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# Export Structure of ASEAN–4[1] and Contributions of Exports to Economic Growth

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**Abstract**

This paper examines the contribution of exports on economic growth of four ASEAN countries (Indonesia, Malaysia, the Philippines and Thailand). Estimation model is designed to show exports' contribution to economic growth through two mechanisms: marginal productivity in export sector is higher than in non-export sector, and shifting resources from non-export to export sector positively contribute to economic growth. The analytical framework is an extension of neoclassical production function where exports and imports of intermediate inputs are added as additional explanatory variables. Time-series analysis covering period 1981–2004 is applied to each country. The separation of export into two commodity groups in the estimation is to address the specific features of export composition. The incorporation of intermediate import variable into the model is to investigate the existence of foreign exchange constraint. The results demonstrate the positive contribution of exports to economic growth. The marginal productivity in export sector is higher than the one in non-export sector in all countries. Besides, ASEAN–4 do not face a severe problem of foreign exchange constraint due to high level of intra-industry trade.

## 1 Introduction

Export-oriented policies have been a prominent framework in most of South East Asian economies since the early 1980's. ASEAN's industrialization can indeed be characterized as export-driven in its salient nature (Ishido, 2004). East Asian NIEs have been moving from the production and export of agricultural products and labor-intensive manufactures towards the production and exports of capital-intensive products like computer chips, consumer electronics and high-tech capital goods (Adams and Shachmurove, 1997). ASEAN countries have been following this trend as well. Among ASEAN countries, the present study focuses on four countries; Indonesia, Malaysia, the Philippines and Thailand. These four countries are now playing an important role in the economy of the region in terms of GDP, labor force, destination of FDI. They are sharing the common features of export-oriented development policies and at the same time possess different trade structures. Those differences may also reflect in the different impacts of trade on economic growth. Objective of this study is to investigate the impacts of export sector on economic growth, focusing on the way that

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exports contribute to GDP growth rate.

The relation between exports and economic growth has been the subject of numerous studies. Empirical observations across countries demonstrated that developing countries with a favorable export growth record tended to enjoy higher rates of growth of national income. Part of the empirical studies support export promotion policies by finding significant correlation between export expansion and output growth (Michaely, 1977; Kavouski, 1984; Khan and Saqib, 1993; Hotchkiss, Moore and Rockel, 1994; Dimkpah, 2002). Empirical studies of Balassa (1978), Chenery et al (1970) and Tyler (1981) demonstrated that exports contribute to GDP not only as a component of GDP but also through other indirect impacts. They have constructed an analytical framework that includes these indirect impacts. A number of economists have highlighted various beneficial aspects of exports such as greater capital utilization, economies of scale, incentives for technological improvements and efficient management due to competitive pressure abroad (Balassa, 1978; Keesing, 1967, 1979; Krueger, 1980).

More specifically, several studies were focusing on the ways of contribution of exports to GDP growth (Feder, 1982; Chow, 1987). Feder (1982) pointed out that implications of Balassa, Keesing and Krueger's discussions is that there are substantial differences between marginal factor productivities in export-oriented and non-export-oriented industries, such that the former have higher factor productivity. To meet the objective of investigating how do exports of ASEAN−4 create impact to economic growth, present study will inherit the approach developed by Feder (1982).

An attempt to model an explicit link between trade and growth was undertaken by Feder (1982) which focused on one mechanism: higher productivity in the export sector positively affects growth in the non-export sector. Structural rigidities in a developing economy presumably allow higher productivity to persist in the export sector and this produces a positive externality on the non-export sector. Feder used cross-country estimation to analyze the sources of growth in the period 1964−1973 for 31 semi-industrialized developing countries. The cross-country analyses of Feder and a replication by Ram (1987) both found that marginal productivity in export sector is significantly higher than the one in non-export sector in developing countries. However, Feder's study got such critics on his model as measurement errors in the data; ignorance of important variables; and implicit assumption which presume the same parameter for all countries. Ram (1987) estimated Feder's equation using time-series data of 88 developing countries to get the conclusion on contribution of exports to economic growth. He found that productivity differential was positive for more than 80% of both the broad and narrow samples of countries and was significant for nearly one-half of the positive coefficients.

As an extension of Feder's study, Esfahani (1989) has developed his model to estimate the two effects of export on economic growth: create externality to non-export sector and reduce foreign exchange constraint. With the existence of foreign exchange constraint, exports may play a very important role in generating foreign exchange needed to import intermediate inputs which are

essential for production in developing countries. Esfahani argued that imports of intermediate input should be added as an explanatory variable of regression of GDP growth rate on capital, labor and export growth rate. The reason is that exports and imported intermediate inputs are closely related; failing to include imports in the regression may bias the coefficient of exports upward and, thus, exaggerate the contribution of exports. To allow the effects of shortage in the supply of imported intermediate goods, in the model, a variable of import intermediate goods has been added. Esfahani's cross-country analysis of 31 semi-industrialized countries came up to the conclusion that the positive relation between export expansion and economic growth has been due to the contribution of exports to the reduction of import "shortage".

Dawson (2005)'s study is another extension of Feder's model. Dawson examined the contribution of agricultural exports to economic growth in less developed countries. A source-of-growth equation is developed from a model where export and non-export sectors are both divided into agricultural and nonagricultural sub-sectors, using data for 62 developing countries. The result demonstrated that marginal productivity of export-sector in agricultural and non-agricultural sectors is higher than marginal productivity of the corresponding non-export sector.

Present study looks at contribution of exports both through the higher marginal productivity of export sector than non-export sector and through the externality created by export sector, and investigates the existence of foreign exchange constraint in ASEAN–4 economies. The originality of the study is to apply time-series into the model and combine the framework of three previous studies. The study introduces a time-series analysis covering period 1981–2004. Since the objective of the study is to investigate the contribution of exports to economic growth, taking into account the specific features of export composition of each country, a time-series appears to be an appropriate choice. Separate time-series estimations also surmount the shortcoming of implicit assumption in cross-countries analysis that presumes the same parameters for all countries. This study employs Feder's framework in which, for the first time, the combination of both Esfahani's and Dawson's methodology is applied, i.e., export variable was divided into industrial sub-sectors and the intermediate import variable was added as an explanatory variable. Depending on the feature of export compositions, exports will be divided to industrial sub-sectors to estimate the contribution of those sub-sectors' exports to economic growth. The combination of the separated export variables and incorporation of import variable is to deal with specific export structure of each country and takes the relationship between export and intermediate import into account. The study also refers to intra-industry trade (IIT) index of ASEAN–4 to interpret the significance of intermediate import variable in the estimations.

The remainder of the study is organized as follows. Section 2 reviews Feder's framework including extensions of Feder's model, and introduces estimation model for current study. Section 3 presents data sources. Section 4 presents country-specific model for estimation equations and result

of estimations, and link those results with an intra-industry trade analysis. The last section summarizes and concludes.

## 2 Model Specification[2]

### 2.1 Feder's Framework

Feder assumes two sectors in the economy: export and non export sector. Output of the export sector generates an "externality" effect on the production of non-export output. Labor and capital serve as the conventional inputs in both sectors. Production functions of export and non export sector are different and relative marginal productivity differs across the two sectors.

The production functions of the two sectors are:

$$N=F(K_n, L_n, X) \tag{1}$$

$$X=E(K_x, L_x) \tag{2}$$

Where, $N$= output of non-export production,

$X$= output of export production,

$K_n$, $K_x$= capital stocks of non-export and export sectors,

$L_n$, $L_x$= labor forces of non-export and export sectors.

If we assume the ratio of respective marginal productivities of capital and labor in the two sectors deviates from the unity by a factor $\delta$ ($\delta \neq 0$), then

$$\frac{E_k}{F_k}=\frac{E_l}{F_l}=1+\delta \tag{3}$$

where, $E_k$, $E_l$, $F_k$, $F_l$ denote partial derivatives of $F$ and $E$ with respect to the input shown by subscripts.

Denoting Gross Domestic Product by $Y$, and since by definition $Y=N+X$,

$$dY=dN+dX. \tag{4}$$

Taking differential of N and X and replacing $dK$ by $I$ (investment), we have

$$\begin{aligned} dY=dN+dX&=F_kI_n+F_ldL_n+F_xdX+(1+\delta)F_kI_x+(1+\delta)F_ldL_x \\ &=F_k(I_n+I_x)+F_l(dL_n+dL_x)+F_xdX+\delta(F_kI_x+F_ldL_x). \end{aligned} \tag{5}$$

$I$ is total investment ($\cong I_n+I_x$) and total growth of labor $dL$ ($\cong dL_n+dL_x$). Recall (3), we have

$$F_kI_x+F_ldL_x=\frac{1}{1+\delta}(E_kI_x+E_ldL_x)=\frac{dX}{1+\delta}. \tag{6}$$

Using this result in (5) yields

$$dY=F_kI+F_ldL+(\delta/(1+\delta)+F_x)dX. \tag{7}$$

If we assume that real marginal productivity of labor in a given sector increases at the same rate as average output per laborer in the economy, say $F_L=\beta(Y/L)$, denote $F_k=\alpha$, and divide equation (7) by $Y$, then the growth rate of GDP can be written as[3]

$$\frac{dY}{Y}=\alpha\left(\frac{I}{Y}\right)+\beta\left(\frac{dL}{L}\right)+\left(\frac{\delta}{1+\delta}+F_X\right)\left(\frac{dX}{X}\right)\left(\frac{X}{Y}\right) \tag{8}$$

Denote the total increment to GDP brought by marginal increase in capital allocated to the export sector by $TPMK_X$, then

$$TPMK_X=F_xE_k+E_k. \tag{9}$$

Similarly $TPML_X=F_xE_l+E_l$. (10)

Then

$$\frac{(TMPL_X-F_l)}{E_l}=\frac{(TMPK_X-F_k)}{E_k}=\frac{\delta}{1+\delta}+F_X. \tag{11}$$

Two terms on the left hand sides of (11) are the difference between marginal contribution to GDP of production factors (capital and labor) in the two sectors, relative to the marginal contributions of these factors to export sector's output. $\frac{\delta}{1+\delta}$ is the productivity differential between export and non-export sectors and $F_x$ is the externality effect of export to non-export sector. The interpretation for equation (8) is that GDP growth rate is composed of the contribution of factor accumulation and the gains brought about by shifting factors from a low productivity sector (non-exports) to a high productivity sector (exports). If we denote $\frac{\delta}{1+\delta}+F_X$ as $\gamma$ then the estimation equation will become

$$\frac{dY}{Y}=\alpha\left(\frac{I}{Y}\right)+\beta\left(\frac{dL}{L}\right)+\gamma\left(\frac{dX}{X}\right)\bullet\left(\frac{X}{Y}\right), \tag{12}$$

where $Y$, $I$, $L$ and $X$ are GDP, Investment, Labor and Exports values respectively and $\gamma$ is expected to be positive and significantly different from zero.

### 2.2 Separation of Export Variable

In order to avoid the problem of aggregate export variable, Dawson (2005) has developed a framework to divide export into two commodity groups: export of agricultural commodities and export of non-agricultural commodities. The production function takes the form

$$Y=f(K, L, X^{Agr}, X^{Nagr}), \tag{13}$$

where $Y$ is aggregate real output or *GDP*, $K$ is capital, $L$ is labor, and $X^{Agr}$ and $X^{Nagr}$ are agricultural and nonagricultural exports respectively. Following Feder's assumptions and way of manipulation, Dawson's estimation equation takes the form

$$\frac{dY}{Y}=\alpha\left(\frac{I}{Y}\right)+\beta\frac{dL}{L}+\sum_i\gamma_i\left(\frac{dX_i}{X_i}\frac{X^i}{Y}\right) \tag{14}$$

where $i=Agr, Nagr,$

and $\gamma_i(=\delta_i/(1+\delta_i)+F_x^i)$ is the marginal factor productivity differential between export and non-export sectors for $i$. In this paper, applying the same method, export will be divided into sub-sectors in case of Thailand and Indonesia.[4]

### 2.3 Inclusion of Import Variable

The framework is constructed by Esfahani (1991: 35, 93–116). To allow for the effects of imports of intermediate goods, an intermediate good N is added in to the list of inputs necessary for the production of each product. $N$ is assumed to be a composite good, aggregating intermediate good imports, $M$, with a portion of domestic products, $R$.

The total output of each sector can be written as

Domestic sector: $D=\theta X+F(K_d, L_d, N_d)$ (15)

where $\theta X$ is externality of exports and $\theta$ is a positive parameter.

Export sector: $X=H(K_x, L_x, N_x)$, (16)

Composite goods: $N=J(M, R)$, (17)

$$\frac{H_K}{F_K}=\frac{H_L}{F_L}=\frac{H_N}{F_N}=1+\delta. \tag{18}$$

Where, $\delta$ is a factor that measures the difference in the marginal factor productivities of inputs in the two sectors.[5] If factors are perfectly mobile between the sectors $\delta$ will be equal to zero. This assumption can be used to derive a relationship between GDP growth rate and the rates of growth of $K$, $L$, $M$ and $X$. Estimation of the parameters of this relationship will allow us measure the effect of externality and effect of difference in marginal factor productivity exports and compare them with effect of possible import-shortage. To derive this relationship, we first differentiate $D$ and $X$

$$dD=F_K dK_d+F_L dL_d+F_N dN_d+\theta dX, \tag{19}$$

$$dX=H_K dK_x+H_L dL_x+H_N dN_x. \tag{20}$$

If all factors are fully employed, then

$$dX=(1+\delta)[F_K(dK-dK_d)+F_L(dL-dL_d)+F_N(dN-dN_d)]. \tag{21}$$

Solving the above equation for $F_K dK_d+F_L dL_d+F_N dN_d$, substituting the result in (19), and then adding $dX$ to both sides of the outcome yield

$$dA=dD+dX=F_K dK+F_L dL+F_N dN+\left(\frac{\delta}{1+\delta}+\theta\right)dX, \tag{22}$$

where, $A$ is total output.

If $dN$ is substituted by $J_M dM+J_R dR$ and the growth rate of each variable is denoted by its corresponding lower case letter, we can write

$$a=\frac{K}{A}F_K k+\frac{L}{A}F_L l+\frac{M}{A}F_N J_M m+\frac{R}{A}F_N J_R r+\frac{X}{A}\left[\frac{\delta}{1+\delta}+\theta\right]x. \tag{23}$$

Let $Y$ be the real GDP of the economy and denote the price indices of $A$, $Y$ and $M$ by $P$, $P_y$, and $P_m$ respectively. Since $P_y Y=PA-P_m M-PR$ by definition, we have

$$p_y=\frac{1}{s_y}\left(1-\frac{R}{A}\right)p-\frac{P_m M}{s_y PA}p_m \quad \text{and } y=\frac{1}{s_y}a-\frac{P_m M}{s_y PA}m-\frac{R}{s_y A}r, \tag{24}$$

where $s_y=P_y Y/PA$ is the share of GDP in total output. Substituting from (23) into the real GDP

growth equation in (24) finally results in

$$y=\frac{KF_K}{s_yA}k+\frac{KF_L}{s_yA}l+\frac{[\delta/(1+\delta)+\theta]X}{s_yA}x+\left[F_NJ_M-\frac{P_m}{P}\right]\frac{M}{s_yA}m-[F_NJ_R-1]\frac{R}{s_yA}r. \quad (25)$$

In equation (25), growth rate of various inputs are the sources of GDP growth: capital, labor force, exports, imports of intermediate inputs and domestic inputs.

The next given assumption is that the firms in the domestic sector are profit maximizers and do not face any constraint in purchasing domestic-good inputs, then $F_NJ_R=1$ and the last terms will vanish. In the absence of import supply constraint, $F_NJ_M=P_m/P$, the coefficient of $m$ will be equal to zero. However, this plausible statement needs to be tested in case of ASEAN-4 where industrialization scheme requires a large amount of intermediate inputs. If we allow the possibility of foreign exchange constraint, i.e., $F_NJ_R-P_m/P$ is positive, $m$ must be included in the model.

Because of the problem of data availability (estimation of capital stock), equation (25) need to be parameterized to take a more practical form for estimation. The model is parameterized by specifying Cobb-Douglass functional form for F.

$F(K_d, L_d, N_d)=BK_d^{\alpha}L_d^{\beta}N_d^{\eta}$ where $B$, $\alpha$, $\beta$, and $\eta$ are constant parameters.

$F_K=\alpha F/K_d$ and $F_L=\beta F/L_d$, therefore

$$\frac{KF_K}{s_yA}k=\alpha\left(\frac{F}{K_d}\right)\left(\frac{I_n}{I}\right)\left(\frac{PI}{P_yY}\right)=\alpha^*k^*, \quad (26)$$

where, $\alpha^*=\alpha\ (F/K_d)\ (I_n/I)$ and $k^*=PI/P_yY$.

And

$$\frac{LF_L}{s_yA}l=\frac{\beta}{s_y}\left(\frac{F/L_d}{A/L}\right)l=\beta^*l \quad (27)$$

where, $\beta^*=(\beta/s_y)\ [(F/L_d)/(A/L)]$.

The export growth term in equation (25) can be written as $\gamma s_x^*x$ where $s_x^*=PX/P_yY$ is the share of exports in GDP and $\gamma=\delta/(1+\delta)+\theta$ is a parameter that can be estimated by treating $s_x^*x$ as an explanatory variable. To specify the parameter of the intermediate import growth term, $\lambda$ is defined as a measure of import shortage by the following relationship

$$F_NJ_M=(\lambda+1)\frac{P_m}{P}. \quad (28)$$

$\lambda=0$ would imply an unconstrained intermediate import level and intermediate import term will vanish from the model. Intermediate import growth term in equation (25) can be written as $\lambda s_m^*m$ where $s_m^*=(P_mM)/(P_yY)$ is the import/GDP ratio. The elasticity of GDP with respect to intermediate imports is, therefore, given by $\lambda s_m^*$

The equation (25) is fully parameterized and by substituting (26), (27) and (28) into equation (25) then we can obtain[6]

$$y=\alpha^*k^*+\beta^*l+\gamma_0s_x^*x+\lambda_0s_m^*m, \quad (29)$$

where $y$: GDP growth rate,

$k^*$: share of investment in GDP,

$l$: labor force growth rate,

$x$: export growth rate,

$m$: intermediate import growth rate,

$s_x^*$ : share of export in total GDP,

$s_m^*$: share of import in total GDP.

GDP growth rate in (29) now becomes a function of ratio between investment and GDP; growth rate of labor force; ratio between export and GDP; growth rate of export; ratio between intermediate imports and GDP; and intermediate imports growth rate.

### 2.4 Specification of Estimated Equation and Meaning of the Variables

#### 2.4.1 Specifications of Estimated Equation

As we have mentioned in the introduction, the present study for the first time combines three frameworks developed by Feder, Dawson and Esfahani. The estimation is therefore conceived to address the difference in marginal factor productivities between export sector and non-export sector. The separation of export into two groups of commodities is to examine the contribution of different export sub-sectors, and the incorporation of intermediate import variable is to test the possibility of intermediate import constraint in ASEAN−4 countries.

The equation for estimation will be specified as

$$y = \alpha^* \left(\frac{I}{Y}\right) + \beta^* l + \sum_i \gamma_i \left(x_i \frac{X^i}{Y}\right) + \lambda \left(m \frac{M}{Y}\right) + DUM + \varepsilon \qquad (30)$$

where $\alpha^*$; $\beta^*$; $\gamma_i$; $\lambda$ are the parameters of Investment, Labor, Export and Intermediate Import variables respectively.

Equation (30) will be estimated with and without intermediate import variable for each country. The estimation is performed using time-series analysis to address the specific features of each country. In case that the country's exports need not be separated into industrial sub-sectors, $i$ is equal to 1. Dummies variables are carefully selected not to mix-up with the effects of intermediate import constraint caused by balance of payment deficit.[7] All regressions in this study are conducted using OLS method.

#### 2.4.2 Hypothesis and Meaning of the Variables

Estimations are to test the hypothesis that marginal productivity of export sector in ASEAN−4 is higher than in non-export sector and shifting resources from non-export sector to export sector (shown by the change of X/Y ratio over time) will positively contribute to economic growth. Parameter $\gamma$ includes two effects of exports: productivity differential effect; and externality effect. We expect $\gamma$ to be positive and significantly different from zero (0). As to the role of imports, imports contribute to

economic growth through imported intermediate inputs for production (including export production). Positive sign of import variable presents the existence of foreign exchange constraint for import of intermediate goods.

## 3 Data Description

The estimations are made basically using data from ASEAN−4 national statistical year books and Asian Development Bank's *Key Indicators* of various years. Labor variable is estimated using the data of employed labor force of each country. As to imports data, in Esfahani's study, he made an assumption that final goods comprise very small proportion of total imports of countries in question and the share of final goods in the imports of these countries has remained remarkably constant in the period under consideration since data for intermediate imports are not available. However, in the present study, since the time-series estimation covers a long period of time (from 1981 to 2004), this assumption may not be appropriate and thus may twist the result of estimation. To overcome this limitation, the data of intermediate imports have been obtained from the Asian International Input-Output Table (1985, 1995, 2000).[8] The data used to compute ratios are at current prices, while growth rates are computed using data at constant prices.

## 4 Result of Estimations

### 4.1 Specific features of ASEAN-4's Trade

#### 4.1.1 Export Composition

As discussed in section 2.4.1, exports will be divided into sub-sectors if necessary. Therefore, we need to look at the export composition of each country. Table 1 presents the export structure of four ASEAN countries, divided into three main groups: agricultural exports (Agr.), mining exports (Min.) and manufactured exports (Man.). The four countries possess the different export composition. Malaysia and the Philippines are the two countries that export of manufactured commodities occupies a large proportion from's up to recent years. Indonesia has a gradually increasing share of manufactured exports. Indonesian agricultural exports occupy less than 10% in total exports while mining exports holds a quite large portion.

Thailand witnesses a rapid expansion of manufactured export sector: from less than 40% in the early 80s to more than 80% in the recent years. Based on these features of export structure, country-specific specification will be needed in the estimation.

#### 4.1.2 Intra-Industry Trade

Intra-industry trade (IIT) index is originally designed to measure the horizontal IIT.[9] However, the increase of IIT index in a sector could also be brought by the increase of vertical IIT.[10] In the

**Table 1 Export composition of ASEAN-4**

**Unit: % of Total Export**

| | 1983 | | | 1996 | | | 2004 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Agr. | Min. | Man. | Agr. | Min. | Man. | Agr. | Min. | Man. |
| Indonesia | 4.7 | 89.8 | 5.6 | 9.2 | 31.9 | 58.9 | 12.5 | 29.4 | 58.1 |
| Malaysia | 15.6 | 25.2 | 59.1 | 7.4 | 8.2 | 84.4 | 6.1 | 11.7 | 82.2 |
| The Philippines | 19.1 | 14.9 | 66.0 | 6.8 | 2.2 | 91.0 | 3.9 | 1.3 | 94.8 |
| Thailand | 51.1 | 11.3 | 37.6 | 19.5 | 5.8 | 74.7 | 12.4 | 5.1 | 82.5 |

*Source: Author's calculation using ADB's Key Indicators and UN's Trade Statistic (SITC 1 digit).*

*Note: Agricultural exports include SITC 0, 1, 4; Mining exports include SITC 2,3; and Manufactured exports include SITC 5, 6, 7, 8 and 9*

scheme of globalization and trade liberalization, ASEAN countries, especially ASEAN-4 have become an important destination of FDI flows from Japan, Europe and the US. In the FDI export-oriented industries, spare parts are imported from parent companies and in the later stage of production chain, final products are exported again. ASEAN-4's export and FDI-oriented economies have been participated more and more actively to the international trade as being a part of the so-called global production chain. This fragmentation of production chain also makes IIT index to increase. ASEAN-4' increased role as a production and processing base is also evident in the high proportion of imports of intermediates and capital goods (Isogai, 2002).[11] Therefore, if IIT index of a country is high then intermediate imports might not be constraint. If IIT is low, it means that exports and imports are relatively independent commodities, and exports may play important role in gaining foreign exchanges (to pay) for imports. Although the theoretical base does not clearly bring up this statement, the empirical results and case-study may lead to this explanation. It would be therefore logical to take into account the level of intra-industry trade in ASEAN-4 economies.

Table 2 presents the Intra-Industry Trade Index (IIT) of four ASEAN countries. In each SITC 2 digits sector, IIT index increases within ASEAN-4. The Philippines and Malaysia have a quite high

**Table 2 Intra-Industry Trade Index - SITC 2 digit**

| Year | 1989 | 1996 | 2003 |
|---|---|---|---|
| Indonesia | 23.3 | 34.5 | 37.9 |
| The Philippines | 43.7 | 52.9 | 67.7 |
| Malaysia | 52.1 | 57.7 | 67.9 |
| Thailand | 40.1 | 47.7 | 54.2 |

*Source: Author's calculation based on United Nations' Trade Statistics*

*Note: 1. The Intra-Industry Index is calculated using the Aquino's Q Index[12](Isogai. 2002)*

*2. The index is computed by using the value of export commo-dities (SITC 2 digit) of each country and respective import value.*

index throughout the time, while Thailand have increasing index together with the increasing share of manufactured exports in total exports value. Compare to other three countries, Indonesia has rather low IIT index.

### 4.2 Country-Specific Equation and Result of Estimation

#### 4.2.1 Malaysia and the Philippines

Among four countries, Malaysia and the Philippines are two countries that have a large share of manufactured exports (SITC 5, 6, 7, 8 and 9 categories). Export value of manufactured products seems to determine the export performance of these two countries and export commodities seem to be rather concentrated. In the recent years more than 90% (the Philippines) and 80% (Malaysia) of total exports are manufactured products. Malaysia was chosen as an export base of home electrical appliances in the late 1970's by foreign investors and became a production center of home electrical appliance in the early 1980's (Hiratsuka 2005). For these two countries, equation (30) will be estimated with aggregate export variable. The regression model takes the form,

$$YGR = c + \alpha^{*} IYR + \beta^{*} LGR + \gamma XGRXY + \lambda MGRMY + DUM + \varepsilon. \quad (31)$$

Where, *YGR* is *GDP* growth rate; *IYR* is investment-*GDP* ratio; *LGR* is labor growth rate; *XGRXY* is export growth rate multiplied by export-*GDP* ratio; *MGRY* is intermediate import growth rate multiplied by intermediate import-*GDP* ratio and *DUM* is dummy variable. In case of Malaysia, *DUM1* for 1998 represents the effect of Asian financial crisis in the late 1990s and *DUM2* for 1985 addresses the effect of economic recession in early 1980s.[13] For the Philippines, *DUM1* for 1984 represents the impacts of the collapse of Marcos's Era. Table 3 presents the result of estimations for Malaysia and the Philippines.

The results indicate a strong presence of export externality and marginal factor productivity differential between export and non-export sectors in Malaysia and the Philippines. Country data have shown a gradual increase of the ratio between export and GDP (*X/Y*). In case of the Philippines, the ratio was 20 percent in the early 80's, 40 percent in the mid 90's and 50 percent in the recent years. The ratio of Malaysia is 60 percent, 90 percent and 120 percent respectively. It means that the shift of resources allocation from non-export sector to export sector, especially export of manufactured products would produce economic growth in these countries.

When intermediate import variable is incorporated in the model, export variables still stay significant while intermediate import variable does not appear to be significant. It may illustrate that these countries did not face foreign exchange constraints for import of intermediate inputs. In case of the Philippines, insignificant coefficients of investment and labor variables may tell us that exports plays a sole imperative role in promoting economic growth. Both economic recession in early 1980s and Asian financial crisis caused negative impacts to Malaysian economy. The breakdown of Marcos government also hit the Philippines' economy. We can accept the hypothesis that exports sector is

**Table 3 Regression Results of Malaysia and the Philippines**
**Dependent Variable: GDP growth rate-YGR**
**Sample period: 1981–2004**

| | Malaysia | | The Philippines | |
|---|---|---|---|---|
| Variable | Without import var. | With import var. | Without import var. | With import var. |
| C | −0.45 | −0.41 | −0.36 | −0.06 |
| | *(−0.29)* | *(−0.26)* | *(−0.13)* | *(−0.02)* |
| IYR | 0.11 | 0.10 | 0.12 | 0.09 |
| | *(2.22)* | *(2.11)*** | *(0.93)* | *(0.65)* |
| LGR | 0.81 | 0.83 | −0.06 | −0.03 |
| | *(2.76)*** | *(2.82)**** | *(−0.35)* | *−(0.19)* |
| XGRXY | 0.18 | 0.13 | 0.46 | 0.48 |
| | *(3.40)**** | *(1.82)** | *(3.88)**** | *(4.01)**** |
| MGRMY | | 0.08 | | 0.15 |
| | | *(0.83)* | | *(1.07)* |
| DUM1 | −12.6 | −13.6 | −9.89 | −9.05 |
| | *(−6.7)**** | *(−6.11)**** | *(−3.98)**** | *(−3.49***)* |
| DUM2 | −4.58 | −4.37 | | |
| | *(2.63)**** | *(−2.46)*** | | |
| Adj. R squared | 0.86 | 0.89 | 0.57 | 0.57 |
| D-W Statistics | 1.59 | 1.52 | 1.49 | 1.44 |

*Note: 1. ***, **, * indicate significance at the 1, 5 and 10 percent level, respectively*
*2. Numbers in parentheses are t-statistics*

more efficient; positively contributes to the economic growth by creating externality to non-export sector.

**4.2.2 Indonesia**

Indonesia seems to rely strongly on export of crude oil, which has held a large portion in total exports. Since the share of agricultural exports is not sizeable, export structure of Indonesia can be divided into two main groups: mining exports and non-mining exports (including manufactured and agricultural commodities). Dummy variable 1 for 1998 reflects the impacts of Asian financial crisis in the late 1990s. Dummy variable 2 for the years 1981, 1991, 2001 and 2003 addresses the impact of the years when oil price went up sharply. Oil revenue is an important part in total Indonesia government's revenue. High oil price considerably helps to increase government revenue and then government's expenditure. The government may therefore increase investment that positively contribute to economic growth[14] Equation (30) with $i=2$ (mining and non-mining exports) is estimated with and without import variable. The regression equation takes the form,

$$YGR = c + \alpha^{*} IYR + \beta^{*} LGR + \gamma_1 XGRXY\_MAN + \gamma_2 XGRXY\_NMAN + \lambda MGRMY + DUM1 + DUM2 + \varepsilon \quad (32)$$

Where, *XGRXY_MIN* is growth rate of mining exports multiplied by ratio of mining exports to

GDP and *XGRXY_NMIN* is similarly defined for non-mining exports.

Table 4 reports the result of estimations of Indonesia. Dummy variable 1 that reflects the impacts of Asian financial crisis appears negatively significant. Positively significant parameter of dummy variable 2 shows that high oil price brought about positive impact on the economy of Indonesia. We can observe that marginal factor productivity in export sectors both mining and non-mining products are higher than in non-export sectors. This may show that both mining and non-mining export sector positively contribute to economic growth of the country. Intermediate import variable when being incorporated into the model does not appear significantly, but has made non-mining export variable lose its significance. It demonstrates that Indonesia did not have to face foreign exchange constraint, and mining exports may have created large revenue to meet import demand.

**Table 4 Regression Result of Indonesia**
**Dependent Variable: GDP growth rate-YGR**
**Sample period: 1981-2004**

| Variable | Without import variable | With import |
|---|---|---|
| C | 2.68 | 2.60 |
| | *(0.58)* | *(0.53)* |
| IYR | 0.11 | 0.11 |
| | *(0.59)* | *(0.58)* |
| LGR | 0.19 | 0.19 |
| | *(1.09)* | *(1.05)* |
| XGRXY_MIN | 0.76 | 0.76 |
| | *(1.83)** | *(1.87)*** |
| XGRXY_NMIN | 0.30 | 0.32 |
| | *(1.88)** | *(0.96)* |
| MGRMY | | −0.03 |
| | | *(−0.07)* |
| DUM1 | −26.8 | −26.5 |
| | *(−6.21)**** | *(−4.45***)* |
| DUM2 | 4.91 | 5.00 |
| | *(1.87)** | *(1.60)* |
| Adjusted R squared | 0.80 | 0.79 |
| D-W Statistics | 2.16 | 2.18 |

*Note: 1. ***, **, * indicate significance at the 1, 5 and 10 percent level, respectively*
*2. Numbers in parentheses are t-statistics*

### 4.2.3 Thailand

As we can observe from table 1, Thailand has important agricultural export sector[15] in the early 80s, a small share of mining export sector and a rapid expanding manufactured export sector. In the regression equation of Thailand, exports variable is divided into manufactured and non-manufactured exports. Since the share of mining exports is very small, non-manufactured exports in fact includes a

majority of agricultural exports. The regression equation takes the form,

$$YGR = c + \alpha^{*} IYR + \beta^{*} LGR + \gamma_1 XGRXY\_MAN + \gamma_2 XGRXY\_NMAN + \lambda MGRMY + DUM + \varepsilon. \quad (33)$$

Dummy variable for 1998 addresses the impact of Asian financial crisis in the late 1990s'. Results of estimation for Thailand are reported in Table 5. Result of estimation of equation (33) without intermediate import variable has revealed that both two groups of export sector have higher marginal factor productivity compared to non-export sector. It might be possible to state that both manufactured and agricultural export sectors of Thailand are effective and positively contribute to economic growth of the country.

**Table 5 Regression Result of Thailand**
**Independent variable: GDP growth rate - YGR**
**Sample period: 1981–2004**

| Variable | Without import variable | With import |
|---|---|---|
| C | −0.05 | 0.41 |
| | *(−0.02)* | *(0.15)* |
| IYR | 0.24 | 0.22 |
| | *(3.71)*** | *(3.52)*** |
| LGR | −0.07 | −0.07 |
| | *(−1.04)* | *(−1.18)* |
| XGRXY_MAN | 0.30 | 0.20 |
| | (2.80)** | *(1.83)** |
| XGRXY_NMAN | 0.29 | 0.23 |
| | *(1.81)** | *(0.93)* |
| MGRMY | | 0.29 |
| | | *(1.17)* |
| DUM | −13.46 | −13.60 |
| | (−7.75)*** | *(−7.91)*** |
| Adjusted R squared | 0.80 | 0.80 |
| D-W Statistics | 1.66 | 1.62 |

*Note: 1. ***, **, * indicate significance at the 1, 5 and 10 percent level, respectively*
*2. Numbers in parentheses are t-statistics*

Agricultural exports, in spite of the gradually decreasing share in total exports, still significantly contribute to GDP growth. When intermediate import variable is added, manufactured export variable's parameter still stays significantly; non-manufactured export parameter loses significance but still appears positively. Insignificant intermediate import variable may illustrate that, similar to previous three countries, intermediate inputs of are not constraint.

#### 4.2.4 Summary of Result

Estimated results of the above four countries give strong support to the hypothesis that marginal productivities in export sectors are higher than in non-export sectors since the coefficient of export

variable is positive and significantly different from zero (0) in all countries' estimations. As to intermediate import variable, it appears to be insignificant in all cases, i.e., in no country imported intermediate inputs are constraint. This finding is different from the result of Esfahani (1991). In his cross-country analysis, import variable appears to be significant in all cases. It therefore raises the question on the specific features of ASEAN-4's exports that have made the situation of ASEAN−4 different from other developing countries.

In high-IIT-countries like Malaysia, the Philippines and Thailand, import of intermediate inputs is not constraint since majority of imports will be exported. In case of Indonesia, although IIT index is low, the country does not face import shortage because it has quite large and effective mining export sector that brings about important revenue to pay for import. High IIT index and large mining export sector may be the reasons that have helped ASEAN−4 not to face intermediate input constraint problem.

## 5 Conclusions

This study investigated the contribution of exports to economic growth of ASEAN−4 countries. The applied methodology is an extension of the model developed by Feder, Dawson and Esfahani. What makes this study different from previous ones is that the time-series analysis is applied to each separate country, taking into account the specific features of export structure of each country. Separate country-specific estimations demonstrated different level of contribution of exports to economic growth of ASEAN−4. Time series analysis also resulted in higher adjusted R square compared to time-series analysis conducted by Ram (1987).

The results demonstrated that ASEAN−4 exports positively contribute to economic growth. Marginal productivities were in fact higher in sub-sectors of major exported commodities because export markets tended to be more competitive and this lead to innovation and greater efficiency in resource use. Export sector had been more effective than non-export sector. The shift of resource from non-export sector to export sector that is reflected in increasing export-GDP ratio, had brought about economic growth of ASEAN−4. Export promotion policies in ASEAN−4 countries therefore made export sectors to create higher marginal productivity than non-export sector and to generate externality to non-export sectors.

The study also discovered that foreign exchange constraint for import of intermediate imports was not present in ASEAN−4. In high IIT economies (Malaysia, the Philippines and Thailand), import of intermediate inputs are not constraint because imported intermediate goods will be exported after processing. Indonesia has low IIT index but large mining export sector paid for imports.

## Notes

1 ASEAN-4: Indonesia, Malaysia, the Philippines and Thailand.

2 Since the study inherits the methodology developed by previous studies, the explanations in some parts are very close to the ones in original paper.

3 See Feder (1982) for more detailed manipulation.

4 The reason of applying this methodology is explained in more detail in section 4.

5 Esfahani (1991): this is a strong assumption since the degree of distortion may not be the same among inputs and across countries. However, to detect sectoral distortion while using aggregate data, one needs to make this or other similar assumption.

6 In the original paper, Esfahani (1991), the estimation equation includes also the variables that take into account the differences in export structure and development level of the countries in a cross-country analysis. Those variables in this single country analysis are not included.

7 The balance of payment in the years of dummy is checked so that the dummy will not takes care of balance of payment deficit.

8 From International I-O table, we can get the data of Intermediate input and GDP and thus can be able to compute the ratio of intermediate imports and GDP of the years 1985, 1995 and 2000. Since the data of GDP is available, we can estimate the value of intermediate imports for these three years. Then we use this estimated value of three years (1985, 1995 and 2000) to calculate the ratio between intermediate imports and total import value. Applying the ratio of 1985 for the period 1981–1989; of 1990 for the period 1990–1997 and of 2000 for the period 1998–2004, we can compute value of intermediate imports at current and constant price for the whole period of estimation (GDP and total imports data are available).

9 Horizontal IIT is viewed primarily as driven by economies of scale and occurs when products are differentiated (within similar qualities) and consumers express preferences for product variety (Helpman, 1981, 1987).

10 Balassa (1986) defines vertical IIT as an exchange between countries of intermediate goods at different stage of production or exchange involving components being exported for processing, with final good being imported. In this case, relative factor endowments are likely to be important. In case of ASEAN-4, FDI seems to be the main reason that contributes to increase IIT volume. FDI enterprises, that are under one big mother companies, are located in different ASEAN countries but still belong to one chain of production. Therefore, vertical IIT might be typical in case of ASEAN-4.

11 In Isogai's paper, East Asian economies refer to NIEs (Korea, Taiwan, Hong Kong, Singapore); ASEAN4 (Thailand, Malaysia, Philippines and Indonesia) and China.

12 Refer to Appendix for the definition of Aquino's Index.

13 The year 1985 is considered as the peak of economic recession.

14 National statistical data of Indonesia show that Government revenue (non tax revenue and/or oil and gas revenue) of the years 1981, 1991, 2001 and 2003 sharply increased compared to previous and following years.

15 Agricultural exports of Thailand include agricultural manufactured products such as processed foods, canned foods.

## Appendix

The Degree of intra-industry index is commonly measured by Grubel and Lloyd's. However, this measure subject to serious distortions, when a country's trade is not balanced, i.e., when exports and imports defer. Aquino's Index, which removes this distortion, is defined as follows:

$$Q=\left\{1-\frac{\sum_i |X_{ij}^c - M_{ij}^c|}{\sum_i (X_{ij}^c + M_{ij}^c)}\right\} x100$$

where $X_{ij}$ = Country $j$'s export of good $i$

$M_{ij}$ = Country $j$'s import of good $i$

and

$$X_{ij}^{e} = X_{ij} x \frac{\sum_{i}(X_{ij}+M_{ij})}{\sum_{i}(X_{ij}+X_{ij})}$$

$$M_{ij}^{e} = M_{ij} x \frac{\sum_{i}(X_{ij}+M_{ij})}{\sum_{i}(M_{ij}+M_{ij})}$$

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