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The effect of exports on economic growth: a case study of Thailand

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THE EFFECT OF EXPORTS ON ECONOMIC GROWTH: A CASE STUDY OF THAILAND

A THESIS
SUBMITTED TO THE FACULTY OF ATLANTA UNIVERSITY
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THE DEGREE OF MASTER OF ARTS

BY
SATIT RUNGKASIRI

DEPARTMENT OF ECONOMICS

ATLANTA, GEORGIA
MAY 1984
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A major goal of Thailand is to foster economic and social growth by promoting agricultural, industrial, commercial, and public utility development. The results of Economic and Social Development Plan,\(^1\) numbers one through three, show that the gross domestic product increased about seven percent annually between 1961 and 1976. In the first two years of the national economic and social development plan number four, 1977 to 1978, the gross domestic product increased 7.8 percent annually. The effect of the economic and social development plans, together with foreign demand, have led to the increase in production among various sectors of the economy. The growth of exports is probably the most significant.

Table 1 shows aggregate export value, the percentage rate of change in exports and exports as a percent of Gross National Product (GNP) from 1961 to 1980. The table indicates that exports constituted sixteen percent of GNP in 1960 and nineteen percent in 1980, and grew at an average annual rate of 15.25 percent between 1961 and 1980. Also from the table it is clear that the percent of GNP accounted for by exports is increasing over time. Table II shows exports by sectors for 1960 and later periods. Exports for agriculture were Baht\(^2\) 8,242 millions, while

---

\(^1\)Thailand has a five year period of economic and social development plan beginning in 1961.

\(^2\)Thailand's currency unit is Baht = 23.05 U. S. dollars at current rates.
industrial exports were Baht 172 million, and the mining exports were Baht eight millions. As a result of the expansion of the economic system between 1977 and 1978, the agricultural exports increased to approximately Baht 68775.5 million; the industrial exports increased to approximately Baht 32,498.5 million, and the mining exports increased to Baht 638.25 million. The export sector also generates employment. It has been estimated that there was an increase in employment from approximately 20,000 persons annually to about 75,000 persons or about five percent of the total labor force from 1961 to 1980. Also, the different sectors of exports: agricultural, industrial and mineral product, are linked to other sectors of the economy through forward and backward linkages. Exports also help maintain a positive trade balance as well as constitute a source of income for the government through export taxes and duties.

---


TABLE 1
EXPORTS ANNUAL, PERCENT CHANGE IN EXPORTS, AND ANNUAL EXPORT AS A PERCENT OF GNP

<table>
<thead>
<tr>
<th>Year</th>
<th>Export Value (Million Baht)</th>
<th>Percent Change of Exports</th>
<th>Exports (Percent of GNP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1961</td>
<td>9,997</td>
<td>16.1</td>
<td>0.17</td>
</tr>
<tr>
<td>1962</td>
<td>9,529</td>
<td>-4.68</td>
<td>0.15</td>
</tr>
<tr>
<td>1963</td>
<td>9,676</td>
<td>1.54</td>
<td>0.14</td>
</tr>
<tr>
<td>1964</td>
<td>12,339</td>
<td>27.52</td>
<td>0.16</td>
</tr>
<tr>
<td>1965</td>
<td>12,941</td>
<td>4.88</td>
<td>0.15</td>
</tr>
<tr>
<td>1966</td>
<td>14,099</td>
<td>8.95</td>
<td>0.14</td>
</tr>
<tr>
<td>1967</td>
<td>14,169</td>
<td>0.45</td>
<td>0.13</td>
</tr>
<tr>
<td>1968</td>
<td>13,679</td>
<td>-3.44</td>
<td>0.12</td>
</tr>
<tr>
<td>1969</td>
<td>14,709</td>
<td>7.53</td>
<td>0.11</td>
</tr>
<tr>
<td>1970</td>
<td>14,772</td>
<td>0.43</td>
<td>0.11</td>
</tr>
<tr>
<td>1971</td>
<td>17,275</td>
<td>16.94</td>
<td>0.12</td>
</tr>
<tr>
<td>1972</td>
<td>22,491</td>
<td>30.19</td>
<td>0.14</td>
</tr>
<tr>
<td>1973</td>
<td>32,226</td>
<td>43.28</td>
<td>0.15</td>
</tr>
<tr>
<td>1974</td>
<td>49,799</td>
<td>54.53</td>
<td>0.18</td>
</tr>
<tr>
<td>1975</td>
<td>45,007</td>
<td>-9.62</td>
<td>0.15</td>
</tr>
<tr>
<td>1976</td>
<td>60,797</td>
<td>35.08</td>
<td>0.18</td>
</tr>
<tr>
<td>1977</td>
<td>71,198</td>
<td>17.11</td>
<td>0.18</td>
</tr>
<tr>
<td>1978</td>
<td>83,058</td>
<td>16.66</td>
<td>0.18</td>
</tr>
<tr>
<td>1979</td>
<td>108,179</td>
<td>23.22</td>
<td>0.19</td>
</tr>
<tr>
<td>1980</td>
<td>133,197</td>
<td>18.78</td>
<td>0.19</td>
</tr>
<tr>
<td>Average (1961-1980)</td>
<td>15.25</td>
<td></td>
<td>0.15</td>
</tr>
<tr>
<td>Variance</td>
<td>16.37</td>
<td></td>
<td>0.25</td>
</tr>
</tbody>
</table>

TABLE 2
AVERAGE EXPORTS CLASSIFIED BY THE TYPE OF GOODS, 1960-1980

<table>
<thead>
<tr>
<th>Year</th>
<th>Agricultural Product (Million Baht)</th>
<th>Industrial Product (Million Baht)</th>
<th>Mines Product (Million Baht)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>8,242.00</td>
<td>171.00</td>
<td>8.00</td>
</tr>
<tr>
<td>1961-1966</td>
<td>10,504.00</td>
<td>603.00</td>
<td>27.67</td>
</tr>
<tr>
<td>1967-1971</td>
<td>11,639.00</td>
<td>2,631.00</td>
<td>89.00</td>
</tr>
<tr>
<td>1972-1976</td>
<td>31,152.00</td>
<td>9,475.00</td>
<td>491.00</td>
</tr>
<tr>
<td>1977-1980</td>
<td>68,775.50</td>
<td>32,498.25</td>
<td>638.25</td>
</tr>
</tbody>
</table>


Characteristic and Structure of Thailand's Export

Export of Agricultural Products 1962-1980

In the economic system of developing countries, income from export is an important source of foreign exchange and thus a major source of funds for the countries' development. The major exports of the developing countries like Thailand are agricultural products.

Agriculture contributed about thirty percent of GNP between 1962 and 1980 compared to eighteen percent contributed from industrial product. The rest of GNP was accounted for by services and other production.
The annual average expansion of agricultural exports is 13.24 percent using 1972 as a base. The ratio of agricultural output exported and the total exports during the period is 71.36 percent. This is due to the fact that agriculture is the most important sector of the economy and the agricultural labor is 73.7 percent of the total employed population over fifteen years old. Agricultural output exported fell from 91.82 percent of total exports between 1962 to 1966 to 78.31 percent between 1967 to 1971, and finally to 67.12 percent in 1972 to 1980. The government's policy is to diversify exports instead of depending solely on agriculture. This policy is aimed at reducing the effects of the uncertainties that characterize world primary commodity prices.

The Export of Industrial Products 1962-1980

The average annual rate of expansion of industrial product from 1962 to 1980 is 32.18 percent. The exports of industrial product is 18.69 percent of the total exports (second to agriculture), but in recent years it has played a more important role and has brought in higher income to the country. Due to government promotion and more favorable world market conditions, the exports of industrial products have risen to about 31.8 percent of total exports compared to a rise of only 15.71 percent between 1966 to 1970. Also, the share of industrial exports increased from Baht 276 in 1962 to Baht 26,394 in 1980. There is all indication that the sector will grow overtime as technology improves and world market prices are favorable.
Export of Mineral Products 1962-1980

The exports of minerals are less important in Thailand's economy than one normally finds in developing countries. The average annual rate of expansion of mineral products was 42.73 percent but it is only 0.69 percent of total exports. The significant minerals in Thailand include tin, tungsten and fluorite, but represent a small portion of gross domestic product compared to agriculture and industry.

Problem Statement

Since the Third National Economic and Social Development Plan, the country has experienced persistent deficits in its balance of payments. The production and exporting of goods can play an important role in solving Thailand's deficit problems. Despite this, research on the influence of gross exports and its impact on capital goods and domestic capital accumulation in Thailand has been neglected.

In Thailand, the major exports are agricultural, industrial and mineral products. Nobody has analyzed the impact of exports of these products on economic growth of Thailand. There is little information on the relative influences of these exports on aggregate economic growth.

With the recent recession in the world market triggered by high energy prices, there is renewed concern as to how the export sector in developing countries can be improved in order to contribute to the process of growth.

High prices discourage demand and therefore the export from developing countries may be diminished. Given that the importation of
capital goods and other goods for development are determined in part by the amount of foreign exchange generated through exports, there is need to analyze the structure of the export markets in order to predict the growth implications of future occurrences.

To the author's knowledge, no one has undertaken a study for Thailand that addresses these issues.

**Objectives**

The objectives of this study are as follows:

A. To investigate the relationship between exports and economic growth by examining the Harrod-Domar model with an open economy and the Chenery Two Gap Model;

B. To empirically test the implications of these models regarding the relationship between exports and economic growth as well as to investigate the relative importance of domestic investment and import of capital goods in the economic growth process;

C. To determine the extent to which these models are consistent with the empirical results; and

D. To examine the policy implications of the findings.
CHAPTER II
LITERATURE REVIEW

Various economists have studied the impact of exports on the economic development of countries. To the early classical economists (Mill, Smith, Richardo and others), goods in which a country has comparative advantage are exported. This contributes to the expansion of domestic production. Free trade leads to a world distribution of consumption that cannot be altered in any way so as to improve the welfare of all trading participants. On the other hand, the Marxian economists believe that international trade between the rich or the industrial countries and the underdeveloped countries will cause the poorer nations to become poorer and the rich industrial countries to become richer.

The Keynesian economists introduced the multiplier, accelerator principle to explain the export of goods and economic growth. According to this principle, the extent to which variations in exports influence variations in national product or national net product depends upon the international trade multiplier.

The Neo-Keynesian economists, led by Sir Roy Harrod and Evsay Domar, modified the Keynesian multiplier principle by introducing dynamic

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7Ibid., p. 337.
elements to explain economic expansion. Their method can be explained as follow: from the general Harrod-Domar growth model, the steady growth of income depends upon the marginal propensity to save and the marginal capital output ratio. Symbolically, this may be written as:

\[ G_w = \frac{S}{c} \] ................................. (1)

where, \[ G_w = \text{growth rate} = \frac{\Delta Y}{Y} \]
\[ S = \text{marginal propensity to save} \]
\[ c = \text{marginal capital-output ratio} = \frac{\Delta K}{\Delta Y} = I/\Delta Y. \]

When there is foreign trade, \( G_w \) would consist of two other components. These two components are exports (X) and imports (M). Now our basic equation will appear as a (2).

\[ G_w = \frac{1}{c} \left[ S - \frac{(X - M)}{Y} \right] \] ................................. (2)

where, \[ X = \text{total exports} \]
\[ M = \text{total imports} \]
\[ Y = \text{national income} \]

Equation 2 states that there is a negative relationship between the rate of growth of domestic product and the proportion of exports to total product.10

A similar conclusion can be drawn using the two-gap model developed by Chenery. This model postulates two limits to the amount of capital formation as specified by the following equation.

\[ I_t = \min \left( aM_t^k, bI_t^d \right) \] ................................. (3)

where, \[ M^K_t \] = Impact of capital goods during the time \( t \)
\[ I^d_t \] = Domestic investment resource measured by domestic capital formation during the time \( t \)

The one limit \( I_t = bI^d_t \) arises when there is insufficient domestic capital formation. Investment and growth are constrained by the limitation on domestic resources. The alternative limit to capital formation is the case where there is sufficient amount of domestic resources but an insufficient amount of capital goods import, namely, \( I = bM^K_t \). Here investment and growth are constrained by the limitation of foreign resources.

If we follow the first limit, \( I = I^d_t \), the final growth model we obtain is
\[
\frac{dY_t}{Y_t} = \frac{1}{g} (s + m - \frac{X_t}{Y_t}) \quad (4)
\]
which is identical to the results arrived by Harrod-Domar. On the other hand, if we follow the second limit, \( I = M^K_t \), the final growth model we obtain is opposite to the Harrod-Domar model. Using the regression equations above, Chenery also studied the relationship of domestic investment, capital formation and economic growth.

Recently, Voivodas has studied the role of export, the flow of capital from abroad and the economic growth of countries using the two-gap model. In Voivodas study, the growth of export and the growth of GNP are greatly related. The linkage medium is imported capital goods. Time series data were used in the analysis for the period 1956 and 1967. The study concerned twenty-two countries. The estimated of regression equation were the following:
\[
\frac{dQ}{Q} = a + b \frac{X}{Q} \quad (5)
\]
and

\[ \frac{M^k}{Y} = c + d \frac{X}{Y} \]  \hspace{1cm} (6)

Q = Gross domestic product

X = Export value

M^k = Import of capital good

The first equation shows a positive correlation between the export and output ratio and rate of growth. The second shows the effects of exports on imports of capital goods. Voivadas found that the positive relationship between exports and capital goods imports is strong enough to secure a positive influence of export on the overall rate of growth. He found the correlation between exports and growth to be .68 with a t-statistic of .40. Trade exercises a beneficial effect on growth through the ability of countries with high export receipts to import the capital goods necessary for development.

Olufemi Fujana\textsuperscript{12} has analyzed growth along similar lines as Harrod-Domar and Chenery. He studied the trade and the economic growth of Nigeria by using a two-gap model. He analyzed the relationship between export, foreign capital and the economic growth. He divided the export products into two kinds; the agricultural and petroleum products. This model may be written mathematically as follows:

\[ \frac{\Delta Y}{Y} = a + b \frac{\Delta X}{Y} \]  \hspace{1cm} (7)

\[ \frac{I_d}{Y} = c + d \frac{\Delta X}{Y} \]  \hspace{1cm} (8)

\[ \frac{M^k}{Y} = c + f \frac{\Delta X}{Y} \]  \hspace{1cm} (9)

where, \( \Delta Y \) = The changing total products of the country
\( Y \) = Total product of the country
\( X \) = Total export
\( \Delta X \) = The changing in export
\( Id \) = The resources consumed for domestic investment
\( Mk \) = The import of capital goods
\( Fv \) = Visible trade balance

He concluded that exports and the rate of economic growth of Nigeria are positively correlated, with the export variable being significant at the five percent level. About forty-seven percent of the variation in the growth rate of output is explained by the export output ratio with a t-statistic of 2.5. The linkage medium that constitutes the export and encourages the output were identified. These are the links between exports and the import of capital goods on the one hand, and the exports of domestic investment resources on the other. Fajana's test reveals that both links have been operative in Nigeria. Regression equation (8) shows a strong positive relationship between domestic investment resources and exports, with over forty percent of the variance in domestic capital formation explained by the regression. The coefficient of the exports variable is significant at the one percent level. Similarly, equation (9) indicates a positive relationship between capital goods imports and exports, and thirteen percent of capital good imports explained by the regression with a t-statistic of .08.
CHAPTER III
ESTIMATING REPRESENTATIVE EXPORT AND GROWTH MODEL FOR THAILAND

In this chapter we investigate two models in which the relationship between trade and growth is explicitly spelled out. We start with the open-economy Harrod-Domar model and continue with the two-gap model of Chenery. Our aim is to divest them from what is considered, for our purposes, expendable detail and to concentrate on the basic structural equations which will prove later to be amenable to empirical verification for Thailand. Since both models are structurally similar, we start with an exposition of the relationships contained in either model and then proceed to build them up separately.

Capacity output and the change in capital stock are related as shown in (1).

\[
dY_t = \frac{1}{g} \frac{I_t}{g}
\]  

where \(Y_t\) is capacity output in period \(t\), \(I_t = dK_t\) is the change in capital stock and \(g\) is the incremental capital-output ratio. The underlying relationship is the production function \(Q_t = \frac{(1)}{g} K_t\) in which it is assumed that capital and labor are employed in fixed proportions and there is always a sufficient amount of labor to ensure that it is not a significant constraint on output.

Savings are related to output and income through the savings function

\[
S_t = sY_t
\]

where \(S\) is the amount of total savings and \(s\) is the average marginal propensity to save. Besides the simplification of equal average and
marginal rate of savings, the above relationship of course ignores the
effects on saving of groups in the distribution of income as between
different groups in the economy.

Imports are related to output and income under a similarly simplified
import function:

\[ M_t = mY_t \]  .........................................................  (3)

where \( M \) is the total amount of imports of the economy and \( m \) is the
average and marginal propensity to import. We assume that imports are
solely for consumption purpose.

Exports are treated as endogenously given and their rate of growth
is assumed to depend on the rate of growth for foreign output and the
foreign income elasticity demand as follows:

\[ X_t = X_0 (1 + r)^t \]  .........................................................  (4)

where \( X \) is the amount of total exports and \( r \) their given rate of growth.

The two-gap model analysis concentrates on an investment function
in which both domestic and foreign capital goods enter in fixed proportions
as follows:

\[ I_t = \min (aI_t, bM_t^k) \]  .........................................................  (5)

where \( I_t \) stands for domestic investment resources and \( M_t \) for imports of
capital goods. Needless to say, this particular formulation is not the
only one relevant to the two-gap analysis. McKinnon (1964), for example,
introduced the fixed proportion element in the overall production function.

Both formulations stress the lack of substitution ability in produc-
tion between domestic and foreign resources. Our formulation is employed
here in order to make the distinction between the Harrod-Domar model with
an open economy and two-gap model stand out more clearly.
To complete the model we need to include equilibrium conditions and identities. Specifically, from the national accounting relationships
\[ y = c + I + x - m \] (where \( c = y - s \) is the total amount of consumption while government expenditures are not treated separately) we derive the equality:

\[ I_t - S_t = M_t - X_t \]  \hspace{1cm} (6)

The complete open economy Harrod-Domar model can be written as,

\[ \frac{dY_t}{Y_t} = \frac{1}{g} \frac{I_t}{Y_t} \]  \hspace{1cm} (1)

\[ S_t = sY_t \]  \hspace{1cm} (2)

\[ M_t = mY_t \]  \hspace{1cm} (3)

\[ X_t = X_0 (1 + r)^t \]  \hspace{1cm} (4)

\[ I_t - S_t = M_t = X_t \]  \hspace{1cm} (5)

Equations (5), (2) and (3) can be combined into:

\[ I_t = sY_t + mY_t - X_t \]  \hspace{1cm} (7)

Substitution of (7) into (1) and dividing both sides by \( Y_t \) we attain:

\[ \frac{dY_t}{Y_t} = \frac{1}{g} \left( s + m = \frac{X_t}{Y_t} \right) \]  \hspace{1cm} (8)

Equation (8) states that there is a negative relationship between the rate of growth of domestic product and the exports-output ratio. The result should not be surprising in view of the structural relationships envisaged in the model. Given that capital formation is the only source of growth, and that imports are solely for consumption purposes, it follows that exports and investment are variables competing for limited domestic resource. From equation (7), if GDP is constant at a period of time \( t \), export and domestic investment are negative correlated. Consequently, the rate of growth of domestic product and exports are negatively correlated.
We now turn to the two-gap model simplified to its bare essentials.

\[ dY_t = \frac{1}{g} I_t \] ......................... (1)

\[ S_t = sY_t \] ......................................... (2)

\[ M_t = mY_t \] ......................................... (3)

\[ X_t = X_0 (1 + r)^t \] ................................. (4)

\[ I = \min (aI_t^d, bM_t^k) \] ............................. (5)

\[ I_t - S_t = M_t - X_t \] ............................. (6)

\[ F_t = M_t - X_t \] .................................... (9)

\[ M_t - M_t^k + M_t^c \] ................................ (10)

\[ I_t = I_t^d + M_t^k \] ................................ (11)

where \( M_t \) is the total amount of consumer goods imports in period \( t \).

The essence of the model is the fact that it posulates two limits to the amount of capital formation as specified by equation (5). The one limit \( I = aI_t^d \) arises when there are sufficient capital goods imports but insufficient domestically produced capital goods. Investment and growth are constrained by the limitation on domestic resources. The alternative limit to capital formation is the case when there is sufficient amount of domestic resources but an insufficient amount of capital goods imports namely, \( I = bM_t^k \). Here investment and growth are constrained by the limitation of foreign resources.

As expected, the reduced form of the model differs according to whether the domestic or foreign resource constraint is operative: Equation (5) is replaced by \( I_t = aI_t^d \) and the reduced form the model becomes:

\[ \frac{dY_t}{Y_t} = \frac{1}{g} \left( s + m - X_t \right) \] ........................... (12)
which is identical to (8), the reduced from the open economy Harrod-Domar model. The implication of (12) is again a negative relationship between the proportion of exports to total product and its rate of growth.

This reduced form equation can be written as:

\[
\frac{dY_t}{Y_t} = \alpha_0 - \alpha_1 \frac{X_t}{Y_t}
\]

where, \( \alpha_0 = \frac{s + m}{g} \) and \( \alpha_1 = \frac{1}{g} \)

Since \( dY_t = \frac{1}{g} bI_t^d \), equation (12) can also be expressed as:

\[
\frac{I_t^d}{Y_t} = \gamma_0 - \gamma_1 \frac{X_t}{Y_t}
\]

where, \( \gamma_0 = \frac{s + m}{b} \) and \( \gamma_1 = \frac{1}{b} \)

Consider now the case when the foreign resource constraint is operative. Equation (5) is replaced by \( I_t = bM_t^k \) and the reduced form of the model becomes:

\[
\frac{dY_t}{Y_t} = \frac{1}{g} \left( \frac{X_t}{Y_t} - \frac{1}{g} \left( \frac{I_t - M_t^C}{Y_t} \right) \right)
\]

because \( M_t^k = F_t + X_t - M_t^C \)

Equation (15) specifies a positive relationship between the proportion of exports to total product and its rate of growth, the intermediate link being the positive relationship between exports and capital goods imports. The equation can be written as:

\[
\frac{dY_t}{Y_t} = \alpha_0 + \alpha_1 \frac{X_t}{Y_t}
\]

or \( \frac{M_t^k}{Y_t} = \gamma_0 + \gamma_1 \frac{X_t}{Y_t} \)

since \( dY_t = \frac{1}{g} aM_t^k \)
where, $\varphi_0 = s - m$ and $\varphi_1 = \frac{1}{g}$

$\psi_0 = s - m$ and $\psi_1 = \frac{1}{a}$

Our test of the trade-growth hypotheses for Thailand consists of the estimation of the reduced form equations as follows:

from (17) \[
\frac{dY_t}{Y_t} = \varphi_0 + \varphi_1 \frac{X_t}{Y_t} \]

where, $\varphi_0 = s + m$, $\varphi_1 = \frac{1}{g}$

This reduced form is to be statistically tested with Thailand data by dividing the production into the agricultural, industrial and mineral outputs. From equation (17) we may write,

\[
\frac{dY_t}{Y_t} = \beta_0 + \beta_1 \frac{X_{1t}}{Y_t} \] \hspace{2cm} (20)

\[
\frac{dY_t}{Y_t} = \xi_0 + \xi_1 \frac{X_{2t}}{Y_t} \] \hspace{2cm} (21)

\[
\frac{dY_t}{Y_t} = \tau_0 + \tau_1 \frac{X_{3t}}{Y_t} \] \hspace{2cm} (22)

where, $X_{1t} =$ agricultural product exported

$X_{2t} =$ industrial product exported

$X_{3t} =$ mineral product exported

If we bring the inflow of foreign capital to be related to equation (17), namely using the visible trade balance ($F_V$) and current balance ($F_C$), it will provide the comparative effect of foreign capital and export to the economic growth included in the regression equation of $dY$ with $dX$ and $F_V$ or $F_C$. Introducing the foreign factors, we may rewrite equation (15) as:

\[
\frac{dY_t}{Y_t} = \phi_0 + \phi_1 \frac{F_{vt}}{Y_t} + 2 \frac{X_t}{Y_t} \] \hspace{2cm} (23)
Later, consider the correlation between export with import of capital goods and export with domestic investment resources which is measured by domestic capital formation. It will provide:

\[ \frac{M_t}{Y_t} = \gamma_0 + \gamma_1 \frac{X_t}{Y_t} \quad \text{(from equation 18)} \]

\[ \frac{I_t^d}{Y_t} = \gamma_0 - \gamma_1 \frac{X_t}{Y_t} \quad \text{(from equation 14)} \]

In summary, we have derived in this section the reduced forms of what may be looked upon as three separate models, namely, the open economy Harrod-Domar model, the two-gap model when the domestic constraint is operative and finally, the two-gap model when foreign constraint is operative. The first two models imply a negative relationship of between proportion of exports to total product and its rate of growth, the intermediate link being the negative relationship between exports and domestic investment. The last model implies a positive relationship between the proportion of exports to total product and its rate of growth, the intermediate link being the positive relationship between exports and capital goods imports. Our next step is to put the above relationships under a statistical test with data obtained from Thailand and covering the period 1962 to 1980.

Hypotheses

In the previous section we have derived two testable hypotheses. The first one is the following:

\[ \frac{I_t^d}{Y_t} = \gamma_0 - \gamma_1 \frac{X_t}{Y_t} \quad \text{(from equation 14)} \]
and consequently,

\[
\frac{dY_t}{Y_t} = -\omega_0 - \omega_1 \frac{X_t}{Y_t} \quad \text{(from equation 17)}
\]

which says that if the open economy Harrod-Domar model and the two-gap model when the domestic constraint is operative, the first hypothesis will imply a negative relationship between exports-output ratio and economic growth, the intermediate link being the negative relationship between exports and domestic investment.

The second hypothesis is the following:

\[
\frac{M_t^k}{Y_t} = \psi_0 + \psi_1 \frac{X_t}{Y_t}
\]

and consequently,

\[
\frac{dY_t}{Y_t} = -\omega_0 + \omega_1 \frac{X_t}{Y_t}
\]

which says that if the two-gap model when foreign constraint is operative, the second hypothesis will imply a positive relationship between exports-output ratio and economic growth, the intermediate link being the positive relationship between exports and capital goods imports.

We proceed to test these alternative hypotheses with annual data from Thailand from 1962 to 1981 in Chapter IV.
CHAPTER IV
DATA, METHODOLOGY AND EMPIRICAL RESULTS

Data and Sources

Time series data were used in this study. Data on domestic product were obtained from various issues of "Thailand National Income" of the National Economics and Social Bureau and the measured at market prices from 1962 to 1981. The value of agricultural exports are obtained from trade by Commodity Group (SITC) Nos. 0, 1, 2, and 4. The value of industrial exports are obtained from SITC Nos. 6, 7, 8, and 9. The value of mineral product exports are obtained from SITC Nos. 3 and 5.

The total domestic capital formation or domestic investment resources is the difference between gross capital formation and the total import of capital good, namely tools, machinery, construction, equipments, electrical, scientific instruments and raw material used in the industrial factories. The visible trade balance at market prices is the difference between total export of goods and total imports of goods. The current account balance at market price is the difference between total exports of goods and services and total imports of goods and services.

Estimation and Results

Multiple linear regression methods were used in our estimation. The method was estimated in three stages. In the first stage, the the Harrod-Domar and the two-gap model were estimated. In the second stage, the adjusted form of the Harrod-Domar and the two-gap model were
estimated. In the third stage, the adjusted form of the first two stages with time lag are estimated.

Stage One Results

In the first stage, the Harrod-Domar with no modifications of the following form, were estimated.

\[
\frac{dY_t}{Y_t} = \gamma_0 + \gamma_1 \frac{X_t}{Y_t} \quad \text{(17 from Chapter III repeated)}
\]

\[
\frac{dY_t}{Y_t} = \beta_0 + \beta_1 \frac{X_t}{Y_t} \quad \text{(20 from Chapter III repeated)}
\]

\[
\frac{dY_t}{Y_t} = \tau_0 + \tau_1 \frac{X_t}{Y_t} \quad \text{(22 from Chapter III repeated)}
\]

\[
\frac{M_t}{Y_t} = \psi_0 + \psi_1 \frac{X_t}{Y_t} \quad \text{(18 from Chapter III repeated)}
\]

\[
\frac{I_t}{Y_t} = \gamma_0 + \gamma_1 \frac{X_t}{Y_t} \quad \text{(14 from Chapter III repeated)}
\]

The statistical results of this estimation are in Tables 3 and 4. The results, with standard error in parentheses, indicate a strong positive relationship between two variables for equations 17, 21 and 22 with the coefficient of the export variable being significant at the five percent level. About thirty-five percent to fifty percent of the variation in the growth rate of output is explained by the export-output ratio. Besides, all of the above mentioned equations are not autocorrelated. For equations 20, 18, and 14 there are not strong positive relationship between the exogenous variables and the endogenous variables and not statistically significant at conventional levels. About six
### TABLE 3

**REGRESSION RESULTS: IMPACT OF TOTAL AND VARIOUS TYPES OF EXPORTS ON ECONOMIC GROWTH BASED ON HARRISON-DOMAR AND CHENERY MODEL**

<table>
<thead>
<tr>
<th>Equation No.</th>
<th>Endogenous Variable</th>
<th>Constant Value</th>
<th>( \frac{X_t}{Y_t} )</th>
<th>( \frac{X_{1t}}{Y_t} )</th>
<th>( \frac{X_{2t}}{Y_t} )</th>
<th>( \frac{X_{3t}}{Y_t} )</th>
<th>F-Test</th>
<th>( R^2 )</th>
<th>DW</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>( \frac{\Delta Y_t}{Y_t} )</td>
<td>-0.5515</td>
<td>1.469</td>
<td>(2.988)**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>( \frac{\Delta Y_t}{Y_t} )</td>
<td>0.05333</td>
<td>0.5511</td>
<td>(1.0428)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>( \frac{\Delta Y_t}{Y_t} )</td>
<td>0.07054</td>
<td>1.6855</td>
<td>(3.3319)**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>( \frac{\Delta Y_t}{T_t} )</td>
<td>0.06712</td>
<td>50.6851</td>
<td>(4.2180)**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Calculation from Appendix Table 1.

Given the value in the brackets as:

* = The confidence interval of 90 percent
** = The confidence interval of 95 percent
*** = The confidence interval of 99.9 percent
TABLE 4
REGRESSION RESULTS: IMPACT OF TOTAL EXPORTS ON DOMESTIC AND FOREIGN CAPITAL FORMATION BASED ON HARROD-DOMAR AND CHENERY MODEL

<table>
<thead>
<tr>
<th>Equation No.</th>
<th>Endogenous Variable</th>
<th>Constant Value</th>
<th>$\frac{X_t}{Y_t}$</th>
<th>F-Test</th>
<th>$R^2$</th>
<th>DW</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>$I_d$</td>
<td>0.13278</td>
<td>0.04582</td>
<td>0.07917</td>
<td>0.46</td>
<td>1.48469***</td>
</tr>
<tr>
<td>14</td>
<td>$M_k$</td>
<td>0.08294</td>
<td>0.015806</td>
<td>1.07583</td>
<td>5.95</td>
<td>1.99***</td>
</tr>
</tbody>
</table>

Source: Calculation from Appendix Table 1.

* = The confidence interval of 90 percent
** = The confidence interval of 95 percent
*** = The confidence interval of 99.9 percent

percent of the variation in the growth rate of output is explained by the export of agricultural product exported and not more than five percent of the endogenous variables in equations 18 and 14 is explained by the exogenous variables.

Stage Two Results

The first stage empirical results are more consistent with the two-gap model with a foreign capital constraint. However, a methodological weakness of the empirical test is the failure to take the size of the economy and the rate of growth of products into account.13 Some products

---

are not highly important to the GDP but the rate of growth may be high and important to the rate of growth of the economy.

If the rate of growth of GDP is held to be dependent on the rate of growth of export, \( dX \), then the form of the function become:

\[
\frac{dY}{dX} = \phi_0 + \phi_1 \frac{dX}{Y} + \phi_2 \frac{dX}{Y} + \phi_3 \frac{F_{et}}{Y_t} + \phi_5 \frac{dX_{t}}{Y_t}
\]

(25)

\[
\frac{dY}{dX} = \phi_0 + \phi_1 \frac{dX}{Y} + \phi_2 \frac{dX}{Y} + \phi_3 \frac{F_{et}}{Y_t} + \phi_5 \frac{dX_{t}}{Y_t}
\]

(26)

where, \( dX \) = change of export to total product; then the estimated equations in this stage are as follows:

From (17) \( \frac{dY_t}{Y_t} = \phi_0 + \phi_1 \frac{dX_t}{Y_t} \) .......................... (26)

From (20) \( \frac{dY_t}{Y_t} = \phi_0 + \phi_1 \frac{dX_{1t}}{Y_t} \) .......................... (27)

From (21) \( \frac{dY_t}{Y_t} = \phi_0 + \phi_1 \frac{dX_{2t}}{Y_t} \) .......................... (28)

From (22) \( \frac{dY_t}{Y_t} = \phi_0 + \phi_1 \frac{dX_{3t}}{Y_t} \) .......................... (29)

From (18) \( \frac{I_t}{Y_t} = \phi_0 + \phi_1 \frac{dX_t}{Y_t} \) .......................... (30)

From (14) \( \frac{M_t}{Y_t} = \phi_0 + \phi_1 \frac{dX_t}{Y_t} \) .......................... (31)

From (23) \( \frac{dY_t}{Y} = \phi_0 + \phi_1 \frac{dX_{t}}{Y_t} + \phi_2 \frac{dX_{t}}{Y_t} + \phi_3 \frac{F_{ct}}{Y_t} + \phi_5 \frac{dX_{t}}{Y_t} \) .......................... (32)

From (24) \( \frac{dY_t}{Y} = \phi_0 + \phi_1 \frac{dX_{t}}{Y_t} + \phi_2 \frac{dX_{t}}{Y_t} + \phi_3 \frac{F_{ct}}{Y_t} + \phi_5 \frac{dX_{t}}{Y_t} \) .......................... (33)

Results are summarized in Tables 5, 6 and 7. The results show that equation nos. 26, 27 and 28 have strong positive relationship between

TABLE 5
REGRESSION RESULTS: IMPACT OF TOTAL AND VARIOUS TYPES OF ECONOMIC GROWTH USING ADJUSTED MODELS NO. 1

<table>
<thead>
<tr>
<th>Equation No.</th>
<th>Endogenous Variable</th>
<th>Constant Value</th>
<th>$\frac{dX_t}{Y_t}$</th>
<th>$\frac{dX_{1t}}{Y_t}$</th>
<th>$\frac{dX_{2t}}{Y_t}$</th>
<th>$\frac{dX_{3t}}{Y_t}$</th>
<th>F-Test</th>
<th>$R^2$</th>
<th>DW</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>$dY_t/Y_t$</td>
<td>0.08558</td>
<td>1.72695 (4.1500)***</td>
<td></td>
<td></td>
<td></td>
<td>17.22305***</td>
<td>50.36</td>
<td>1.99***</td>
</tr>
<tr>
<td>27</td>
<td>$dY_t/Y_t$</td>
<td>0.10451</td>
<td></td>
<td>0.8574 (2.615)**</td>
<td></td>
<td></td>
<td>16.83952***</td>
<td>68.69</td>
<td>1.45***</td>
</tr>
<tr>
<td>28</td>
<td>$dY_t/Y_t$</td>
<td>0.07782</td>
<td></td>
<td></td>
<td>5.966 (4.7114)***</td>
<td></td>
<td>22.19763***</td>
<td>56.63</td>
<td>1.454***</td>
</tr>
<tr>
<td>29</td>
<td>$dY_t/Y_t$</td>
<td>0.10915</td>
<td></td>
<td></td>
<td></td>
<td>55.282 (2.378)*</td>
<td>5.65511</td>
<td>24.96</td>
<td>1.036</td>
</tr>
</tbody>
</table>

Source: Calculation from Appendix Table 1.

* = The confidence interval of 90 percent

** = The confidence interval of 95 percent

*** = The confidence interval of 99.9 percent
TABLE 6
REGRESSION RESULTS: IMPACT OF TOTAL EXPORTS ON CAPITAL FORMATION USING ADJUSTED MODEL NO. 1

<table>
<thead>
<tr>
<th>Equation No.</th>
<th>Endogenous Variable</th>
<th>Constant Value</th>
<th>( \frac{dX_t}{Y_t} )</th>
<th>F-Test</th>
<th>( R^2 )</th>
<th>DW</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>Id ( \bar{V}_t )</td>
<td>0.14089 (23.6129)</td>
<td>-0.0553 (-0.27267)*</td>
<td>0.07435</td>
<td>0.43</td>
<td>1.38**</td>
</tr>
<tr>
<td>30</td>
<td>Mk ( \bar{V}_t )</td>
<td>0.09936 (19.65)</td>
<td>0.3858 (2.24)</td>
<td>5.038**</td>
<td>22.86</td>
<td>1.52***</td>
</tr>
</tbody>
</table>

Source: Calculation from Appendix Table I.

* = The confidence interval of 90 percent
** = The confidence interval of 95 percent
*** = The confidence interval of 99.9 percent

change of export and growth, with between fifty to fifty-seven percent of the economic change of growth explained by the regression. The coefficient of export variable is significant at the five percent level.
### TABLE 7

REGRESSION RESULTS: TRADE BALANCE, CURRENT TRADE BALANCE, AND PERCENT CHANGE IN EXPORTS ON ECONOMIC GROWTH USING ADJUSTED MODEL NO. 1

<table>
<thead>
<tr>
<th>Equation No.</th>
<th>Endogenous Variable</th>
<th>Constant Value</th>
<th>$F_r^Y_{t}$</th>
<th>$F_c^Y_{t}$</th>
<th>$dX_t^Y_{t}$</th>
<th>F-Test</th>
<th>$R^2$</th>
<th>DW</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>$\frac{dY_t}{Y_t}$</td>
<td>0.0892 (5.014)</td>
<td>0.0551 (.2879)</td>
<td>1.678 (3.65039)**</td>
<td>8.18840**</td>
<td>50.58</td>
<td>2.015***</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>$\frac{dY_t}{Y_t}$</td>
<td>0.0917 (5.513)</td>
<td>0.1834 (0.5590)</td>
<td>1.6218 (3.49087)**</td>
<td>8.41958***</td>
<td>51.27</td>
<td>2.05***</td>
<td></td>
</tr>
</tbody>
</table>

Source: Calculation from Appendix Table 1.

* = The confidence interval of 90 percent  
** = The confidence interval of 95 percent  
*** = The confidence interval of 99.9 percent
Stage Three Results

In this stage the basic Harrod-Domar and two-gap model and the adjusted model in the first two stages were modified by specifying a one period lagged impact of the exogenous variables and endogenous variables. Because we suspect that adjustments are not instantaneous, there are a large number of equations, some of these results are in the appendix Nos. II through IX. Only a few important equations are reported. Based on the reported results, the exogenous variables are highly significantly correlated with the endogenous variables at a five percent level.

From the result of the Harrod-Domar and Chenery and adjusted models as described above, it would appear that some exogenous variables and endogenous variables are statistically not highly significantly correlated and can not explain a reasonable correlation. Considering T-test, F-test, R^2 and DW, the result of the mentioned calculation will consider selecting the statistically highly significantly exogenous variable and eliminate the low statistically insignificant variables from the about sixty equations calculated. Our test of the hypothesis will be based on the variable by observing the reasonable truth of Thailand.

Model

The final equations we used in analyzing our objective will be as follows:

\[
\frac{dY_t}{Y_t} = \alpha + \beta \frac{dY_t}{Y_t} \quad \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots
\[
\frac{dY_t}{Y_t} = \alpha_1 + \beta_1 \frac{X_t}{Y_t} \tag{2}
\]

Agricultural output export:
\[
\frac{dY_t}{Y_t} = \alpha_2 + \beta_2 \frac{X_{1t}}{Y_t} \tag{3}
\]
\[
\frac{dY_t}{Y_t} = \alpha_3 + \beta_3 \frac{X_{1t}}{Y_t} \tag{4}
\]

Industrial product export:
\[
\frac{dY_t}{Y_t} = \alpha_4 + \beta_4 \frac{X_{2t}}{Y_t} \tag{5}
\]
\[
\frac{dY_t}{Y_t} = \alpha_5 + \beta_5 \frac{X_{2t}}{Y_t} \tag{6}
\]

Mineral product export:
\[
\frac{dY_t}{Y_t} = \alpha_6 + \beta_6 \frac{X_{3t}}{Y_t} \tag{7}
\]
\[
\frac{dY_t}{Y_t} = \alpha_7 + \beta_7 \frac{X_{3t}}{Y_t} \tag{8}
\]

The import of capital goods:
\[
\frac{dY_t}{Y_t} = \alpha_8 + \beta_8 \frac{M^k_t}{Y_t} \tag{9}
\]
\[
\frac{M^k_t}{Y_{t-1}} = \alpha_9 + \beta_9 \frac{dX_{t-1}}{Y_{t-1}} \tag{10}
\]

The domestic capital formation:
\[
\frac{dY_t}{Y_t} = \alpha_{10} + \beta_{10} \frac{I^d_t}{Y_t} \tag{11}
\]
\[
\frac{I^d_t}{Y_{t-1}} = \alpha_{11} + \beta_{11} \frac{dX_{t-1}}{Y_{t-1}} \tag{12}
\]

The inflow of foreign capital:
\[
\frac{dX_t}{Y_t} = \alpha_{12} + \beta_{12} \frac{F_V}{Y_t} \frac{dX_t}{Y_t} \tag{13}
\]
\[
\frac{dX_t}{Y_t} = \beta_{13} \frac{F_c}{Y_t} + \gamma_2 \frac{dX_t}{Y_t}
\] (14)

The change of gross export value:

\[
dY_t = \beta_{14} dX_t - 1
\] (15)

Equation 1 means that the rate of growth of domestic production is a function of the ratio between the change of gross export value per year with the domestic output value in the same period.

Equation 2 means the rate of growth of domestic products is a function of export ratio divided by the domestic output during the same period.

Equation 3 means the rate of growth of domestic product as a function of the rate of change of agricultural export value and the domestic value in the same period.

Equation 4 means the rate of growth of domestic product as a function of the ratio of agricultural product export value divided by the domestic product value during the same time.

Equation 5 means the rate of growth of the domestic product as a function of the rate between the change of industrial product export value divided by the domestic product value during the same period.

Equation 6 means the rate of growth of domestic product as a function of ratio of industrial product export value against the domestic product value during the same period.

Equation 7 means the rate of growth of domestic output as a function of the rate between the change of mineral output export value against the domestic output value in the same period.
Equation 8 means the rate of growth of domestic output as a function of the ratio of the mineral output export value against the domestic output in the same period.

Equation 9 means the rate of growth of domestic output as a function of the rate of the import value of capital goods against the domestic output value during the same period.

Equation 10 means the rate of the import value of capital goods in that period against the domestic output value in the former period as a function of the rate of gross export value changed against the domestic output value in the last period as well.

Equation 11 means the rate of growth of domestic output as a function of the rate of domestic capital formation value against the domestic output value during the same period.

Equation 12 means the rate of domestic capital formation value in that period against the domestic product value in the former period as a function of the rate of change in gross export value against the domestic product value in the last period as well.

Equation 13 means the rate of growth of domestic product as a function of the rate of visible trade balance against the domestic product value during the same period and the rate of change in gross export value against the domestic product value in the same period.

Equation 14 means the rate of growth of domestic product as a function of the rate between the current account balance against the domestic product in the same period and the rate of change in export value against the domestic product value in the same period.
Equation 15 means the change of domestic product value as a function of the change in gross export value in the last period.

Correlation analysis, showing the relationship between exports, the rate of domestic product, domestic capital formation and the import of capital goods, was used to explain the effect of growth on GDP. Statistical tests for significance were used to determine the importance of variables in explaining the growth in Thailand.
CHAPTER V
STATISTICAL RESULTS

The results of final equations estimated in this model are shown in Tables 8, 9, 10 and 11. Based on these results, each equation can be classified as the analysis as follows:

1) The result of gross export was shown in equations 1, 2 and 15. The rate of growth of domestic outputs of each year is depended on the value of gross export of each year.

The rate of growth of gross domestic product varies in the same direction of the rate of change in export value of the same period. The two variables are positively correlated, that is when the rate of change in export value is increased, the rate of growth of gross domestic products will also increase. Based on the estimated statistics, this variable is statistically significant at the one percent level. About fifty percent ($R^2 = 50.36$) of the rate of growth of gross domestic products can be explained by the rate of change in export value in the same period and does not cause an auto-correlation ($DW = 1.99$). This result is consistent with the rate of change in export value is significantly affected by the rate of economic growth of the country.

Equation (2) gives the results of the empirical test of the relationship between the growth of product (GDP) and exports. These results, with standard error in parentheses, indicate a strong positive relationship between the two variables with the coefficient of the export variable being significant at the five percent level. About thirty-four percent
of the variation in the growth rate of GDP is explained by the export-output ratio. This is in accordance with the second hypothesis that the ratio of export value is significantly affected by the rate of the country's economic growth as well.

The change of total domestic product value in that period from equation 15 will be affected by the change of export value of the previous year (the correlation between the variables is positive). The t-value is significant at five percent level. The change of value of the country's total domestic products in that period can be explained by the change in exports of the previous year. About thirty-four percent of the variation in change of domestic products is explained by the change of previous year exported ($R^2 = 33.79$). It is because most of the exported products and the domestic production structure are the agricultural primary goods (see Table 3 and 7) of which the production situation of the agricultural product is depended on the price of the previous year and do not cause an auto-correlation ($DW = 1.8$). But this form of testing will be biased because it is not concerned with the size of the economy.

2) The agricultural product exports which are correlated to the rate of growth of product, as in equation 3 and 4, has shown that the rate of domestic product growth and the rate of change in exports value of agricultural product in the same period is correlated in the same direction because the rate of domestic product growth and the rate of change in exports per year against the domestic product in the same period are statistically positively significant at five percent level.
About sixty-nine percent ($R^2 = 68.69$) of the rate of domestic output growth can be explained by the rate of change in agricultural product exports of the same period and does not cause an auto-correlation ($DW = 1.45$). But the correlation between the rate of domestic product growth and the ratio of agricultural product exports against the domestic product value in the same period is not statistically significantly correlated (t-value) at the lower rate of ninety percent and can explain the rate of the domestic product growth only 6.01 percent.

3) The industrial product exports have affected the rate of growth of domestic products as shown in equations 5 and 6, appears that the rate of growth of domestic products and the rate of change in industrial product export value per year are significantly at the one percent level. It is 56.63 percent ($R^2 = 56.63$) of the rate of growth of domestic products and can be explained by the rate of change in industrial product export value against the domestic product value in the same period. The correlation between the rate of growth of domestic product and the ratio of industrial product exports value against the domestic output value is also in the same direction. This correlation of t-value correlate at the one percent level of about forty percent ($R^2 = 39.9$) of the rate of growth of domestic product can be explained by the ratio of industrial product export value in the same period and do not cause an auto-correlation ($DW = 1.42$).

4) The mineral product exports have affected the rate of growth of domestic product as shown in equations 7 and 8. The rate of change in mineral product exports and the rate of growth of domestic product in the same period are not significantly correlated at ninety percent
of confident interval. The rate of growth can be explained by the rate of change in mineral product export value against the domestic product value of the same period by only about twenty-five percent. For the rate of growth of domestic product and the ratio of mineral product exported against the domestic product, which is in the same direction correlated, such as the rate of growth of domestic product and the ratio of mineral product export value against the domestic product value in the same period, t-value is positively correlated statistically at the one percent level and about fifty percent (49.19) of the rate of growth of domestic product is explained by the ratio of mineral product export value in the same period and does not cause an auto-correlation (DW = 1.6043).

5) The results of foreign capital inflow, the visible trade balance and current account balance, is shown in Table 10 as equation 13 and 14 that is positively correlated with economic's growth in Thailand. But the coefficient of foreign capital has a small value and is not statistically significant at one percent level. When comparing to equations 1, 13 and 14, it is shown that the foreign capital variable has only a small effect on the $R^2$ value which will indicate that the foreign capital has played the second most important role from export in encouraging the rate of growth of product. And in Thailand, the rate of change in export value per year is more affected by the rate of growth of product than by the increment of foreign capital inflow.

Next, when we consider the domestic capital formation as resources which are domestically consumed and the import of capital goods which
are correlated to the rate of growth of domestic product as equations 9 and 11, it appears that the domestic capital formation is greatly positive correlated with the rate of growth of domestic product. Therefore, when the rate of value of domestic capital formation has increased, the rate of growth of total domestic product will increase. This correlation when seen from the t-value is statistically at the one percent level. About eighty-three percent ($R^2 = 82.36$) of the rate of growth of domestic product can be explained by the rate of value of domestic capital formation. For the value of foreign capital goods imported, it is positively correlated with the rate of growth of domestic product as well. When the value of foreign capital product import has increased, the rate of growth of total domestic product will increase. This correlation, when examined from the t-value, is statistically at the one percent level. And about fifty-eight percent ($R^2 = 58.40$) of the rate of growth of domestic product is explained by the value of foreign capital goods import, and it has shown that the import of foreign capital goods is an explanation of the variable of the rate of growth of domestic product which is less than the domestic capital formation. When examined from the $R^2$ value, the domestic capital formation has a higher affect on the rate of growth of domestic product than on the import of foreign capital goods for the case of Thailand.

6) The link between the export and the import of capital goods and the export with domestic capital formation as equations 10 and 12 have shown the greatly positive correlation between the rate of change in export and domestic capital formation at the confidence level of ninety-nine percent and about thirty-two percent ($R^2 = 31.62$) of the rate of
domestic capital formation against the total domestic product value in the previous years is explained by the rate of change in export in the previous years as well as prevent an auto-correlation (DW = 2.0795).

For the import of foreign capital goods, it shows the positive correlation with the rate of change in export and is a t-value. at the ten percent level. About thirteen percent ($R^2 = 13.08$) of the rate of foreign capital goods import value against the domestic product value in the previous year can explained by the rate of change in export value per year and of the previous year as well. That is the export will be more affected by the domestic capital formation than by the import of foreign capital goods.

There are some remarks from the analysis that the rate of change in export value will help accelerate the rate of economic expansion of the country and, in the meantime, if the ratio of export value against the domestic product is high, the rate of economic expansion of the country will increase as well; but the result of the rate of change in export value will be more affected by the rate of growth of the country's economy than by the ratio of gross export value against the domestic product value. The factor which encourages linkage of export is the import of capital goods and domestic capital formation. For Thailand, the domestic capital formation is greatly correlated by the result which has shown that the trend of export which affected the rate of economic growth is more than the foreign capital inflow. In exporting each kind of product, it appears that mineral product export value is more affected by the rate of growth of product than other kinds of products.
# TABLE 8

**REGRESSION RESULTS: IMPACT OF EXPORT AND VARIOUS TYPES OF EXPORTS ON ECONOMIC GROWTH**

<table>
<thead>
<tr>
<th>Equation No.</th>
<th>Endogenous Variable</th>
<th>Constant Value</th>
<th>$\frac{dX_t}{Y_t}$</th>
<th>$\frac{dX_{1t}}{Y_t}$</th>
<th>$\frac{dX_{2t}}{Y_t}$</th>
<th>$\frac{dX_{3t}}{Y_t}$</th>
<th>$dX_{t-1}$</th>
<th>F-Test</th>
<th>$R^2$</th>
<th>DW</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$dY_t/Y_t$</td>
<td>0.08558</td>
<td>1.72695</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17.22305***</td>
<td>50.36</td>
<td>1.99**</td>
</tr>
<tr>
<td>3</td>
<td>$dY_t/Y_t$</td>
<td>0.10451</td>
<td>0.8574</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16.83592***</td>
<td>68.69</td>
<td>1.455***</td>
</tr>
<tr>
<td>5</td>
<td>$dY_t/Y_t$</td>
<td>0.07782</td>
<td></td>
<td>5.966</td>
<td></td>
<td></td>
<td></td>
<td>22.19763***</td>
<td>56.63</td>
<td>1.454***</td>
</tr>
<tr>
<td>7</td>
<td>$dY_t/Y_t$</td>
<td>0.10915</td>
<td></td>
<td></td>
<td>55.282</td>
<td></td>
<td></td>
<td>5.65511*</td>
<td>24.96</td>
<td>1.036</td>
</tr>
<tr>
<td>15</td>
<td>$dY_t$</td>
<td>15152.62</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.89</td>
<td>7.318**</td>
<td>32.79</td>
</tr>
</tbody>
</table>

Source: Calculation from Appendix Table 1.

* = The confidence interval of 90 percent

** = The confidence interval of 95 percent

*** = The confidence interval of 99.9 percent
TABLE 9

REGRESSION RESULTS: IMPACT OF EXPORT-OUTPUT RATIO AND VARIOUS TYPES OF EXPORT-OUTPUT RATIO ON ECONOMIC GROWTH

<table>
<thead>
<tr>
<th>Equation No.</th>
<th>Endogenous Variable</th>
<th>Constant Value</th>
<th>$X_t$</th>
<th>$X_{1t}$</th>
<th>$X_{2t}$</th>
<th>$X_{3t}$</th>
<th>F-Test</th>
<th>R²</th>
<th>DW</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>$\frac{dY_t}{Y_t}$</td>
<td>-0.05515</td>
<td>1.469 (2.988)***</td>
<td></td>
<td></td>
<td></td>
<td>8.93023***</td>
<td>34.44</td>
<td>1.37005***</td>
</tr>
<tr>
<td>4</td>
<td>$\frac{dY_t}{Y_t}$</td>
<td>0.05333</td>
<td></td>
<td>0.5511 (1.0428)**</td>
<td></td>
<td></td>
<td>1.08</td>
<td>6.01</td>
<td>1.03899</td>
</tr>
<tr>
<td>6</td>
<td>$\frac{dY_t}{Y_t}$</td>
<td>0.07054</td>
<td></td>
<td></td>
<td>1.6855 (3.9438)***</td>
<td></td>
<td>11.10172***</td>
<td>39.50</td>
<td>1.42718***</td>
</tr>
<tr>
<td>8</td>
<td>$\frac{dY_t}{Y_t}$</td>
<td>0.06712</td>
<td></td>
<td></td>
<td></td>
<td>50.6851 (4.2180)***</td>
<td>16.40675***</td>
<td>49.19</td>
<td>1.6043***</td>
</tr>
</tbody>
</table>

Source: Calculation from Appendix Table 1.

* = The confidence interval of 90 percent

** = The confidence interval of 95 percent

*** = The confidence interval of 99.9 percent


### TABLE 10

**REGRESSION RESULTS: DOMESTIC CAPITAL FORMATION, IMPORT OF CAPITAL GOODS, AND INFLOW OF FOREIGN CAPITAL ON ECONOMIC GROWTH**

<table>
<thead>
<tr>
<th>Equation No.</th>
<th>Endogenous Variable</th>
<th>Constant Value</th>
<th>$dY_t/Y_t$</th>
<th>$M_t^k$</th>
<th>$F_v$</th>
<th>$dX_t$</th>
<th>$F_c$</th>
<th>F-Test</th>
<th>$R^2$</th>
<th>DW</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>$dY_t$</td>
<td>11.1386</td>
<td>68.5066</td>
<td>(8.516)**</td>
<td></td>
<td></td>
<td></td>
<td>72.519***</td>
<td>82.861</td>
<td>1.99054***</td>
</tr>
<tr>
<td>11</td>
<td>$dY_t$</td>
<td>-2.274022</td>
<td>0.2420884</td>
<td>(4.5884836)**</td>
<td></td>
<td></td>
<td></td>
<td>21.057***</td>
<td>58.4</td>
<td>2.33925***</td>
</tr>
<tr>
<td>13</td>
<td>$dY_t$</td>
<td>0.0892</td>
<td>0.0551</td>
<td>(0.2879)</td>
<td>1.678</td>
<td>(3.65039)**</td>
<td>8.18840***</td>
<td>50.58</td>
<td>2.015***</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>$dY_t$</td>
<td>0.0917</td>
<td>1.6218</td>
<td>(3.49087)**</td>
<td>0.1834</td>
<td>(0.5590)</td>
<td>8.41958***</td>
<td>51.27</td>
<td>2.05***</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Calculation from Appendix Table 1.*

* = The confidence interval of 90 percent
** = The confidence interval of 95 percent
*** = The confidence interval of 99.9 percent
### TABLE 11

**REGRESSION RESULTS: EXPORT-OUTPUT RATIO ON DOMESTIC INVESTMENT AND IMPORT OF CAPITAL GOODS**

<table>
<thead>
<tr>
<th>Equation No.</th>
<th>Endogenous Variable</th>
<th>Constant Value</th>
<th>dX_{t-1} \sqrt{V_{t-1}}</th>
<th>F-Test</th>
<th>R^2</th>
<th>DW</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>I^d_t \sqrt{V_{t-1}}</td>
<td>0.891</td>
<td>18.502 (2.633)***</td>
<td>6.94**</td>
<td>31.61</td>
<td>2.0795***</td>
</tr>
<tr>
<td>12</td>
<td>K_t \sqrt{M_{t-1}}</td>
<td>0.112</td>
<td>0.252 (1.5)*</td>
<td>2.258</td>
<td>13.08</td>
<td>0.908</td>
</tr>
</tbody>
</table>

Source: Calculation from Appendix Table 1.

* = The confidence interval of 90 percent

** = The confidence interval of 95 percent

*** = The confidence interval of 99.9 percent
CHAPTER VI

SUMMARY

Conclusion and Recommendation

Export is one of the various factors which affects the rate of economic growth of a country. This has been the view of the economists over time for the Classical until the present day. However, modern view differs in exports may be an accelerator, causing the economic growth or reducing it, and depends on the economic structure of each country, including the kind and sort of export as well. For Thailand, the trend of exports expanded in the rate of 15.25 percent; the expansion rate of agricultural exports is 13.24 percent; the industrial 32.18 percent and the mineral 42.73 percent or the total export is fifteen percent of domestic product (during 1962 to 1980).

In this study, the Harrod-Domar and two-gap model of Chenery were adopted to a study of Thailand's exports and economic growth for the period 1962 to 1980. We empirically test the implications of these models regarding the relationship between exports and economic growth as well as to investigate the relative importance of domestic investment and import of capital goods in the economic growth process. We have derived two testable hypotheses that if the open economy Harrod-Domar model and a two-gap model when the domestic constraint is operative, they imply a negative relationship between the proportion of exports to the total product and its rate of growth. The intermediate link being the negative relationship between export and domestic investment.
If a two-gap model, when the foreign capital constraint is operative, the model implies a positive relationship between proportion of exports to total product and its rate of growth, the intermediate link being the positive relationship between exports and import of capital goods.

Generally, our results indicate a positive and strong relationship between export and output changes and hence provide empirical support for the thesis that trade has been an important factor in Thailand's growth. The possible links through which exports can exert their stimulation effect on output were examined: the importation of capital goods and the induced change in domestic investment resource. For Thailand, the former was found to be the stronger link by using original model of Harrod-Domar and Chenery. The latter was found to be the stronger link if we use time lag for one period.

The policy implications of these results are obvious: a plan for sustained expansion of exports should form part of the country's strategy for achieving rapid economic growth. Although the evidence presented in this paper indicates tentatively that the impact of mineral and industrial exports on economic growth may have been stronger than that of agricultural exports. Trade expansion of the exports of agricultural commodities should be given more emphasis in Thailand's trade policy. This would help to lessen the high and precarious dependence of Thailand on mineral and industrial products. Besides, Thailand is mostly an agricultural country. This is due to the conditions of natural resources, its climate and its skilled laborers.

For the mentioned reasons, the government should increase the rate of growth of agricultural exports by increasing the export volume, the
product's standard, kinds of agricultural product exported, expand the market for agricultural product wider than at the present, and support more of the market research. For the exports of mineral and industrial products, they should increase the share of export-output by increasing the mineral and industrial export volume. Besides this, the government should promote the industrial factory which uses the factor of production from agriculture sector which is the major sector of Thailand's economy to increase the linkage effect for economic growth, increased employment and reduction in the income gap.
### APPENDIX I

**Data Being Used in this Study**

<p>| Year | $\frac{dY}{Y}$ | $\frac{X}{Y}$ | $\frac{X_1}{Y}$ | $\frac{X_2}{Y}$ | $\frac{X_3}{Y}$ | $\frac{I_d}{Y}$ | $\frac{M_k}{Y}$ | $\frac{dX}{Y}$ | $\frac{dX_1}{Y}$ | $\frac{dX_2}{Y}$ | $\frac{dX_3}{Y}$ | $\frac{F_Y}{Y}$ | $\frac{F_C}{Y}$ |
|------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 1962 | 0.076          | 0.153          | 0.143          | 0.004          | 0.0001         | 0.119          | 0.076          | -0.007         | -0.008         | 0.001          | 0.00000        | -0.031         | -0.023         |
| 1963 | 0.063          | 0.145          | 0.136          | 0.005          | 0.0002         | 0.130          | 0.091          | 0.002          | 0.002          | 0.001          | 0.00001        | -0.046         | -0.036         |
| 1964 | 0.088          | 0.169          | 0.159          | 0.004          | 0.0003         | 0.119          | 0.094          | 0.0036         | 0.0035         | 0.000          | 0.00001        | -0.026         | -0.017         |
| 1965 | 0.114          | 0.156          | 0.142          | 0.009          | 0.0007         | 0.182          | 0.092          | 0.007          | 0.002          | 0.005          | 0.00004        | -0.031         | -0.013         |
| 1966 | 0.168          | 0.141          | 0.120          | 0.017          | 0.0006         | 0.151          | 0.098          | 0.012          | 0.002          | 0.009          | 0.00001        | -0.045         | -0.004         |
| 1967 | 0.063          | 0.133          | 0.107          | 0.021          | 0.0009         | 0.127          | 0.114          | 0.001          | -0.005         | 0.005          | 0.00003        | -0.076         | -0.021         |
| 1968 | 0.077          | 0.118          | 0.094          | 0.018          | 0.0003         | 0.144          | 0.112          | -0.004         | -0.007         | -0.001         | 0.0006         | -0.092         | -0.039         |
| 1969 | 0.102          | 0.114          | 0.088          | 0.020          | 0.0005         | 0.167          | 0.109          | 0.008          | 0.004          | 0.004          | 0.00002        | -0.087         | -0.041         |
| 1970 | 0.054          | 0.108          | 0.084          | 0.020          | 0.0006         | 0.147          | 0.113          | 0.001          | 0.001          | 0.001          | 0.00001        | -0.089         | -0.045         |
| 1971 | 0.059          | 0.119          | 0.099          | 0.023          | 0.0012         | 0.136          | 0.104          | 0.017          | 0.011          | 0.005          | 0.00007        | -0.068         | -0.031         |
| 1972 | 0.122          | 0.137          | 0.098          | 0.030          | 0.0017         | 0.106          | 0.097          | 0.031          | 0.019          | 0.009          | 0.00006        | -0.054         | -0.014         |
| 1973 | 0.240          | 0.149          | 0.103          | 0.037          | 0.0026         | 0.133          | 0.104          | 0.045          | 0.028          | 0.015          | 0.00014        | -0.050         | -0.018         |
| 1974 | 0.202          | 0.184          | 0.137          | 0.039          | 0.0027         | 0.132          | 0.166          | 0.065          | -0.055         | 0.009          | 0.00005        | -0.053         | -0.025         |
| 1975 | 0.092          | 0.151          | 0.114          | 0.032          | 0.0017         | 0.154          | 0.109          | -0.016         | -0.011         | -0.004         | 0.00008        | -0.068         | -0.047         |
| 1976 | 0.115          | 0.180          | 0.135          | 0.042          | 0.0011         | 0.144          | 0.098          | 0.047          | 0.035          | 0.013          | 0.00003        | -0.033         | -0.028         |
| 1977 | 0.141          | 0.181          | 0.142          | 0.046          | 0.0008         | 0.149          | 0.113          | 0.027          | 0.027          | 0.010          | 0.00002        | -0.113         | -0.061         |
| 1978 | 0.164          | 0.177          | 0.156          | 0.056          | 0.0010         | 0.186          | 0.115          | 0.027          | -0.004         | 0.019          | 0.00003        | -0.115         | -0.054         |
| 1979 | 0.155          | 0.195          | 0.124          | 0.065          | 0.0014         | 0.140          | 0.120          | 0.005          | 0.027          | 0.018          | 0.00005        | 0.072          | 0.061          |
| 1980 | 0.188          | 0.195          | 0.116          | 0.072          | 0.0015         | 0.150          | 0.109          | 0.037          | 0.135          | 0.016          | 0.00004        | 0.092          | 0.054          |
| 1981 | 0.147          | 0.190          | 0.122          | 0.061          | 0.0016         | 0.156          | 0.108          | 0.025          | 0.023          | 0.000          | 0.00003        | 0.085          | 0.046          |</p>
<table>
<thead>
<tr>
<th>Equation No.</th>
<th>Endogenous Variable</th>
<th>Constant Value</th>
<th>$\frac{X_{t-1}}{Y_{t-1}}$</th>
<th>$\frac{X_{t-1}}{Y_{t}}$</th>
<th>$\frac{dX_{t-1}}{Y_{t-1}}$</th>
<th>$\frac{dX_{t-1}}{Y_{t}}$</th>
<th>F-Test</th>
<th>R²</th>
<th>DW</th>
</tr>
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<tbody>
<tr>
<td>34</td>
<td>$\frac{dY_t}{Y_t}$</td>
<td>0.058</td>
<td>0.357 (0.0670)</td>
<td>-0.327 (0.653)</td>
<td>0.826 (1.549)*</td>
<td>0.448</td>
<td>0.448</td>
<td>2.90</td>
<td>1.21047**</td>
</tr>
<tr>
<td>35</td>
<td>$\frac{dY_t}{Y_t}$</td>
<td>0.154</td>
<td></td>
<td></td>
<td></td>
<td>0.428</td>
<td>0.428</td>
<td>2.771</td>
<td>1.0850</td>
</tr>
<tr>
<td>36</td>
<td>$\frac{dY_t}{Y_t}$</td>
<td>0.094</td>
<td></td>
<td>0.826</td>
<td>0.270 (0.792)</td>
<td>2.126</td>
<td>2.126</td>
<td>12.41</td>
<td>1.877**</td>
</tr>
<tr>
<td>37</td>
<td>$\frac{dY_t}{Y_t}$</td>
<td>0.105</td>
<td></td>
<td></td>
<td></td>
<td>0.625</td>
<td>0.625</td>
<td>4.001</td>
<td>1.529**</td>
</tr>
</tbody>
</table>

Source: Calculation from Appendix Table 1.

* = The confidence interval of 90 percent

** = The confidence interval of 95 percent

*** = The confidence interval of 99.9 percent
### APPENDIX III

Regression Results of Export-output, Ratios on Domestic Investment and Import of Capital Goods Using Adjusted Model No. 2

<table>
<thead>
<tr>
<th>Equation No.</th>
<th>Endogenous Variable</th>
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<th>$\frac{X_{t-1}}{Y_{t-1}}$</th>
<th>$\frac{X_t}{Y_t}$</th>
<th>$\frac{dX_{t-1}}{Y_{t-1}}$</th>
<th>$\frac{dX_t}{Y_t}$</th>
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<th>$R^2$</th>
<th>DW</th>
</tr>
</thead>
<tbody>
<tr>
<td>38</td>
<td>$\frac{dI_t}{Y_t}$</td>
<td>0.108</td>
<td>0.216 (1.215)</td>
<td></td>
<td></td>
<td>1.213</td>
<td>7.48</td>
<td>0.77459</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>$\frac{dI_t}{Y_t}$</td>
<td>0.115</td>
<td>0.185 (1.00)</td>
<td></td>
<td></td>
<td>1.002</td>
<td>6.26</td>
<td>1.228</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>$\frac{dI_t}{Y_t}$</td>
<td>0.139</td>
<td></td>
<td>0.025 (0.1096)</td>
<td></td>
<td>0.102</td>
<td>7.9</td>
<td>1.170*</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>$\frac{dI_t}{Y_t}$</td>
<td>0.144</td>
<td></td>
<td>-0.188 (1.541)</td>
<td></td>
<td>2.367</td>
<td>13.628</td>
<td>1.036</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>$\frac{M_t^k}{Y_t}$</td>
<td>0.117</td>
<td>0.054 (0.335)</td>
<td></td>
<td></td>
<td>0.00115</td>
<td>0.008</td>
<td>0.64550</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>$\frac{M_t^k}{Y_t}$</td>
<td>0.110</td>
<td>-0.049 (0.454)</td>
<td></td>
<td></td>
<td>0.20474</td>
<td>1.35</td>
<td>0.79583</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>$\frac{M_t^k}{Y_t}$</td>
<td>0.101</td>
<td></td>
<td>0.103 (0.811)</td>
<td></td>
<td>0.657</td>
<td>4.193</td>
<td>0.712</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>$\frac{M_t^k}{Y_t}$</td>
<td>0.102</td>
<td></td>
<td>0.033 (0.446)</td>
<td></td>
<td>0.197</td>
<td>1.50</td>
<td>0.708</td>
<td></td>
</tr>
</tbody>
</table>

Source: Calculation from Appendix Table 1.

* = The confidence interval of 90 percent  
** = The confidence interval of 95 percent  
*** = The confidence interval of 99.9 percent
APPENDIX IV

REGRESSION RESULTS: EXPORT-OUTPUT RATIOS ON ECONOMIC GROWTH USING ADJUSTED MODEL NO. 2

<table>
<thead>
<tr>
<th>Equation No.</th>
<th>Endogenous Variable</th>
<th>Constant Value</th>
<th>$\frac{X_{1t-1}}{Y_t}$</th>
<th>$\frac{X_{1t-1}}{Y_{t-1}}$</th>
<th>$\frac{dX_{1t-1}}{Y_t}$</th>
<th>$\frac{dX_{1t-1}}{Y_{t-1}}$</th>
<th>F-Test</th>
<th>$R^2$</th>
<th>DW</th>
</tr>
</thead>
<tbody>
<tr>
<td>54</td>
<td>$\frac{dY_t}{Y_t}$</td>
<td>0.178</td>
<td>-0.622 (1.169)**</td>
<td></td>
<td></td>
<td></td>
<td>1.363</td>
<td>8.332</td>
<td>1.16049</td>
</tr>
<tr>
<td>55</td>
<td>$\frac{dY_t}{Y_t}$</td>
<td>0.093</td>
<td>0.167 (0.888)</td>
<td></td>
<td></td>
<td></td>
<td>0.790</td>
<td>5.003</td>
<td>1.31430*</td>
</tr>
<tr>
<td>56</td>
<td>$\frac{dY_t}{Y_t}$</td>
<td>0.103</td>
<td>0.741 (0.956)</td>
<td></td>
<td></td>
<td></td>
<td>0.915</td>
<td>5.748</td>
<td>1.60683**</td>
</tr>
<tr>
<td>57</td>
<td>$\frac{dY_t}{Y_t}$</td>
<td>0.101</td>
<td>0.769 (1.124)</td>
<td></td>
<td></td>
<td></td>
<td>1.263</td>
<td>7.771</td>
<td>1.68265**</td>
</tr>
</tbody>
</table>

Source: Calculation from Appendix Table 1.

* = The confidence interval of 90 percent

** = The confidence interval of 95 percent

*** = The confidence interval of 99.9 percent
### APPENDIX V

**REGRESSION RESULTS: INDUSTRIAL EXPORTS-OUTPUT RATIOS ON ECONOMIC GROWTH USING ADJUSTED MODEL NO. 2**

<table>
<thead>
<tr>
<th>Equation No.</th>
<th>Endogenous Variable</th>
<th>Constant Value</th>
<th>( \frac{X_{2t-1}}{Y_t} )</th>
<th>( \frac{X_{2t-1}}{Y_{t-1}} )</th>
<th>( \frac{dx_{2t-1}}{Y_t} )</th>
<th>( \frac{dx_{2t-1}}{Y_{t-1}} )</th>
<th>F-Test</th>
<th>R(^2)</th>
<th>DW</th>
</tr>
</thead>
<tbody>
<tr>
<td>58</td>
<td>( \frac{dY_t}{Y_t} )</td>
<td>0.079</td>
<td>1.272 (3.675)**</td>
<td></td>
<td></td>
<td></td>
<td>13.523</td>
<td>47.41</td>
<td>2.07338***</td>
</tr>
<tr>
<td>59</td>
<td>( \frac{dY_t}{Y_t} )</td>
<td>0.086</td>
<td>1.099 (1.497)*</td>
<td></td>
<td></td>
<td></td>
<td>2.243</td>
<td>13.009</td>
<td>1.43487**</td>
</tr>
<tr>
<td>60</td>
<td>( \frac{dY_t}{Y_t} )</td>
<td>0.092</td>
<td>4.140 (1.534)*</td>
<td></td>
<td></td>
<td></td>
<td>2.353</td>
<td>13.56</td>
<td>1.76686***</td>
</tr>
<tr>
<td>61</td>
<td>( \frac{dY_t}{Y_t} )</td>
<td>0.092</td>
<td>4.387 (1.942)**</td>
<td></td>
<td></td>
<td></td>
<td>3.773</td>
<td>20.096</td>
<td>1.91940***</td>
</tr>
</tbody>
</table>

Source: Calculation from Appendix Table 1.

* = The confidence interval of 90 percent

** = The confidence interval of 95 percent

*** = The confidence interval of 99.9 percent
### APPENDIX VI

**Regression Results: Mineral Exports-Output Ratios on Economic Growth Using Adjusted Model No. 2**

<table>
<thead>
<tr>
<th>Equation No.</th>
<th>Endogenous Variable</th>
<th>Constant Value</th>
<th>( \frac{X_{3t-1}}{Y_t} )</th>
<th>( \frac{X_{3t-1}}{Y_{t-1}} )</th>
<th>( \frac{dX_{3t-1}}{Y_t} )</th>
<th>( \frac{dX_{3t-1}}{Y_{t-1}} )</th>
<th>F-Test</th>
<th>R²</th>
<th>DW</th>
</tr>
</thead>
<tbody>
<tr>
<td>62</td>
<td>( \frac{dY_t}{Y_t} )</td>
<td>0.083</td>
<td>33.506</td>
<td>(1.307)**</td>
<td></td>
<td></td>
<td>3.636</td>
<td>19.51</td>
<td>1.73012***</td>
</tr>
<tr>
<td>63</td>
<td>( \frac{dY_t}{Y_t} )</td>
<td>0.080</td>
<td>33.056</td>
<td>(2.337)**</td>
<td></td>
<td></td>
<td>5.462</td>
<td>29.69</td>
<td>1.73320***</td>
</tr>
<tr>
<td>64</td>
<td>( \frac{dY_t}{Y_t} )</td>
<td>0.104</td>
<td>42.259</td>
<td>(1.773)**</td>
<td></td>
<td></td>
<td>3.143</td>
<td>17.32</td>
<td>1.65119***</td>
</tr>
<tr>
<td>65</td>
<td>( \frac{dY_t}{Y_t} )</td>
<td>0.104</td>
<td>44.098</td>
<td>(1.520)*</td>
<td></td>
<td></td>
<td>2.309</td>
<td>13.34</td>
<td>1.59656***</td>
</tr>
</tbody>
</table>

Source: Calculation from Appendix Table 1.

* = The confidence interval of 90 percent

** = The confidence interval of 95 percent

*** = The confidence interval of 99.9 percent


