was conducted by employing the availability of macroeconomic indicators. It might be useful for future research to extend the analysis to see the impact of exports and imports behavior towards more disaggregated sectors as well as the determinants of exports performance

in Indonesia.

## Endnotes

[1] The World Bank (1993) and ADB (2005) supported the view that export growth and trade oriented policy had been a significant source of rapid economic growth in the HPAEs through greater access to best practice technologies.
[2] Rodrik (1999) raises some doubts on such proposition. He argues that exports are important only insofar as they represent "price" an economy pays for having access to imports, and should be treated as a means not an end. Further, he adds that in fact it is imports of capital and raw material goods that are critical to long-run economic growth.
[3] This is one of significant distinctions from most previous studies, in which total imports are used instead of imports of capital and intermediates goods due to data limitation. As pointed out by Islam (1998), only imports of intermediate goods should ideally be included in the import figures.
[4] Ishida (2003)
[5] Basri and Hill (2007)
[6] Hill (1996)
[7] Hill (1996) and Ishida (2003)
[8] Definition of export-led growth and domestic demand-led growth used in the study as explained in appendix follows definitions proposed by Felipe and Lim (2005). However, instead of using term of *weakly speaking* as they proposed, we prefer a different expression.
[9] Hill (2007)
[10] Biro Pusat Statistik, *Statistical Yearbook of Indonesia 2008*
[11] Some scholars might argue an expansion in exporting sectors simply lead to shrinkage in the importing sectors (assuming the production possibility set is unchanged). We are grateful to the reviewer for this critical insight.
[12] See for example, Michaelly (1977), Balassa (1978), Heller and Porter (1978), and Tyler (1981)
[13] See, for instance Feder (1982), Balassa (1985), Kavoussi (1984), and Moschos (1989)
[14] Some of such studies include Jung and Marshall (1985), Chow (1987), Bahmani-Oskooee *et.al.* (1991), Ahmad and Kwan (1991), and Jin and Yu (1995)
[15] Alternatively, Islam (1998) proposes to use of exports proportion to GDP following Michaelly (1977), or economic growth is measured by real GDP per capita (or its annual growth). It is also logical to represent economic growth in the non–export component of GDP as suggested by Heller and Porter (1978).
[16] We also considered alternative period of estimation to capture the possible impacts of different trade regime, such as 1971 to 1985 for ISI strategy and 1986 to 2008 for EP strategy, just as what we did in decomposition analysis. However, the former cannot be further processed due to insufficient number of observation in VAR system, while the latter one did not perform very well in the empirical work. Therefore, we considered the period of observation used in this study as the best estimate for our objectives.
[17] Masih and Masih (1996) had a sample of 37 annual observations to study the impact of monetary aggregates on output growth in a VAR framework for the Indonesia economy. The sample in this study is comparable to most time series studies related to economic growth.
[18] Ahmad and Kwan (1991), Ahmad and Harnhirun (1995) and Tsen (2006).
[19] We also considered an alternative test of Granger causality test based on VECM using F-stats. In relation to exports and economic growth, the conclusion generated by using F-statistics is not much different with that of using $\chi^2$. However, the result indicates that there is a unidirectional causality between imports and growth running from GDP per capita to imports, and no evidence for otherwise. The complete results are available from the authors upon request.

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## Appendix

*Decomposition analysis of demand-side growth accounting,*

In this section, we perform a growth accounting analysis on the component of demand side of real output, given by the National Income and Product account as:

$$GDP \equiv Y \equiv C_p + C_g + I + X - M$$

where GDP stands for gross domestic product, Cp is private consumption, Cg is government consumption, I is gross domestic investment or gross domestic capital formation, and X and M are exports and imports of goods and service, respectively. In growth rate terms:

$$GDP \equiv (\frac{C_p}{GDP})x\hat{C}_p + (\frac{C_g}{GDP})x\hat{C}_g + (\frac{I}{GDP})x\hat{I} + (\frac{X}{GDP})x\hat{X} - (\frac{M}{GDP})x\hat{M}$$

where the symbol ^ denotes growth rate of respective variable.

The above simply states that the growth rate of GDP is the sum of the products of the shares in GDP times the growth rate of private and government consumption, growth domestic investment and exports, less the product of the share of imports and its growth rate. However, in spirit of Kranendonk and Verbruggen's work (2008), we modify above equation to differentiate between total domestic and foreign demand (proxied by exports) so that the growth rate of GDP is the sum of the products of the shares in GDP times the growth rate of private and government consumption, and domestic investment less the product of the share in GDP times the growth rate of imports, which represent total domestic demand, plus the products of the share of exports to GDP times its growth rate.

Average annual growth rate of a variable, denoted $\hat{x}$, was derived, say for 1971 to 1985 (under ISI strategy), as:

$$\hat{x} = (((x_{1985} - x_{1971}) / x_{1971}) * 100) / 15$$

The rest definitions provided here are following Felipe and Lim (2005). We will refer to an exports-led development growth strategy as one that results in:

a) high export growth accompanied by high GDP and income growth;

b) improvement in export growth.

Conversely, we will say that growth is *strictly speaking* domestic demand-led if domestic demand is growing, accompanied by GDP and income growth. The right-hand side of growth identity or consumption of private and government sector plus investment are domestic demand, then minus imports is net domestic demand component, while exports represents foreign demand that positively contributes to GDP growth. Thus following cases can arise:

1. Domestic demand is growing and exports are deteriorating (becoming a smaller positive number or larger

negative number). If GDP growth is positive then growth must be domestic demand-led.

2. Domestic demand and exports are growing. Thus, growth is due to both domestic demand and exports. Which one is contributing more to growth is simply an empirical issue. If domestic demand is growing faster, we will say that growth is *weakly speaking* or *seemingly* demand-led.
3. Domestic demand is deteriorating and exports are increasing. If growth is positive (which is often not the case since domestic demand is usually a much larger component of GDP), growth must be export-led. If growth is negative, the recession is due to decline in domestic demand.
4. Both domestic demand and exports are decreasing. Obviously, we have an economic recession and negative growth rates are due to declines in both domestic demand and exports.