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Exports, Imports, FDI and Economic Growth

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This study analyzes the impact of trade liberalization on economic growth for Malaysia and South Korea. A four variable vector autoregression (VAR) is used to study the relationships between trade, FDI and economic growth over the time period from 1970 to 2004 (for Malaysia) and from 1976 to 2007 (for Korea). The estimated results from the Granger causality/Block exogeneity test, impulse response functions and variance decompositions confirm that exports are long-run source of both Malaysia and Korean economic growth. (2) For Malaysia, there is evidence to support the two-way causalities between each pair among the four those variables except for the absence of causality from GDP to exports. (3) For Korea, there is one-way causality from exports, imports and GDP to FDI, from exports and imports to GDP and from exports to imports. Exports are not affected by the other three variables. The differences in the estimated results are explained by the differences in the economic policies between the two countries. Although both countries implemented policies of export-orientated industrialization, the Malaysian government promoted FDI as a tool of industrialization, while the Korea government built an "integrated national economy" using "chaebol" industrial structures and minimizing the role of FDI.

1 INTRODUCTION

Even after more than 20 years of carrying out import-substitution industrialization, many Asian countries have not improved their economies. At the end of the 1960s, most Asian countries shifted from import-substitution industrialization to export-oriented industrialization. In addition, Asian countries pursued programs attracting foreign direct investment (FDI), relaxed trade barriers and simultaneously carried out social programs, obtaining spectacular economic achievement. Such a high level of economic growth in Asian countries calls for research that can provide theoretical explanations, lessons for the future and an economic forecast. This paper focuses on the following main questions: Are there causal relationships between economic growth, exports, imports and FDI? What is the effect of trade liberalization on economic growth? What is the implication for economic policy?

There are still many papers trying to understand these issues, in spite of the fact that the problem is not new. The literature partly provides theoretical explanations through the exports-led growth hypothesis, the growth-led exports hypothesis, the import-compression growth hypothesis and the intertemporal budget constraint hypothesis.

The exports-led growth hypothesis rests on the following assumptions: (1) Exports lead to a higher level of specialization in production, which improves productivity and thus increases economic growth. (2) Thanks to export growth, resources are allocated more efficiently, through shifting factors, to the more productive export sectors. (3) Exports increase the capacity of utilization and economies of scale, which improves productivity. (4) Exports promote diffusion of knowledge through interaction with foreign buyers and through learning by doing. Economic growth is thus increased by higher innovation. (5) Exporting firms are forced to learn technological advancements and better management techniques in order to compete in international markets, further improving productivity. (6) Exports provide a foreign exchange that is used to import capital goods and intermediate goods, thus improving the input quality of production, which promotes productivity. Exports promote economic growth, and, consequently, the productivity growth leads to lower unit cost, facilitating further exports. Thus, economic growth also promotes exports, an argument that is called the growth-led exports hypothesis (Asafu-Adjaye & Chakraborty, 1999, p. 164; Baharumshah & Rashid, 1999, p.391; Kim, H. Lim, & Park, 2009, p.1821; Ramos, 2001, p. 613-614).

While carrying out exports-promoting policies, some Asian countries relaxed trade barriers and opened domestic market to attract FDI. Therefore, FDI can be a factor, beyond exports, to explain the strong economic growth of Asian countries in the 1970s. FDI contributes to economic growth in the following ways (Lim, 2001, p.3): (1) FDI contributes to GDP through its impact on two of the three main production factors: investment capital and innovation. Increase in innovation is due to technology diffusion from multinational corporations to local firms. (2) Local firms are forced to use their current sources more efficiently and look for more advanced technologies, in order to confront the severe competition arising from the entry of multinationals, and their productivity should increase accordingly. (3) Multinationals provide assistance for local suppliers in training, management, organization, finding customers, production and skills, thereby increasing the productivity of local suppliers.

The import-substitution policies in Asian countries assumed a negative impact of imports on economic growth. After this policy was rejected in most Asian countries, the positive effect of imports on economic growth was gradually recognized. The imports-compression growth hypothesis suggests that a shortage in imports will restrict economic growth. The imports-compression growth hypothesis (Asafu-Adjaye & Chakraborty, 1999, p.164; Esfahani, 1991, p.95-99; Kim et al., 2009, p.1821) is based on the following arguments. (1) Importing consumption goods forces the domestic import-substitution firms to innovate and restructure themselves, which improves their productivity. (2) Imports can increase productivity through improving input quality, varieties of inputs and the reallocation of capital and labor to importers. (3) Imports of capital goods and intermediate goods can increase economic growth through technological diffusion. In contrast, a higher income level pushes up demand for high-quality luxury consumption goods, and modern design that may not be domestically produced. On the other hand, a higher quality output calls for a higher quality input, which increases the demand for importing capital and intermediate goods.

The relationship between exports and imports can be carried out through two channels. Exports provide foreign exchange that can be used for importing consumption goods, intermediate goods or capital goods. Also, importing high-technological equipment intermediate goods for production will accelerate production for exports.

An Increase in FDI may require a high level of importing essential intermediate goods and capital goods for production. But, a higher level of importing consumption goods may have a negative effect on the import-substitution industry with foreign capital, and thus FDI may decrease. Therefore, there may be causality between FDI and imports (Alguacil, 2003, p.20; Liu, Wang, & Wei, 2001, p.191-193).

As multinational firms consider the options of exporting goods or establishing factories in foreign markets, the choice between exports and FDI depends on the level of convenience, risk and profit and long run developing strategy of firms, competitors, etc (Liu et al., 2001, p.191-193). The profit is determined by the gap between goods-exporting fees (including money to pay for tariffs and transportation costs) and the cost of establishing a new factory in a particular foreign market. Exports are usually easier and less risky, but they face trade barriers such as tariffs and nontariff barriers (import quotas, import licensing, and others). Almost all Asian countries limit imports in order to protect both main and infant industries, while at the same time usually encouraging FDI. However, for multinational firms, the choice of FDI also depends on how much advantage can be derived from foreign countries through factors such as cheap labor costs, availability of natural resources and the priorities of foreign governments with regard to FDI. For example, some Asian countries implement exports-promoting policies, which offer many special benefits, such as tax holidays and free import duties for firms manufacturing export goods. So, to better receive those benefits, FDI flows into Asian countries in order to produce the export goods. Therefore, export promotion attracts FDI, and then FDI increases exports. So, we may have two-way causality between exports and FDI.

Support for theoretical hypothesis has come from a substantial body of empirical evidence. However, the empirical results from different authors for the same Asian country are sometimes in conflict. For example, two-way causality between Korean exports and imports is discovered by Fung, Sawhney, Lo and Xiang (1994) and by Bahmani-Oskooee and Rhee (1997). But, Mahadevan and Suari (2008) and also Kim, H. Lim and Park (2009) provide evidence of no causality between Korean exports and imports. Chang, Fang, Liu and Henry (2000) find a two-way causality between exports and imports in Taiwan, but Mahadevan and Suari (2008) suggest no causality between them. There are further examples of inconsistency. What causes these conflicting results?

Observing prior studies of Asian countries, I find that they typically use the two-variable VAR model or the three-variable VAR model to consider the dynamic impacts of some of four variables (GDP, exports, imports and FDI) on other variables. However, theoretical analysis reveals that all three series, FDI, exports and imports, interact as follows with GDP: (1) They generate capital flow in or out of the domestic country; (2) They promote technological diffusion through relations with foreign partners, in learning by doing, and in other ways; and (3) They are influenced by competition in international markets, which requires improvement in management and technology. In addition, there is theoretical evidence suggesting a possible relationship between exports, imports and FDI. Furthermore, observing four time series (GDP, exports, imports and FDI) in two Asian countries (Malaysia and Korea) during the period from 1970 to the present, one can see that they have the same stochastic time trend. Therefore, there may possibly be cointegration between the four series. Also, a two-variable or three-variable VAR model constructed from two or three series out of the four series (GDP, exports, imports and FDI) will be misspecified. In addition, prior studies have ignored dynamic analysis, such as impulse responses and variance decompositions, and have had gaps in their econometric procedure of applying the VAR model, such as ignoring VAR diagnostics. All of these factors may have caused biased results.

This study is subject to contribute to the literature: (1) It provides the econometric application in the correct way, to avoid misspecification and to minimize the resulting bias. It also tests and estimates the causal relationship by applying the four-variable VAR model based on the four time series (GDP, exports, imports and FDI); (2) It supplements the literature on relationships between trade liberalization, economic growth and empirical evidence about the source of economic development for the Asian countries, Malaysia and Korea; (3) It analyzes and maps economic policy onto estimated results, and then gives lessons and policy implications.

In this study, I test the long-run and short-run relationships between GDP, exports, imports and FDI for Malaysia from 1970 to 2004 and for Korea from 1976 to 2007, using a four-variable VAR. I apply econometric procedures, including the unit root test of four series, lag structure, the VAR diagnostic, the Johansen cointegration test, the Granger causality/block exogeneity Wald test (GCBEW test), analysis of impulse response and analysis of variance decomposition.

The estimated results suggest that the four variables are cointegrated for both Malaysia and Korea. Exports are a long-run source of economic growth for both Malaysia and Korea. For Malaysia, there is evidence to support two-way causalities between each pair among the four variables, except for causality of GDP on exports. For Korea, there is one-way causality from exports, imports, and GDP to FDI, from exports and imports to GDP and from exports on imports. Exports are not affected by the other three variables. Trade liberalization has increased Malaysian economic growth through the positive effects of both exports and imports, while trade liberalization has also increased Korean economic growth, but only through the positive effects of one channel: exports. The difference in the estimated results is explained by the difference between the two countries' economic policies. Although both countries have implemented policies of export-oriented industrialization, the Malaysian government has promoted FDI as a tool of industrialization, while the Korean government has built an "integrated national economy" using industrial conglomerate structures and does not emphasize the role of FDI.

The rest of the paper is organized as follows. The second section describes the methodology. The third section describes the data set and reports the primary estimation results. The fourth section offers a conclusion.

2 METHODOLOGY

In this section, I will review my strategy, which includes the following steps:

- Test unit root of four time series;
- Construct four-variable VAR model;
- VAR diagnostics;
- Johansen cointegration test;
- Causality test;
- Dynamic simulation (impulse response function and variance decomposition);

I implement the unit root test of four series—(realGDP_L, realexports_L, realimports_L and realFDI_L)—by using the Dickey-Fuller (GLS) test (see Enders 2003, p.190). If those studied series are I(1), they will be used to construct a four-variable VAR. If some of the series, or all four, have a higher order than I(1), I will transfer them into other forms such as logarithms, share of GDP or form of difference, and then retest the unit root. This step will cease when the transformed series are nonstationary with an order of one.

Next, I consider the four-variable standard VAR model of order p as (unstructured form) (Shin and Pesaran, 1998, p. 18, eq.1)

$$y_t = \sum_{i=1}^{p} A_i y_{t-i} + Bx_i + e_t \ , \qquad (1)$$

where y_t is n x 1 random vector. In my model, four-variable VAR, n = 4 and y_t = (realGDP_L realexports_L realimports_L realFDI_L)'; However, there will be 4! = 24 ordering of vector y_t ; The A_i is n x n fixed coefficient matrices; p is order of lags; B is n x d coefficient matrix of exogenous variables; x_j is d x 1 vector of exogenous variables; For Malaysia, exogenous variables are dummy variables for years 1974, 1998 and 2001, while exogenous variables are dummy variables for year 1998 and year 2001 for Korea; Thus, d = 3 for Malaysia and d =2 for Korea; e_t is a n x 1 random vector of error terms and is a white noise process.

According to Shin and Pesaran (1998), the model satisfies the following conditions:
Assumption 1: $E(e_t) = 0$; $E(e_t e_t') = \sum_e$ (nonsingular) ; $E(e_t e_s') = 0$ if s ‡ t.
Assumption 2: No roots are inside the unit circle.
Assumption 3: There are not full collinearity among y_{t-1}, $y_{t-2}\ldots$ y_{t-p}, x_t,.

To check whether the assumptions of our VAR model are met, the following tests should be implemented:

- Lag order selection;
- VAR residual serial correlation LM test;
- VAR residual normality.

According to Enders (2003), the model will be misspecified when lag length is too small. The more lags, the more parameters we need to estimate and the less bias in our results. The model will be overparameterized if the number of lags is too large. Selecting the lag order is simply to understand that we find p such that A_i =0 for all i > p in the VAR model. There are two approaches: lag order selection based on the LR test; and lag order selection based on Information criteria such as AIC (Akaike's Information Criterion), FPE (final prediction error), SC (Schwarz criterion), HQ (the Hannan & Quinn (1979) criterion) (See Lutkepohl 2005, p. 142 -49).

However, it is not unusual that different criteria give a different number of maximum lag lengths. The problem is which criteria we should choose. To overcome this problem, we should run VAR with different lag orders, chosen by different criteria and the LR test, and then implement the VAR residual serial correlation LM test (Lutkepohl, 2005, p. 171) and the residual normality test (Lutkepohl, 2005, p. 176). An appropriate lag order needs to satisfy those tests.

To test the long-run cointegration of four time series, we will implement Johansen cointegration test. Consider the model (Enders, 2003, p. 354, eq.6.54)

$$\Delta y_t = \alpha_0 + \alpha\, y_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta y_{t-i} + \varepsilon_t\,, \qquad (2)$$

where $\alpha = -\left(I - \sum_{i=1}^{p} A_i\right)$ and $\alpha_i = -\sum_{j=i+1}^{p} A_j$.

The number of cointegration vectors (r) is determined by the maximum eigenvalue test (Enders, 2003, p.353) and the trace test (Enders, 2003, p.352). Both tests are based on the likelihood ratio test. When λ_{trace} and λ_{max} conflict, we should choose the number of the cointegration vector based on λ_{max} , because "the λ_{max} test has the sharper alternative hypothesis. It is usually preferred for trying to pin down the number of cointegrating vectors." (Enders, 2003, p. 354).

If all series are not stationary with a lag order of 1 and are not cointegrated, we should implement VAR in the first difference. If all series are not stationary with a lag order of 1 and cointegrated, we should implement VAR in levels (Enders, 2003, p. 358).

In order to know the causality between those four time series, we should apply the Granger causality/ Block exogeneity Wald test (Enders, 2003, p. 284). This test detects whether the lags of one variable can Granger-cause any other variables in the VAR system. The null hypothesis is that all lags of one variable can be excluded from each equation in the VAR system. For example, this test helps to answer whether or not all lags of FDI can be excluded from the equation of GDP or not. Rejection of the null hypothesis means that if all lags of FDI cannot be excluded from the GDP equation, then GDP is an endogenous variable and there is causality of FDI on GDP. The test statistic is (Enders, 2003, p. 282, eq.5.44)

$$(T-3p-1)(\log\left|\sum_{re}\right|-\log\left|\sum_{un}\right|) \sim \chi^2(2p), \tag{3}$$

where T is the number of observations; $\sum_{un}$ is variance/covariance matrices of the unrestricted VAR system; $\sum_{re}$ is variance/covariance matrices of the restricted system when the lag of a variable is excluded from the VAR system; and p is the number of lags of the variable that is excluded from the VAR system.

Based on this test, we do not know whether or not exports and imports have a positive effect on GDP. It is also unclear whether or not the impact of exports on GDP is stronger than that of imports on GDP. To answer these questions, we analyze the impulse-response function and the variance decomposition. Shin and Pesaran defined the impulse response function: "An impulse response function measures the time profile of the effect of shocks at a given point in time on the (expected) future values of variables in a dynamic system" (p. 18).

The impulse response function is defined as

$$IR(\mathrm{m}, h, Z_{t-1}) = E\left(y_{t+m}\middle|e_t = h, Z_{t-1}\right) - E\left(y_{t+m}\middle|= Z_{t-1}\right), \tag{4}$$

where m denotes the time, h = (h_1,…, h_m)' is n x 1 vector denotes the size of shock, Z_{t-1} denotes accumulative information about the economy from the past up to time t-1 (Shin and Pesaran, 1998, eq. 4).

The choice of h plays an important role in the relations of the properties of the impulse-response function. Sim (1980) establishes the orthogonalized impulse response (OIR) by identifying the shock h through using the Cholesky decomposition of $\sum_e$ = P P'. P is n x n lower triangular matrix. Thus the orthogonalized impulse response is

$$IR_{ij}^{0}(m) = Q_m P \varepsilon_j \qquad \mathrm{m} = 0, 1, 2, \ldots, \tag{5}$$

where ε_t is n x 1 selected vector in which j^{th} element is unity and other elements are zeros.

$Q_m = A_1 Q_{m-1} + A_2 Q_{m-2} + \ldots + A_p Q_{m-p}$, $Q_o = I_n$

The IOR is criticized because it is imposed by the restriction. The restriction is that the series have no contemporaneous effect on the other series. According to Lutkepohl, when this assumption is violated, OIR will change with reordering of endogenous variables. There are two approaches to deal with the ordering of the endogenous variables. The choice depends on the consistency between the estimated results from impulse response function and the estimated results of the GCBEW test.

The first approach is to use the generalized impulse response (GIR)(Shin and Pesaran, 1998, p.19, eq.10)

$$IR_{ij}^{G}(m) = \left(g_{ij}\right)^{1/2} Q_m \textstyle\sum_e \varepsilon_j) , \tag{6}$$

where $h_j = (g_{ij})^{1/2}$. GIR is invariant to changes in the ordering of the endogenous variables.

The second approach is to use OIR with the ordering of the variables in the VAR model will be as follows (Enders, 2003, p. 276):

- The first place in the list of ordering will be reserved for the variable that is not caused by any other variables;
- The ordering of the remaining variables will follow in order of increasing correlation among them;
- The last place in the list of ordering will be reserved for the target variable.

According to Enders (2003), variance decomposition tells how much a given variable changes under the impact of its own shock and the shock of other variables. Therefore, the variance decomposition defines the relative importance of each random innovation in affecting the variables in the VAR. If $\varepsilon_{realexports\_L}$, $\varepsilon_{realimports\_L}$ and $\varepsilon_{realFDI\_L}$ explain none of the forecast error variance of realGDP_L at all forecast horizons, then realGDP_L is said to be exogenous. If $\varepsilon_{realexports\_L}$ or/and $\varepsilon_{realimports\_L}$ or/and $\varepsilon_{realFDI\_L}$ can explain some of the forecast error variance of realGDP_L at all forecast horizons, then realGDP_L is said to be endogenous. Variance decomposition can be derived from the orthogonalized impulse-response function ($IR_{ij}^{0}(m)$) as well as from the generalized impulse-response function ($IR_{ij}^{g}(m)$) (Shin and Pesaran 1998, p. 20).

The variance decompositions are also sensitive to the ordering of the variables. We can change the ordering of the variables until we get the variance decompositions that are closest to the estimated results from GCBEW test (Enders, 2003, p. 280; Sims, 1980).

3. EMPIRICAL ANALYSIS AND FINDINGS

3.1 Data and Unit Root Test

The countries that I have chosen to study are Malaysia and Korea. The time of estimation is 1970 – 2004 for Malaysia and 1976 – 2007 for Korea. The four time series are realGDP_L, realexports_L, realimports_L and realFDI_L. RealGDP_L is the logarithm of real GDP; realexports_L is the logarithm of real exports; realimports_L is the logarithm of real imports and realFDI_L is the logarithm of real FDI. The data is sourced from World Bank. The choice of the variables requires some comment. First, to avoid the effect of inflation, I divide four time series—GDP, exports, imports and FDI—by a GDP deflator, to obtain realGDP, real exports, real imports and real FDI, respectively. However, the four series realGDP, real exports, real imports and real FDI are nonstationary with an order higher than one, for which we can't construct VAR. Therefore, to satisfy the condition of the VAR model that all variables must be I(1), I must transfer these series into the natural logarithm.

Table 1 and Table 2 provide the evidence that the four time series (realGDP_L, realexports_L, realimports_L and realFDI_L) are nonstationary with an order of one for Malaysia. Table 3 and Table 4 provide evidence that these four time series (realGDP_L, realexports_L, realimports_L and realFDI_L) are nonstationary with an order of one for Korea. The first column of each table exhibits the name of the series. The next columns report the t-statistic values, the numbers of lag, the numbers of maximum lag, and the number of observations, in that order, left to right.

Table 1: Unit Root Test in Levels for Malaysia

Series	t-Stat	Lag length	Max lag	Obs
RealGDP_L	-2.283188	1	8	33
Realexp_L	-2.953621	5	8	29
Realimp_L	-2.469140	1	8	33
RealFDI_L	-3.439528	3	8	31

Note:
Unit root test by Dickey-Fuller (GLS) test
1 percent critical value = - 3.770

Table 2: Unit Root Test in First Difference for Malaysia

Series	t-Stats	Lag Length	Max lag	Obs
RealGDP_L	-4.455159	0	8	33
Realexp_L	-4.388893	0	8	33
Realimp_L	-4.119046	0	8	33
RealFDI_L	-3.153449	3	8	30

Note:
Unit root test by Dickey-Fuller (GLS) test
5 percent critical values = -1.951

Table 3: Unit Root Test in Levels for Korea

Series	t-Stat	Lag length	Max lag	Obs
RealGDP	-2.010870	0	7	31
Realexp	-3.135229	1	7	30
Realimp	-2.816564	1	7	30
RealFDI	-2.662293	1	7	30

Note:
Unit root test by Dickey-Fuller (GLS) test
1 percent critical value = - 3.770

Table 4: Unit Root Test in First Difference for Korea

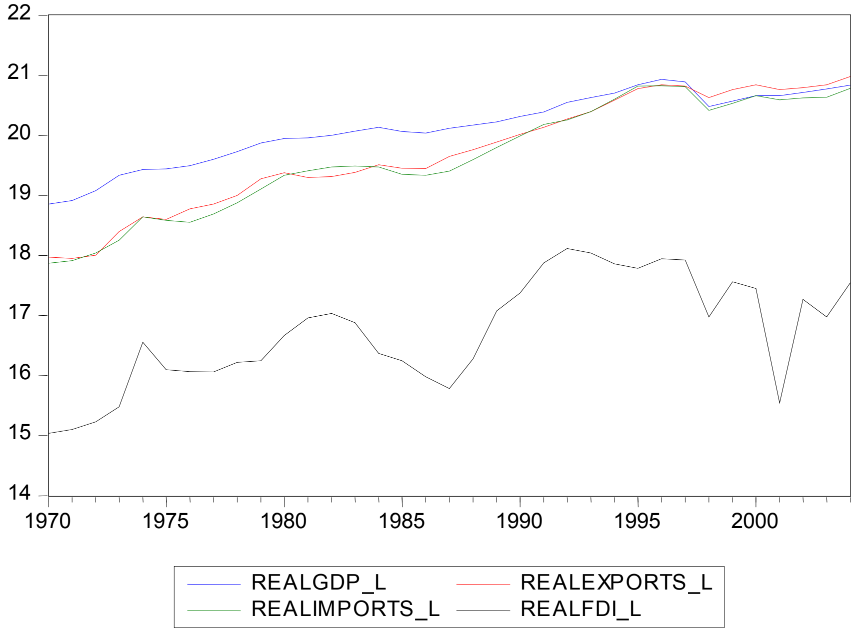
Series	t-Stats	Lag length	Max lag	Obs
RealGDP	-4.635355	0	7	30
Realexp	-3.836050	0	7	30
Realimp	-4.587495	1	7	29
RealFDI	-4.304318	1	7	29

Note:
Unit root test by Dickey-Fuller (GLS) test
5 percent critical values = -1.951

The test result from unit root test in levels (reported in Table 1 and Table 3) with constant and time trend shows that we cannot reject the null hypothesis (of nonstationary) at a 0.01 significant level. The t-statistic values for each series in the case of Malaysia are -2.283, -2.953, -2.469 and -3.439, respectively. Their absolute values are less than the absolute value of 1 percent critical value of - 3.770. The t-statistic values for each series in the case of Korea are -2.010, -3.135, -2.861 and -2.662, respectively. Their absolute values are less than the absolute value of 1 percent critical value of - 3.770. Thus, they have a unit root and I continue to test the unit root of their first difference. The test results using a constant and no time trend are reported in Table 2 (for Malaysia) and Table 4 (for Korea). The t-statistics for each series of Malaysia are -4.455, -4.388, -4.119 and -3.153 and the t-statistics for each series of Korea are -4.635, -3.836, -4.587 and -4.304. Since their absolute values are higher than the absolute value of 5 percent critical values of -1.951, we can reject the null hypothesis of non-stationary at a 0.05 level. Thus, we can conclude that the four series are non-stationary with the root of order 1 for both Malaysia and Korea.

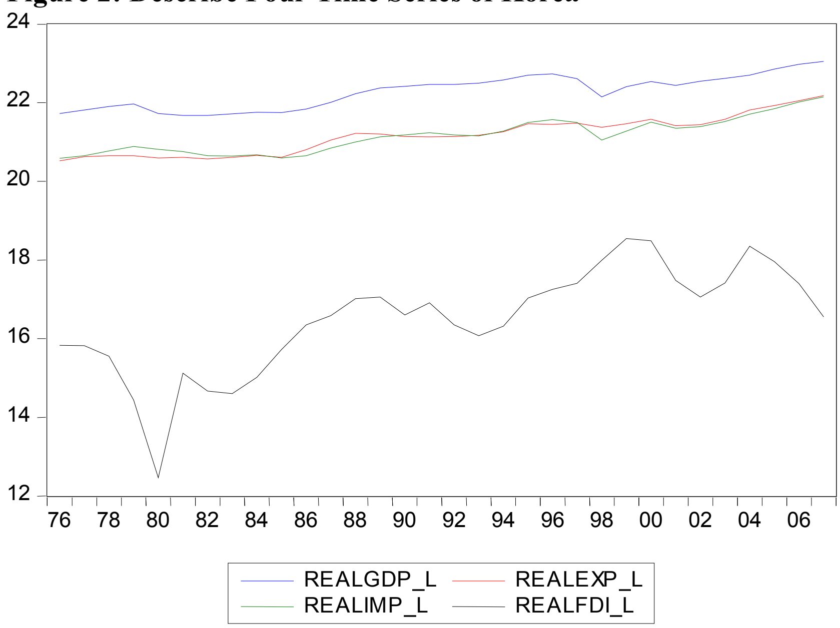
Figures 1 and 2 describe the four series, realGDP_L, realexports_L, realimports_L and realFDI_L for Malaysia and Korea, respectively. Examining data and Figure 1, we realize that the Asian financial crisis in 1998, the OPEC oil crisis in 1974, and the US recession in 2001 had a strong impact on the economy of Malaysia. The OPEC oil crisis in 1974 led the growth rate in GDP, exports and imports down from 8.3%, 15.9% and 36.8% in 1974 to 0.801%, -2.99% and -17.095% in 1975, respectively. The share of FDI in GDP also fell from 5.6% in 1974 to 3.54% in 1975. To cause the economy to recover, the Malaysian government continued to strongly promote export-oriented industrialization, by establishing free trade zones and allowing duty-free imports of raw material and capital goods. In 1994, the Malaysian economy boomed again with a growth rate of GDP, exports and imports of about 9%, 21.9% and 25.6%, respectively. In 1997-1998, the Asian financial crisis hurt the Malaysian economy. In 1998, exports growth declined about 5% compared with 1997. The growth rates of imports and GDP were down to -18.75% and -7% in 1998, respectively. The Malaysian government then implemented a series of programs with the aim of stabilizing the currency, restoring and stabilizing the market, and other policies. Thanks to these government efforts, the Malaysian economy recovered fully. However, the economic downturn repeated itself again in 2001, when the global economy was in danger of recession and the September 11, 2001 terrorist attacks occurred in the United States. The GDP growth rate reached only 0.517% in 2001. The growth rates of exports and imports fell to -6.8% and -8.23% in 2001, respectively. The share of FDI in GDP was only 0.597%, compared with 4% in the year 2000. To control for these special events, I use dummy variables: dummy74, dummy98, and dummy01. Each dummy variable will receive the value of 1 if the year is 1974, 1998, or 2001 and zero otherwise.

Figure 1: Describe Four Time Series of Malaysia



Looking at Figure 2 and examining the data set for Korea, we find that the 1998 Asian financial crisis and 2001 U.S. recession also affected the Korean economy. Because the Korean data set only covers 1976 to 2007, we do not take into consideration the OPEC oil crisis. To control for the special events, I use the dummy variables dummy98 and dummy01. Each dummy variable will receive the value of 1 if the year is 1998 or 2001 and zero otherwise.

Figure 2: Describe Four Time Series of Korea



3.2 Malaysia

I construct the VAR system with four endogenous variables (realGDP_L, realexports_L, realimports_L and realFDI_L) and three exogenous variables (dummy74, dummy98, and dummy01). The result from the test for lag length criteria, based on the four-variable VAR system with the maximum lag number of 4, is reported in Table 5. The lag orders chosen by the LR test, the FPE, the AIC criterion, and the SC criterion are all 4.

Table 5: Test for Lag Length Criteria for Malaysia

Lag	LogL	LR	FPE	AIC	SC	HQ
0	39.42305	NA	2.61e-06	-1.511165	-0.771042	-1.269903
1	155.7180	172.5667	4.21e-09	-7.981805	-6.501560	-7.499282
2	174.1028	22.53621	4.08e-09	-8.135663	-5.915296	-7.411879
3	208.8670	33.64279	1.59e-09	-9.346257	-6.385768	-8.381211
4	250.0789	29.24717*	5.34e-10*	-10.97283*	-7.272220*	-9.766525*

Note:
(*) indicates the lag order selected by the criterion
LR: Sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC:Akaike Information Criterion
SC: Schwarz Information Criterion
HQ: Hannan-Quinn Information Criterion

I run VAR with the lag order of 4. The results of VAR are reported in Table 6. The results from the VAR residual normality test and the VAR residual serial correlation LM test are reported in Table 7 and Table 8, respectively. With the data from Table 7, we cannot reject the hypothesis of normality properties, since P-values are 0.5922, 0.4665 and 0.6055 for skewness, kurtosis and the Jarque-Bera test. This provides some support for the hypothesis that residuals from our VAR model have a normal distribution. Table 8 shows that we also cannot reject the null hypothesis of no autocorrelation up to lag 5, since P-values are 0.6273, 0.7736, 0.1147, 0.5396 and 0.9795 for the lag order of 1, 2, 3, 4, and 5, respectively. These two tests give support to the assumptions of our model about white noise residuals.

Table 6: VAR Model with Lag of Four and Dummy Variables (1974, 1998, and 2001)

	REALGDP_L	REALEXP_L	REALIMP_L	REALFDI_L
REALGDP_L(-1)	0.647111	0.179518	0.395451	-1.050808
	(0.30209)	(0.50780)	(0.28040)	(0.84949)
	[2.14214]	[0.35352]	[1.41029]	[-1.23699]
REALGDP_L(-2)	0.245256	0.286731	0.595571	0.508008
	(0.25045)	(0.42101)	(0.23248)	(0.70429)
	[0.97924]	[0.68105]	[2.56183]	[0.72130]
REALGDP_L(-3)	-0.395830	-0.277350	0.211687	-1.727269
	(0.48598)	(0.81693)	(0.45110)	(1.36661)
	[-0.81450]	[-0.33950]	[0.46927]	[-1.26391]
REALGDP_L(-4)	0.160928	-0.154698	-0.185253	2.676573
	(0.35974)	(0.60472)	(0.33392)	(1.01161)
	[0.44735]	[-0.25582]	[-0.55479]	[2.64586]
REALEXP_L(-1)	0.146521	1.145285	0.403589	0.512872
	(0.16611)	(0.27924)	(0.15419)	(0.46713)
	[0.88205]	[4.10147]	[2.61743]	[1.09793]
REALEXP_L(-2)	-0.273971	-0.401343	0.123865	2.039328
	(0.25000)	(0.42025)	(0.23206)	(0.70302)
	[-1.09587]	[-0.95501]	[0.53376]	[2.90080]
REALEXP_L(-3)	0.608077	1.049759	0.591281	-0.257556
	(0.23786)	(0.39984)	(0.22079)	(0.66887)
	[2.55647]	[2.62546]	[2.67806]	[-0.38506]
REALEXP_L(-4)	-0.015761	-0.269045	0.410873	1.043130
	(0.22506)	(0.37832)	(0.20890)	(0.63287)
	[-0.07003]	[-0.71116]	[1.96681]	[1.64825]
REALIMP_L(-1)	0.109557	-0.294999	0.299976	0.160276
	(0.22569)	(0.37939)	(0.20949)	(0.63466)
	[0.48543]	[-0.77757]	[1.43191]	[0.25254]
REALIMP_L(-2)	-0.151617	-0.174671	-0.866361	-0.650335
	(0.23976)	(0.40303)	(0.22255)	(0.67422)
	[-0.63237]	[-0.43339]	[-3.89285]	[-0.96457]
REALIMP_L(-3)	-0.482309	-0.956386	-0.698072	-1.028931
	(0.22754)	(0.38250)	(0.21121)	(0.63987)
	[-2.11963]	[-2.50036]	[-3.30507]	[-1.60804]
REALIMP_L(-4)	0.164141	0.776936	-0.052905	-1.802223
	(0.18478)	(0.31062)	(0.17152)	(0.51962)
	[0.88829]	[2.50125]	[-0.30845]	[-3.46833]
REALFDI_L(-1)	0.035568	0.082424	0.099003	0.431450
	(0.02715)	(0.04563)	(0.02520)	(0.07633)
	[1.31026]	[1.80630]	[3.92914]	[5.65208]
REALFDI_L(-2)	0.044059	0.087575	0.127590	0.369349
	(0.02398)	(0.04031)	(0.02226)	(0.06743)
	[1.83744]	[2.17266]	[5.73239]	[5.47755]
REALFDI_L(-3)	0.030798	0.034916	0.057044	0.078184
	(0.02969)	(0.04991)	(0.02756)	(0.08349)
	[1.03726]	[0.69956]	[2.06978]	[0.93640]
REALFDI_L(-4)	0.011160	-0.058811	-0.031996	-0.074026
	(0.04495)	(0.07557)	(0.04173)	(0.12641)
	[0.24825]	[-0.77826]	[-0.76678]	[-0.58559]
C	2.876051	-0.569493	-9.208637	-5.327591
	(2.75414)	(4.62969)	(2.55647)	(7.74483)

	[1.04426]	[-0.12301]	[-3.60209]	[-0.68789]
DUMMY01	-0.296448	-0.422590	-0.240961	-3.314420
	(0.17039)	(0.28642)	(0.15816)	(0.47914)
	[-1.73985]	[-1.47542]	[-1.52354]	[-6.91744]
DUMMY98	-0.416886	-0.265084	-0.489520	-0.757724
	(0.06155)	(0.10347)	(0.05713)	(0.17309)
	[-6.77302]	[-2.56202]	[-8.56803]	[-4.37775]
DUMMY74	0.006568	0.112351	0.419895	1.506881
	(0.07432)	(0.12493)	(0.06899)	(0.20899)
	[0.08838]	[0.89930]	[6.08662]	[7.21014]
R-squared	0.996450	0.996558	0.998916	0.990015
Adj. R-squared	0.990318	0.990614	0.997044	0.972769
Sum sq. resids	0.021793	0.061580	0.018777	0.172329
S.E. equation	0.044510	0.074821	0.041315	0.125165
F-statistic	162.5063	167.6398	533.6550	57.40522
Log likelihood	68.54561	52.44471	70.85441	36.49411
Akaike AIC	-3.131975	-2.093207	-3.280930	-1.064136
Schwarz SC	-2.206822	-1.168054	-2.355777	-0.138983
Mean dependent	20.26644	19.92651	19.84779	16.92738
S.D. dependent	0.452357	0.772283	0.759966	0.758497

Determinant resid covariance (dof adj.)	7.29E-11
Determinant resid covariance	1.16E-12
Log likelihood	250.0789
Akaike information criterion	-10.97283
Schwarz criterion	-7.272220

Table 7 VAR Residual Normality Test for Malaysia

Component	Skewness	Chi-sq	Df	Prob.
1	0.167632	0.145187	1	0.7032
2	0.396988	0.814265	1	0.3669
3	-0.225524	0.262782	1	0.6082
4	0.552263	1.575804	1	0.2094
Joint		2.798038	4	0.5922
Component	**Kurtosis**	**Chi-sq**	**Df**	**Prob.**
1	2.313992	0.607867	1	0.4356
2	2.534493	0.279900	1	0.5968
3	3.662707	0.567276	1	0.4513
4	4.281239	2.120366	1	0.1454
Joint		3.575408	4	0.4665

Component	Jarque-Bera	df	Prob.
1	0.753053	2	0.6862
2	1.094165	2	0.5786
3	0.830058	2	0.6603
4	3.696170	2	0.1575
Joint	6.373446	8	0.6055

Table 8: VAR Residual Serial Correlation LM Test for Malaysia

Lags	LM-Stat	Prob
1	13.61586	0.6273
2	11.56153	0.7736
3	22.96220	0.1147
4	14.79601	0.5396
5	6.646689	0.9795

Probs from chi-square with 16 df.

To test the long-run cointegration relationship between the four time series, I carry out the Johansen cointegration test (1993). The test results, reported in Table 9, indicate that four series are cointegrated and there are three cointegrating vectors. Table 9 is divided into two parts. The first part reports the results from the trace test, while the second part reports the results of the maximum eigenvalue. In each part, columns 1, 2, 3, 4, and 5 report the number of cointegrating vectors we want to test, the eigenvalue, the value of λ_{TRACE} equal to each number of cointerating vectors, the critical value at the 0.05 significance level and the P-value, respectively.

Table 9: Johansen Cointegration Test with Optimal Lag Length of Three for Malaysia

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.930588	161.3113	47.85613	0.0000
At most 1 *	0.854538	78.61259	29.79707	0.0000
At most 2 *	0.422458	18.84953	15.49471	0.0150
At most 3	0.057365	1.831346	3.841466	0.1760

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.930588	82.69872	27.58434	0.0000
At most 1 *	0.854538	59.76305	21.13162	0.0000
At most 2 *	0.422458	17.01819	14.26460	0.0179
At most 3	0.057365	1.831346	3.841466	0.1760

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

To consider the hypothesis that the variables are not cointgrated (r=0) against the alternative of one or more cointegrating vectors (r>0), we have to look at the value of λ_{TRACE}. Column 3 of the first part of Table 9 indicates the value of λ_{TRACE} equal to each number of the cointegrating vector: λ_{TRACE} (0) = 161.31, λ_{TRACE} (1) = 78.61, λ_{TRACE} (2) = 18.84 and λ_{TRACE} (3) = 1.831 Since the value of λ_{TRACE} (2) exceeds the critical value (15.495) at the 0.05 significance level, we can reject the null hypothesis of two cointegrating vectors (r=2) and accept the alternative hypothesis of more than two cointegrating vectors (r>2) at the 0.05 level. Because the value of λ_{TRACE} (3) is less than the critical value (3.841) at the 0.05 level, we cannot reject the null hypothesis of $r \leq 3$ and reject the alternative hypothesis of four or more cointegrating vectors at the 0.05 level. If we consider the hypothesis that the variables are not cointgrated (r=3) against the alternative of three cointegrating vectors (r=4), we need to look at the λ_{MAX}. Column 3 of the second part of Table 9 indicates the values of λ_{MAX} (0), $\lambda_{MAX}(1)$, $\lambda_{MAX}(2)$ and $\lambda_{MAX}(3)$ are 82.69, 59.76, 17.01 and 1.83, respectively. The test of the null hypothesis r=3 against the specific alternative r=4 cannot be rejected at the 0.05 level, because the value of $\lambda_{MAX}(1)$ is less than the 5 percent critical value of 3.84. This suggests that the number of cointegration vectors is three.

The Johansen test gives the estimate that there are three contegrating vectors within the four series. Since the number of cointegration within the four series is affirmed, I continue to the next step of testing the causality relationships between them. Table 10 reports the results from the GCBEW test. Table 10 includes four parts. The first part reports the result of testing whether we can exclude each variable out of the equation of realGDP_L. Similarly, the next part reports the results of testing for the equation of realexports_L, realimports_L and realFDI_L. Each part of Table 10 includes four columns. The first column lists the variables which will be excluded from the equation. The next columns are the value of chi-sq, degrees of freedom and P-value. The last row in each part of Table 10 reports the joint statistics of the three variables excluded from the equation.

The GCBEW test suggests that the four variables—realGDP_L realexports_L, realimports_L and realFDI_L—are not exogenous, because the P-values of the joint test for each equation of those variables are 0.0171, 0.0409, 0.000 and 0.000, respectively. The test also provides evidence that we can reject the null hypothesis of excluding almost all variables except one case. We fail to reject the null hypothesis of excluding realGDP_L from the realexports_L equation at a 0.100 significance level, due to the fact that chi-sq = 2.467 and the P-value = 0.6505. It suggests that GDP does not cause exports. This test provides some reason to believe that there are bidirectional causalities between FDI and imports, FDI and exports, FDI and GDP, GDP and imports and exports and imports. The only unidirectional causality is of exports on GDP. Causalities from FDI to GDP and from FDI to exports are significant at the 0.05 level, while all other causalities are significant at the 0.01 level. Tentatively, it looks as if FDI shows weaker signs of causal impact on GDP and exports than other causal relations. This conclusion needs to be compared with those from the impulse response function and the variance decomposition. However, this test does not provide information about the direction of the impact, nor the relative importance between variables that simultaneously influence each other. For example, this test shows the causality of exports on GDP and also of imports on GDP.

Based on this test, we do not know whether or not exports and imports have a positive effect on GDP. It is also unclear whether or not the impact of exports on GDP is stronger than that of imports on GDP. To answer these questions, we analyze the impulse-response function and the variance decomposition.

Figure 3 exhibit the generalized asymptotic impulse response function. It includes 16 small figures which are denoted Figure 3.1, Figure 3.2 . . . Figure 3.16. Each small figure illustrates the dynamic response of each target variable (realGDP_L, realexports_L, realimports_L and realFDI_L) to a one-standard-deviation shock on itself and other variables. In each small figure, the horizontal axis presents the six years following the shock. The vertical axis measures the yearly impact of the shock on each endogenous variable.

Table 10: Granger Causality/Block Exogeneity Wald Test for Malaysia

Excluded	Chi-sq	df	Prob.
Dependent variable: REALGDP_L			
REALEXP_L	15.68534	4	0.0035
REALIMP_L	10.69470	4	0.0302
REALFDI_L	9.238898	4	0.0554
All	24.55474	12	0.0171
Dependent variable: REALEXP_L			
REALGDP_L	2.467139	4	0.6505
REALIMP_L	12.92560	4	0.0116
REALFDI_L	9.341260	4	0.0531
All	21.70638	12	0.0409
Dependent variable: REALIMP_L			
REALGDP_L	25.05008	4	0.0000
REALEXP_L	93.08102	4	0.0000
REALFDI_L	62.68971	4	0.0000
All	122.8555	12	0.0000
Dependent variable: REALFDI_L			
REALGDP_L	18.17507	4	0.0011
REALEXP_L	45.38248	4	0.0000
REALIMP_L	34.01062	4	0.0000
All	233.6008	12	0.0000

Figure 3.1 presents the long-run positive effect on GDP of a shock to GDP. After slightly decreasing, GDP returns to its preshock level after five years. Thereafter, it reduces very slightly over time. The Granger causality /block exogeneity test shows that GDP does not affect exports. But Figure 3.2 shows that a shock to GDP has short-run positive impact on exports from the first through the third years. After that, the impact is not significant. This data conflicts with the GCBEW test. Under a shock to GDP, imports increases considerably after five years. The impact of a shock to GDP on imports turns out to be statistically insignificant thereafter (Figure 3.3). Figure 3.4 shows that shock to GDP leads to increase in FDI only in the third and fifth years. Outside of those years, the impact of a shock to GDP on FDI is not statistically significant.

Figure 3.1

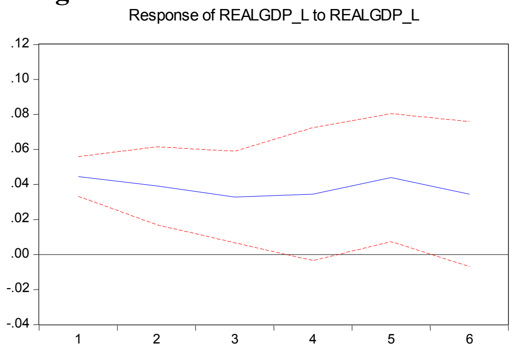


Figure 3.2

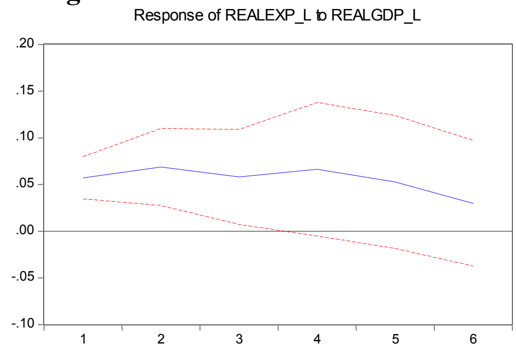


Figure 3.3

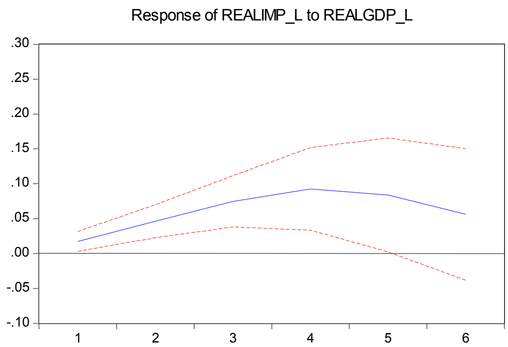
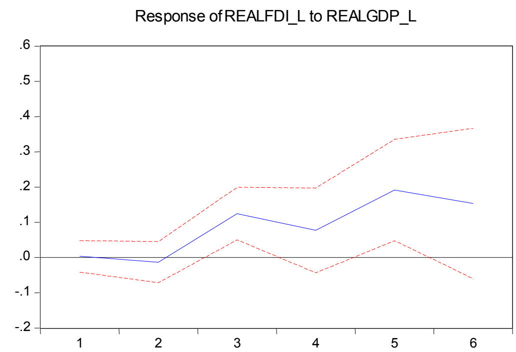


Figure 3.4



Figures 3.5 through 3.8 suggest that in the long run, a shock to exports has positive significant impact on GDP, imports, FDI and exports. The new equilibrium of all variables is reached after about five years. After reaching the minimum level in the third year, GDP increases over time. A shock to exports leads to an increase in imports for five years. It takes about six years to reach a new equilibrium, which is five times higher than the starting level. Before the second year, the impact of a shock to exports on FDI is not statistically significant. Thereafter, FDI increases over time and the response of FDI to export shock has a staircase shape. The response of exports to shocks on exports has a wave shape. It begins to increase slightly and reaches a maximum in the second year, then returns to preshock level and down to a minimum level in the third year; thereafter, it increases again and reaches a maximum level in the fifth year, before decreasing again to the new equilibrium after the sixth year.

Figure 3.5

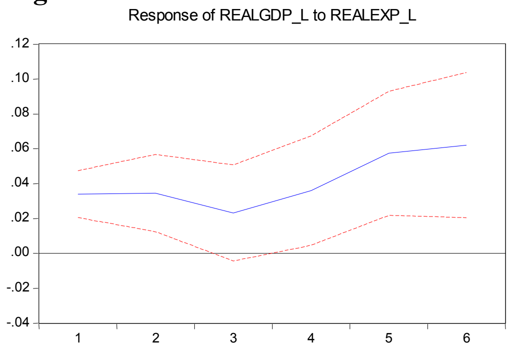


Figure 3.6

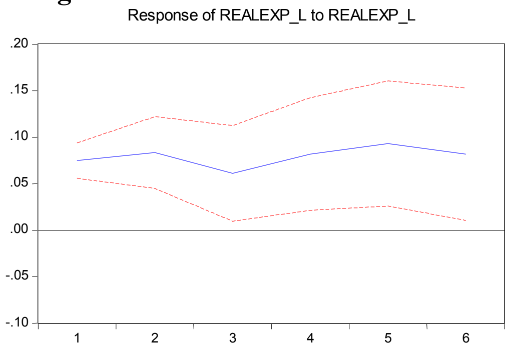


Figure 3.7

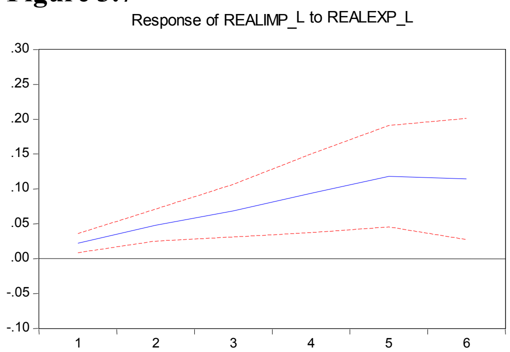
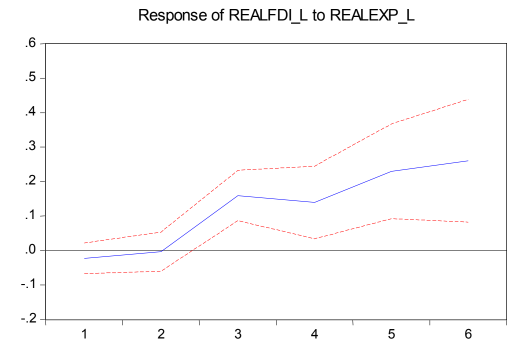


Figure 3.8



Figures 3.9 through Figure 3.12 show the responses of GDP, exports, imports and FDI to import shock. Import shocks have short-run positive effects on GDP, exports, and imports and FDI. In the first two years, import shock leads to an increase in GDP, exports and imports. Thereafter, the impacts of import shock on GDP as well as on exports and imports are not statistically significant. Import shock has a positive effect on FDI only in the third year. For other years, the impact of import shock on FDI is not statistically significant.

Figure 3.9

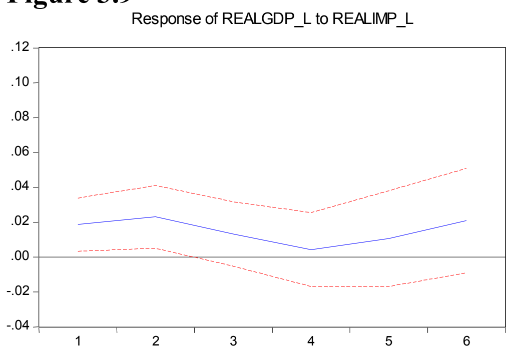


Figure 3.10

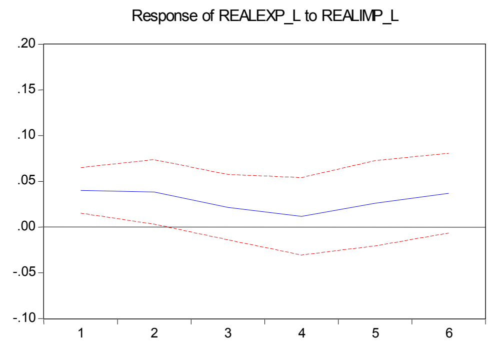


Figure 3.11

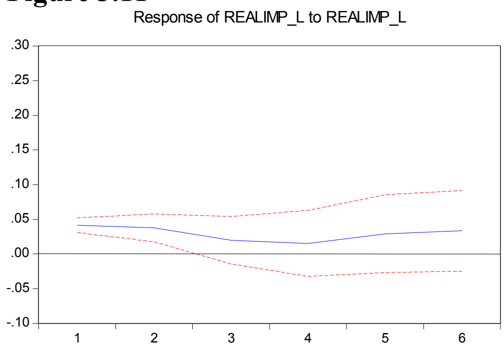
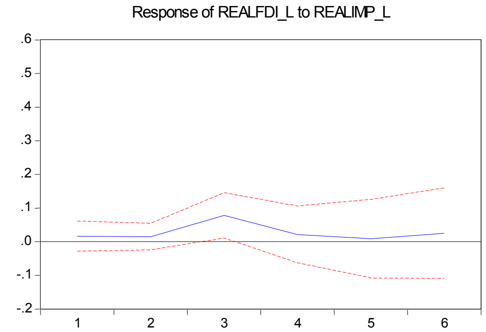


Figure 3.12



Looking at Figures 3.13 and 3.16, a shock to FDI has statistically insignificant effects on GDP, exports and imports. This is in conflict with the GCBEW test results. But, the shock to FDI has a short-run positive effect on FDI for the first two years. Thereafter, the impact of FDI shock on FDI is not statistically significant.

Figure 3.13

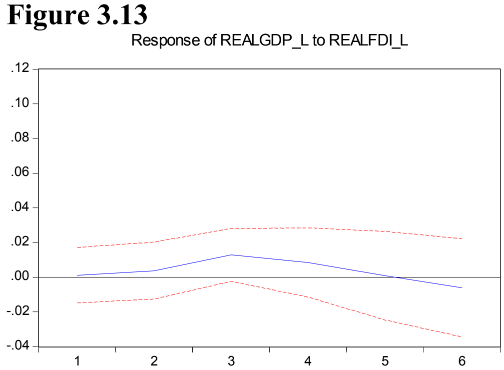


Figure 3.14

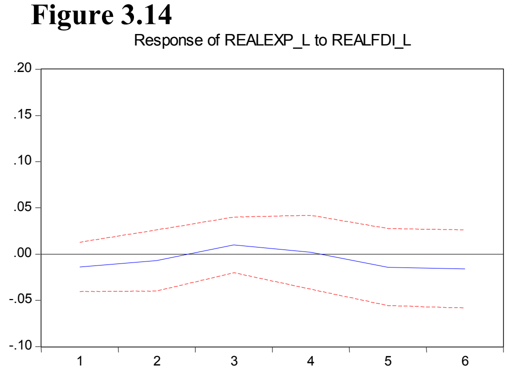


Figure 3.15

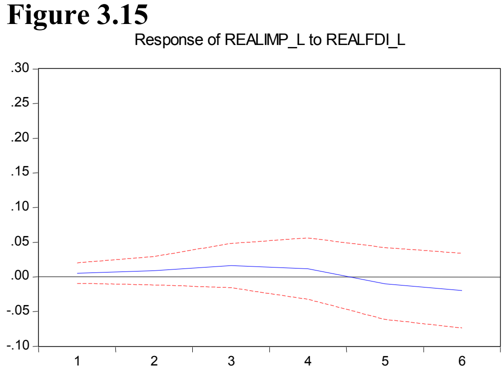
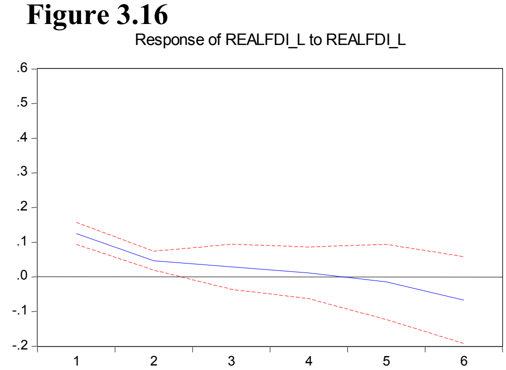


Figure 3.16



In summary, impulse response is mostly consistent with the GCBEW test, except for the impact of shock to FDI on GDP, exports and imports, and the impact of shock to GDP on exports. All significant impacts are positive. Based on analysis of the above estimated results and the performance of the Malaysia economic policy mentioned in section 3.4.1 and the accuracy of GCBEW test, I prefer the results from the GCBEW test.

Table 11 reports the variance decomposition of each endogenous variable. This table contains four parts. The first part reports the variance decomposition of realGDP_L. The following parts present the variance decomposition of realexports_L, realimports_L and real FDI_l, respectively. In each part, there are six columns. The first column lists the time periods. The second column reports the standard error of the sample set. The remaining columns report the variance proportion of the shock to each variable in each time period. The number in the parenthesis reports the standard error of the coefficient of variance proportion.

Table 11: Variance Decomposition for Malaysia

Variance Decomposition of realGDP_L

Period	S.E.	REALEXP_L	REALGDP_L	REALIMP_L	REALFDI_L
1	0.044510	58.29825	41.70175	0.000000	0.000000
		(11.1220)	(11.1220)	(0.00000)	(0.00000)
2	0.060076	65.07595	33.77356	0.696485	0.454006
		(12.9930)	(12.5413)	(4.45809)	(0.70082)
3	0.069539	59.65168	36.51093	0.526018	3.311379
		(14.9958)	(14.1898)	(4.56535)	(2.19963)
4	0.083192	60.37793	27.19957	4.999343	7.423153
		(17.1632)	(15.0005)	(5.52887)	(3.92453)
5	0.105746	66.89622	16.83452	8.206329	8.062931
		(15.3455)	(13.9314)	(6.74347)	(3.85607)
6	0.126046	71.33686	14.38464	7.040865	7.237633
		(14.2664)	(12.9520)	(5.93970)	(3.54565)

Variance Decomposition of realexp_l

Period	S.E.	REALEXP_L	REALGDP_L	REALIMP_L	REALFDI_L
1	0.074821	100.0000	0.000000	0.000000	0.000000
		(0.00000)	(0.00000)	(0.00000)	(0.00000)
2	0.112913	98.40425	0.460208	0.445332	0.690204
		(5.57647)	(3.47637)	(2.41383)	(0.83221)
3	0.132103	93.22448	2.117101	1.340131	3.318289
		(10.7244)	(6.41192)	(5.74238)	(2.57798)
4	0.162574	86.87339	1.525765	6.371994	5.228853
		(13.1734)	(8.79499)	(7.23310)	(3.58131)
5	0.192609	85.28043	3.320760	6.621013	4.777793
		(11.9220)	(8.78269)	(6.81159)	(3.30163)
6	0.215804	82.22300	8.088420	5.378865	4.309717
		(12.7645)	(10.4284)	(6.52262)	(2.93806)

Variance Decomposition of realimp_L

Period	S.E.	REALEXP_L	REALGDP_L	REALIMP_L	REALFDI_L
1	0.041315	28.64207	0.020316	71.33761	0.000000
		(13.5929)	(3.09017)	(13.2982)	(0.00000)
2	0.067397	61.41540	4.800254	30.98939	2.794949
		(11.9645)	(6.93608)	(11.0723)	(1.63977)
3	0.108082	64.28080	12.05942	15.78998	7.869790
		(13.7295)	(9.05271)	(6.83575)	(3.55625)
4	0.156624	66.39535	10.07907	14.72992	8.795664
		(15.9670)	(10.9640)	(7.97180)	(4.10882)
5	0.202545	73.75662	6.279328	12.77066	7.193393
		(14.3079)	(8.83909)	(8.69442)	(3.73181)
6	0.240906	74.60503	8.464300	10.80167	6.128996
		(13.5322)	(9.21920)	(8.61516)	(3.47272)

Variance Decomposition of realFDI_L

Period	S.E.	REALEXP_L	REALGDP_L	REALIMP_L	REALFDI_L
1	0.125165	3.452186	6.716352	7.153008	82.67845
		(7.33552)	(8.55318)	(8.18333)	(12.8071)
2	0.136942	2.962069	6.995421	8.116230	81.92628
		(7.43730)	(7.87631)	(8.84338)	(13.8846)
3	0.220332	53.45616	2.748089	3.287926	40.50783
		(13.1913)	(4.76177)	(5.13689)	(10.3520)
4	0.281224	57.28586	4.308757	6.899840	31.50554
		(13.5008)	(7.72989)	(6.07683)	(9.30283)
5	0.393450	63.33581	2.610052	15.37060	18.68353
		(14.1047)	(6.16625)	(9.14200)	(7.03473)
6	0.496962	67.13638	3.654766	16.88496	12.32390
		(13.7799)	(9.18469)	(9.94689)	(5.20484)

Looking at Table 11, the fluctuations of GDP are explained mainly by GDP shocks and export shocks, in the long run. GDP shock accounts for 41.7% in the first year. Its proportion in the variance of GDP decreases over time and reaches 15.75% in the sixth year. Export shock accounts for 58.29% in the first year. Its proportion increases over time and reaches 71.33% in the sixth year. Export shock, which is assumed to account for the whole variance of exports in the first year, continuously dominates in the following years. Its proportion decreases over time, but still accounts for 82.22% in the sixth year. In the long run, export shock is the most important source of imports variability. The role played by export shock increases over time and accounts for 74.6% in the sixth year. In addition, the fluctuation of imports is also explained by its shock. Import shock accounts for 71.33% in the first year and falls to 10.8% in the sixth year. The evidence suggests that FDI shock is the important factor explaining FDI variability. FDI shock accounts for 82.67%. Its proportion decreases over time and reaches 12.32% in the sixth year.

In summary, export shock is the most important source of shock to GDP and imports. Shocks to GDP, imports and exports are important sources of variability for themselves at first, but this self-effect diminishes for all variables except exports.

The estimated results from the Granger causality/ Block exogeneity test, the impulse-response function and variance decomposition confirm the exports-led growth hypothesis, imports-compression growth hypothesis and the intertemporal budget constraint hypothesis for Malaysia. The positive effect of trade liberalization results from positive effects of both imports and exports on economic growth.

3.3 Korea

As with Malaysia, I construct a four-variable VAR system with four endogenous variables (realGDP_L, realexports_L, realimports_L and realFDI_L) and two exogenous variables (dummy98 and dummy01). The results from the test for lag length criteria, based on the four-variable VAR system with a maximum lag number of 5, is reported in Table 12. The lag order chosen by the LR test and the SC criterion is 1, (by the FPE criterion), 2, and, by the AIC and HQ criteria, 4.

Table 12: Test for Lag Length Criteria for Korea

Lag	LogL	LR	FPE	AIC	SC	HQ
0	11.70564	NA	1.21e-05	0.021805	0.597732	0.193058
1	128.4014	172.8827*	7.26e-09	-7.437143	-6.093312*	-7.037551
2	149.1957	24.64503	5.93e-09*	-7.792272	-5.680538	-7.164342
3	167.6133	16.37122	7.15e-09	-7.971355	-5.091718	-7.115088
4	188.9186	12.62539	1.07e-08	-8.364343	-4.716802	-7.279738
5	226.8587	11.24149	1.44e-08	-9.989531*	-5.574087	-8.676588*

Note:
(*) indicates the lag order selected by the criterion
LR: Sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC:Akaike Information Criterion
SC: Schwarz Information Criterion
HQ: Hannan-Quinn Information Criterion

I run VAR with the lag order of 1, 2 and 5. For each lag order, I will apply the normality test and the LM test for VAR residuals. Since only a lag order of 2 satisfies both the normality test and the LM test, I choose a lag order of 2 as the appropriate order for the four-variable VAR system. The results of four-variable VAR with a lag order of 2 are reported in Table 13

Table 13: VAR Model of Korea with Lag of Two and Dummy Variables (1998 and 2001)

	REALGDP_L	REALEXP_L	REALIMP_L	REALFDI_L
REALGDP_L(-1)	1.023080	0.145202	-0.121273	-3.134711
	(0.25146)	(0.38365)	(0.30448)	(2.94745)
	[4.06848]	[0.37848]	[-0.39829]	[-1.06353]
REALGDP_L(-2)	-0.007714	-0.128993	0.191425	5.526554
	(0.24231)	(0.36968)	(0.29340)	(2.84015)
	[-0.03183]	[-0.34893]	[0.65244]	[1.94587]
REALEXP_L(-1)	0.828110	1.677445	0.736414	4.488236
	(0.18502)	(0.28228)	(0.22403)	(2.16870)
	[4.47567]	[5.94246]	[3.28706]	[2.06955]
REALEXP_L(-2)	-0.265466	-0.496184	-0.300288	2.980913
	(0.25078)	(0.38261)	(0.30366)	(2.93947)
	[-1.05854]	[-1.29685]	[-0.98890]	[1.01410]
REALIMP_L(-1)	-0.770692	-0.494140	0.615231	-2.608679
	(0.27335)	(0.41704)	(0.33098)	(3.20399)
	[-2.81941]	[-1.18488]	[1.85879]	[-0.81420]
REALIMP_L(-2)	0.181448	0.348080	-0.149837	-5.715754
	(0.30433)	(0.46430)	(0.36849)	(3.56708)
	[0.59622]	[0.74969]	[-0.40662]	[-1.60236]
REALFDI_L(-1)	0.000747	-0.014856	-0.006514	0.328179
	(0.02190)	(0.03342)	(0.02652)	(0.25674)
	[0.03413]	[-0.44457]	[-0.24560]	[1.27828]
REALFDI_L(-2)	0.001135	0.010671	0.028728	-0.320007
	(0.02076)	(0.03167)	(0.02514)	(0.24333)
	[0.05468]	[0.33691]	[1.14287]	[-1.31514]
C	0.240383	-0.986320	0.212286	-18.83481
	(1.18382)	(1.80608)	(1.43340)	(13.8756)
	[0.20306]	[-0.54611]	[0.14810]	[-1.35740]

DUMMY98	-0.515967	-0.186249	-0.525966	0.898778
	(0.06577)	(0.10033)	(0.07963)	(0.77084)
	[-7.84560]	[-1.85629]	[-6.60506]	[1.16597]
DUMMY01	-0.177022	-0.238609	-0.323665	-0.135480
	(0.07290)	(0.11121)	(0.08826)	(0.85442)
	[-2.42842]	[-2.14551]	[-3.66696]	[-0.15856]
R-squared	0.987374	0.976285	0.982264	0.841155
Adj. R-squared	0.980729	0.963804	0.972930	0.757553
Sum sq. resids	0.063088	0.146842	0.092494	8.667269
S.E. equation	0.057623	0.087912	0.069772	0.675405
F-statistic	148.5867	78.21949	105.2290	10.06138
Log likelihood	49.89827	37.22581	44.15896	-23.94350
Akaike AIC	-2.593218	-1.748387	-2.210598	2.329567
Schwarz SC	-2.079446	-1.234615	-1.696825	2.843339
Mean dependent	22.31521	21.21140	21.19537	16.52648
S.D. dependent	0.415093	0.462081	0.424067	1.371690

Determinant resid covariance (dof adj.)	1.66E-08
Determinant resid covariance	2.66E-09
Log likelihood	125.8843
Akaike information criterion	-5.458953
Schwarz criterion	-3.403863

The results from the VAR residual normality test and the VAR residual serial correlation LM test are reported in Table 14 and Table 15, respectively. By Table 14, we cannot reject the hypothesis of normality of properties, since P-values are 0.293, 0.267 and 0.218, for skewness, kurtosis and the Jarque-Bera test. Table 15 shows that we also cannot reject the null hypothesis of no autocorrelation up to lag 3, since P-values are 0.1305, 0.2684 and 0.6495 for lag orders 1, 2 and 3, respectively. Two tests support the contention that the assumptions of our model about white noise residuals are met.

Table 14: VAR Residual Normality Test for Korea

Component	Skewness	Chi-sq	Df	Prob.
1	-0.712472	2.538082	1	0.1111
2	0.659506	2.174739	1	0.1403
3	-0.327146	0.535121	1	0.4645
4	-0.226558	0.256643	1	0.6124
Joint		5.504585	4	0.2393

Component	Kurtosis	Chi-sq	Df	Prob.
1	4.901626	4.520226	1	0.0335
2	3.178346	0.039759	1	0.8420
3	2.444207	0.386132	1	0.5343
4	2.547986	0.255396	1	0.6133
Joint		5.201513	4	0.2672

Component	Jarque-Bera	df	Prob.
1	7.058308	2	0.0293
2	2.214498	2	0.3305
3	0.921254	2	0.6309
4	0.512039	2	0.7741
Joint	10.70610	8	0.2189

Table 15: VAR Residual Serial Correlation LM Test for Korea

Lags	LM-Stat	Prob
1	22.40837	0.1305
2	19.00505	0.2684
3	13.31700	0.6495

Probs from chi-square with 16 df.

The Johansen cointegration test results reported in Table 16 indicate that the four series are cointegrated and there is one cointegrating vector. Column 3 of the first part of Table 16 indicates that the value of λ_{TRACE} (1) = 19.893 is less than the critical value (29.797) at the 0.05 level, and therefore, we cannot reject the null hypothesis of $r \leq 1$ and reject the alternative hypothesis of more than two cointegrating vectors at the 0.05 level. Column 3 of the second part of Table 16 indicates that we cannot reject the null hypothesis r=1 against the specific alternative r=2 at the 0.05 level, because the value $\lambda_{MAX}(1)$= 17.294 is less than the 0.05 critical value of 21.131. This suggests that the number of cointegration vectors is 1.

Table 16: Johansen Cointegration Test with Optimal Lag Length of Three for Korea

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.652535	51.60650	47.85613	0.0213
At most 1	0.438136	19.89379	29.79707	0.4300
At most 2	0.049438	2.598905	15.49471	0.9821
At most 3	0.035290	1.077842	3.841466	0.2992

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.652535	31.71271	27.58434	0.0139
At most 1	0.438136	17.29488	21.13162	0.1585
At most 2	0.049438	1.521063	14.26460	0.9978
At most 3	0.035290	1.077842	3.841466	0.2992

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

The GCBEW test reported in Table 17 suggests that the three variables realGDP_L, realimp_L and realFDI_L are not exogenous, since the P-values of the joint test for each equation of those variables are 0.000, 0.000, and 0.009, respectively. Exports are exogenous because we fail to reject the null hypothesis of excluding realGDP_l, real imp_l and realFDI_L from realexp_l at the 0.1 significance level, since chi-sq = 3.593 and P-value = 0.7315. This data implies that GDP, imports and FDI do not have causal on exports. We also fail to reject the null hypothesis of excluding realFDI_L from the realGDP_L equation and excluding realGDP_L and realFDI_L from the realimp_l equation.

Table 17: Granger Causality/Block Exogeneity Wald Test for Korea

Dependent variable: REALGDP_L

Excluded	Chi-sq	df	Prob.
REALEXP_L	22.91372	2	0.0000
REALIMP_L	11.49603	2	0.0032
REALFDI_L	0.004291	2	0.9979
All	59.62624	6	0.0000

Dependent variable: REALEXP_L

Excluded	Chi-sq	df	Prob.
REALGDP_L	0.144426	2	0.9303
REALIMP_L	1.413775	2	0.4932
REALFDI_L	0.300981	2	0.8603
All	3.593115	6	0.7315

Dependent variable: REALIMP_L

Excluded	Chi-sq	df	Prob.
REALGDP_L	0.559915	2	0.7558
REALEXP_L	11.79093	2	0.0028
REALFDI_L	1.348383	2	0.5096
All	33.77495	6	0.0000

Dependent variable: REALFDI_L

Excluded	Chi-sq	df	Prob.
REALGDP_L	5.617262	2	0.0603
REALEXP_L	10.98645	2	0.0041
REALIMP_L	9.695391	2	0.0078
All	16.98314	6	0.0093

This test provides some evidence that there are causalities from imports and exports on GDP; from exports on imports; from GDP, exports and imports on FDI.

As mentioned in section 2, because the estimated results from GIR are not consistent with those from the GCBEW test, we use OIR and change the prior ordering of the endogenous variables. Exports are not affected by any other variables, and thus exports are placed first in the ordering of the list. GDP is considered a target variable, and thus it is placed at the end of the ordering of the list. The magnitude of FDI is higher than that of imports, since FDI is affected by exports, imports and GDP, while imports are affected only by exports. For this reason, FDI is placed after imports in the ordering of the list. Thus, the ordering of variables in my VAR system is as follows: exports, imports, FDI and GDP. The estimated results from OIR (as mentioned below) are consistent with those from the GCBEW test with this ordering of variables, confirming the robustness of this ordering.

Figure 4 exhibits the Cholesky asymptotic impulse response function. It includes 16 small figures which are denoted Figure 4.1, Figure 4.2 . . . Figure 4.16. Each small figure illustrates the dynamic response of each target variable (realGDP_L, realexports_L, realimports_L and realFDI_L) to a one-standard-deviation shock on itself and other variables. In each small figure, the horizontal axis presents the six years following the shock. The vertical axis measures the yearly impact of the shock on each endogenous variable.

Figure 4.1 presents a short-run positive effect of GDP shock on GDP. Figures 4.2 through 4.4 show that GDP shocks do not have effects on exports, imports and FDI. Figures 4.5 through 4.7 suggest that, in the long run, export shocks have positive significant impacts on GDP, imports, and GDP itself. Under export shock, FDI increases little in the first and second years. Thereafter, the impact of export shock on FDI turns out to be insignificant (Figure 4.8).

Figure 4.1

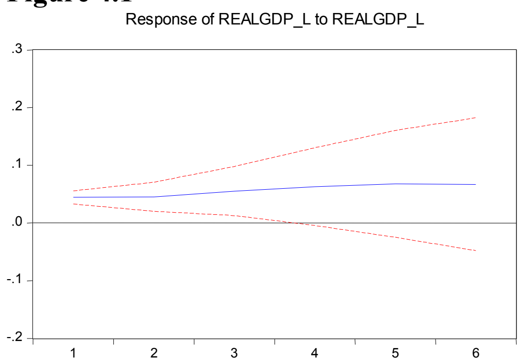


Figure 4.2

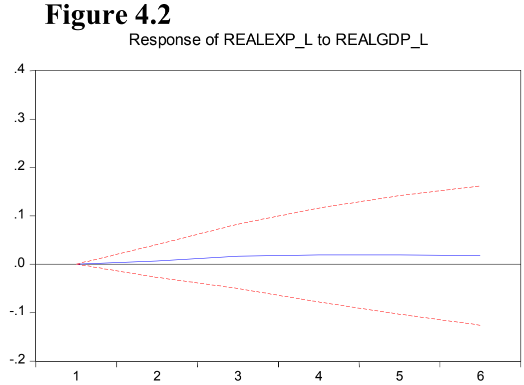


Figure 4.3

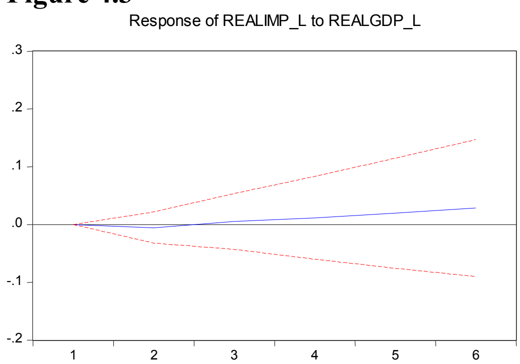


Figure 4.4

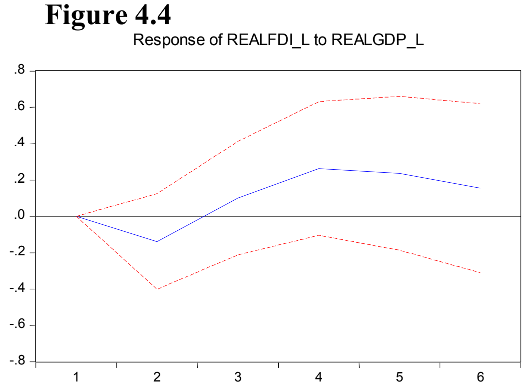


Figure 4.5

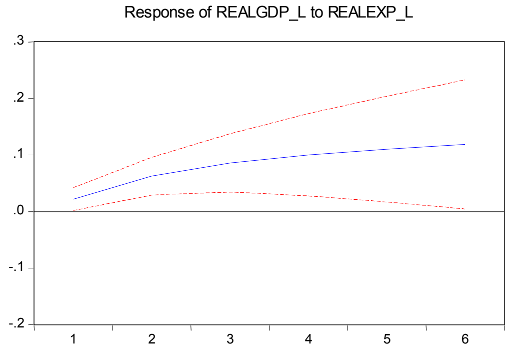


Figure 4.6

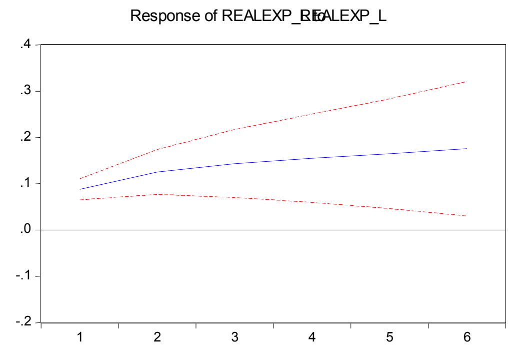


Figure 4.7

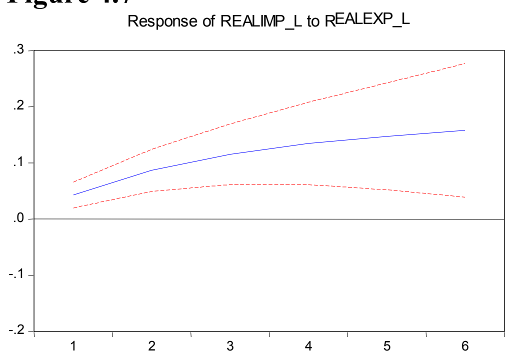


Figure 4.8

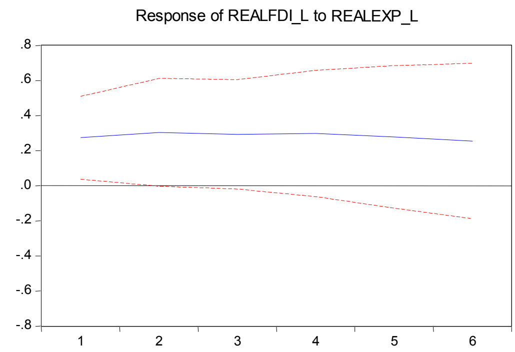


Figure 4.9 shows that import shock has a short-run positive effect on GDP at the beginning. Thereafter, this impact seems to be insignificant in the second year, and turns out to be negative in the third and fourth years. Finally, this impact becomes insignificant in the fifth year. There is no impact of import shock on exports in Figure 4.10. Figure 4.11 shows that import shock has a short-run positive effect on imports in the first and second years. After that, the impact is not significant. Import shock does not have an effect on FDI at the beginning. The impact of import shock on FDI turns out to be negative in the second, third and fourth years, and then becomes insignificant (Figure 4.12).

Figure 4.9

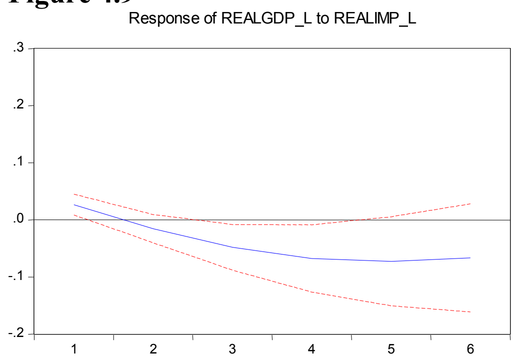


Figure 4.10

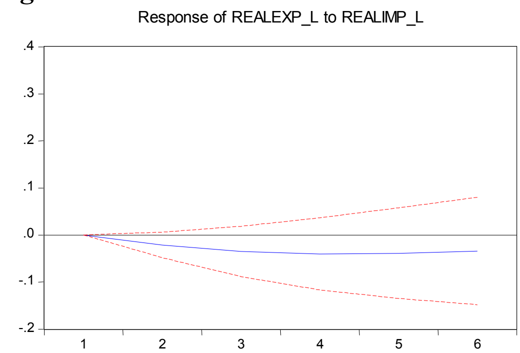


Figure 4.11

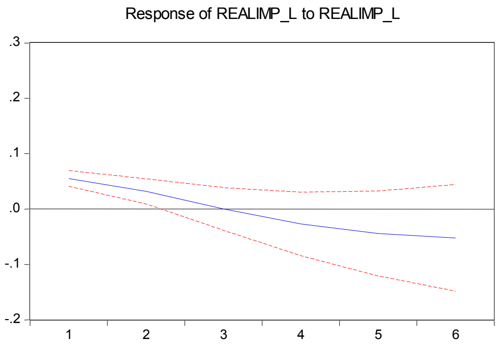
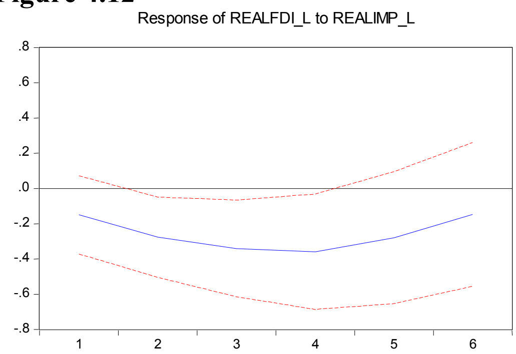


Figure 4.12



Looking at Figures 4.13 – 4.15, FDI shock is statistically insignificant in its effect on GDP, exports and imports. But, it has a short-run positive effect on FDI for the first two years. Thereafter, the impact of FDI shock on FDI is not statistically significant (Figure 4.16).

Figure 4.13

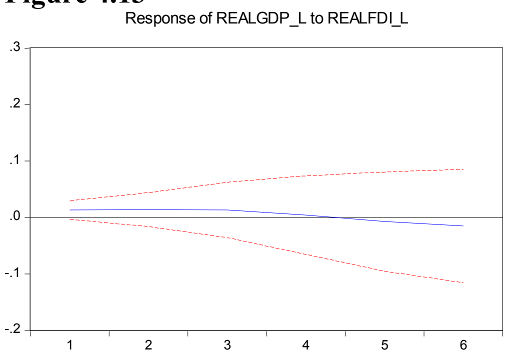


Figure 4.14

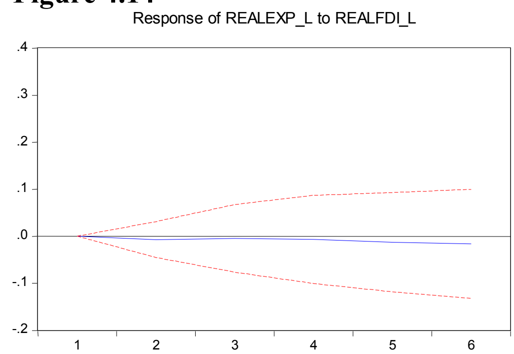


Figure 4.15

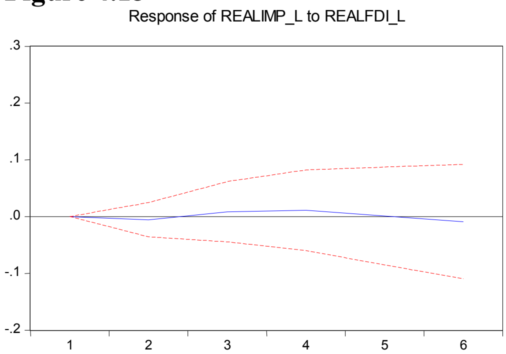
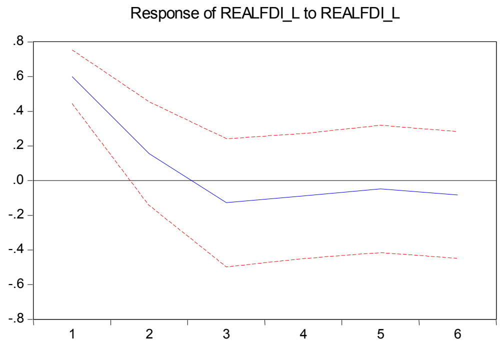


Figure 4.16



In summary, impulse response results are mostly consistent with the GCBEW test, except for the impact of GDP shock on FDI. There is a short-run negative effect of imports on GDP and

FDI. The impact from exports on FDI and imports is positive. Exports are not affected by GDP, imports and FDI, which also differs from the Malaysian results.

Looking at Table 18, the fluctuations of GDP are explained mainly by GDP and export shocks. GDP shock accounts for 58.9% at the first year. Its proportion in the variance of GDP decreases over time and reaches 23.5% in the sixth year. Export shock accounts for 14.37% in the first year. Its proportion increases over time and reaches 55.51% in the sixth year. Export shock, which is assumed to account for the whole variance of exports in the first year, continuously dominates for the following years. Its proportion decreases over time but still accounts for 94.132% in the sixth year. Export shock is the most important source of import variability. The role played by export shock increases over time and accounts for 88.66% in the sixth year. In addition, the fluctuation in imports is also explained by import shock. Import shock accounts for 62.6% in the first year, falls to 15.1% in the third year and is not significant thereafter. FDI variability is due to FDI and export shocks. FDI shock accounts for 78.67% in the first year. Its proportion decreases over time and reaches 27.37% in the sixth year. Export shock is an important source of the variability of FDI. It accounts for 16.38% in the first year, and then increases over time and reaches 31.78% in the sixth year.

In summary, export shock is the most important source of effects on GDP, imports and also FDI. Shocks to GDP, imports and exports are also an important source of their own variability.

Table 18: Variance Decomposition for Korea

Variance Decomposition of realGDP_L

Period	S.E.	REALEXP_L	REALIMP_L	REALFDI_L	REALGDP_L
1	0.057623	14.37624	21.47465	5.185356	58.96375
		(13.3902)	(12.8812)	(5.06982)	(13.0743)
2	0.098492	45.15806	9.776402	3.758596	41.30694
		(15.9700)	(6.59574)	(5.37893)	(11.7953)
3	0.150483	51.93426	14.45985	2.394616	31.21128
		(18.1753)	(10.1176)	(5.61814)	(11.6293)
4	0.203151	52.91728	19.00384	1.354684	26.72420
		(21.0164)	(13.3413)	(6.37415)	(12.5086)
5	0.251680	53.65105	20.72171	0.969634	24.65761
		(23.6061)	(15.2541)	(7.16959)	(13.9573)
6	0.294294	55.51130	20.27906	0.974179	23.23546
		(25.4916)	(16.5155)	(7.93036)	(15.2886)

Variance Decomposition of realexp_l

Period	S.E.	REALEXP_L	REALIMP_L	REALFDI_L	REALGDP_L
1	0.087912	100.0000	0.000000	0.000000	0.000000
		(0.00000)	(0.00000)	(0.00000)	(0.00000)
2	0.154972	97.75755	1.866846	0.203730	0.171877
		(5.87234)	(3.30693)	(2.59127)	(2.11274)
3	0.214860	95.53514	3.643932	0.152108	0.668822
		(11.6416)	(6.03718)	(5.62998)	(5.12109)
4	0.268790	94.33288	4.582398	0.158640	0.926087
		(15.5993)	(7.49658)	(7.62594)	(7.59332)
5	0.318477	93.96773	4.745874	0.269073	1.017319
		(18.2492)	(8.69080)	(8.72860)	(9.67019)
6	0.366074	94.13246	4.456714	0.400873	1.009949
		(20.1654)	(9.90842)	(9.35261)	(11.2609)

Variance Decomposition of realimp_l

Period	S.E.	REALEXP_L	REALIMP_L	REALFDI_L	REALGDP_L
1	0.069772	37.39146	62.60854	0.000000	0.000000
		(14.5798)	(14.5798)	(0.00000)	(0.00000)
2	0.115864	69.36945	30.19124	0.224812	0.214490
		(13.0188)	(12.2330)	(3.08541)	(2.41567)
3	0.163803	84.30055	15.10539	0.381512	0.212545
		(10.9766)	(8.48179)	(3.96507)	(3.69005)
4	0.214234	88.67431	10.42153	0.491330	0.412829
		(12.0321)	(7.32764)	(5.47868)	(5.17732)
5	0.264432	89.21776	9.645542	0.323847	0.812852
		(14.5487)	(8.24416)	(7.09742)	(6.83071)
6	0.313771	88.66792	9.623179	0.310414	1.398484
		(17.1925)	(9.76825)	(8.31776)	(8.48733)

Variance Decomposition of realFDI_L

Period	S.E.	REALEXP_L	REALIMP_L	REALFDI_L	REALGDP_L
1	0.675405	16.38801	4.933555	78.67843	0.000000
		(13.1526)	(9.18030)	(13.3483)	(0.00000)
2	0.817935	25.03464	14.82932	57.26041	2.875632
		(14.3157)	(11.2778)	(13.5534)	(5.57388)
3	0.947295	28.23029	23.97675	44.53591	3.257054
		(14.9717)	(12.3132)	(12.2491)	(6.50668)
4	1.091878	28.68329	28.85665	34.19319	8.266871
		(16.0531)	(13.3380)	(11.6244)	(8.60620)
5	1.185697	29.82354	30.02594	29.16363	10.98689
		(17.1086)	(14.1043)	(11.6183)	(11.1519)
6	1.234119	31.78338	29.13199	27.37955	11.70509
		(17.6951)	(14.0199)	(11.0690)	(12.6004)

The estimated results from the Granger causality/Block exogeneity test, the impulse response test and variance decomposition demonstrate the export-led growth hypothesis. There is causality of imports on GDP, but this impact is weak. We cannot give any conclusion about the impact of trade liberalization on economic growth in the case of Korea.

The differences in estimated results between Korea and Malaysia ask for explanation. Section 3.4 will map the economic policies of Korea and Malaysia onto the results of the Granger causality/Block exogeneity test, the impulse response-function and variance decomposition.

3.4 Analysis, Comparison and Explanation of the Differences in the Estimated Results from Malaysia and Korea

The differences in the estimated results from Malaysia and from Korea are due to differences between the two countries' economic policies. The most fundamental differences arise from the governments' visions of the role of FDI at the times these data were collected. The Malaysian government considered FDI to be the country's leading industrialization program (Jomo, 2003, p.100), whereas South Korea built an integrated national economy based on the lead role of the "chaebol" (Kim, 1998, p. 81).

This section consists of two parts. The first part explains the estimated results through an analysis of Malaysian economic policy. The second part explains the estimated result through an analysis of Korean economic policy and points out the differences between the two countries.

3.4.1 Malaysia

Malaysia shifted from an import-substitution policy to an export-oriented policy in 1968 (Jomo, 2003, p. 36). In 1977, the policy substantially accelerated, when the government stimulated exports using tools such as insurance, credit-refinancing schemes, devaluation of the ringgit, and other methods (Jomo, 2003, p.49). From the 1970s on, the government considered the export-oriented policy to be the most important long-term policy for developing Malaysia's economy. Indeed, the success of this policy supports my finding that exports have had a positive effect on Malaysian economic growth. Table 19 shows that Malaysia's export share of GDP increased from 41.4% in 1970 to 110.2% in 2007. The average export growth rate and the average economic growth rate were 9.39% and 6.67%, respectively, from 1970 – 2007 (Table 19). In the economic and financial crisis, a heavy decrease in export growth rate led to a decrease in the GDP growth rate. Table 19 also reports the GDP export share, the export growth rate, and the GDP growth rate of Malaysia from 1970 to 2007. For example, in the 1974–75 oil crises, the export growth rate fell from 15.9% (1974) to -3% (1975), which partly led to a decrease in the GDP growth rate from 8.3% (1974) to 0.8% (1975). The 1998 Asian financial crisis caused the export growth rate to fall from 9.2% (1996) to 0.5% (1998), which led to a decrease in GDP growth rate from 10% (1996) to -7.4% (1998). These facts are consistent with one-way causality of exports on economic growth.

To promote exports, the Malaysia government exempted an import tax on intermediate input—capital goods—that were used for export production or import-substitution industries. Therefore, in Malaysia, imports of intermediate goods and capital goods promoted export manufacture and domestic production. In other words, imports had a causal relationship with exports and GDP. The export value of Malaysia increased from 1.17 billion USD in 1970 to 114 billion USD in 2004 (Table 19), and provided a foreign exchange source for reimporting intermediate input, capital goods, and consumption goods. One can see that the Malaysian import value also increased from 1.6 billion USD in 1970 to 119 billion USD in 2004 (Worldbank Dataset - WDI). In 2004, the intermediate goods and equipment for export manufacturing had not yet been produced by domestic industries, and thus the country still had to import. Therefore, an increase in GDP asks for increase in imports of intermediate goods and capital goods. These facts are consistent with the estimated results from Granger Causalities, that exports and imports as well as imports and GDP in Malaysia have two-way causalities.

Table 19: Export Share on GDP and Export Growth Rate of Malaysia, 1970-2007 (%)

Year	Export Share on GDP	Export Growth Rate	GDP Growth Rate	Year	Export Share on GDP	Export Growth Rate	GDP Growth Rate
YR1970	13.6	19.6	8.3	YR1989	30.8	-4	6.7
YR1971	15	21.7	8.2	YR1990	28	4.5	9.2
YR1972	19.4	37.2	4.5	YR1991	26.3	11.1	9.4
YR1973	28.7	56	12.0	YR1992	26.6	12.2	5.9
YR1974	26.7	-1.9	7.2	YR1993	26.5	12.2	6.1
YR1975	26.9	18.7	5.9	YR1994	26.6	16.3	8.5
YR1976	30	39.5	10.6	YR1995	28.8	24.4	9.2
YR1977	30.4	21.6	10.0	YR1996	27.9	12.2	7.0
YR1978	28.4	14.2	9.3	YR1997	32.4	21.6	4.7
YR1979	26.6	2	6.8	YR1998	46.2	12.7	-6.9
YR1980	32.1	8.2	-1.5	YR1999	39.1	14.6	9.5
YR1981	34.3	16	6.2	YR2000	38.6		
YR1982	33.2	8.2	7.3	YR2001	35.7	-3.4	4.0
YR1983	33	14.3	10.8	YR2002	33.1	12.1	7.2
YR1984	33.4	8.2	8.1	YR2003	35.4	14.5	2.8
YR1985	32	4.2	6.8	YR2004	40.9	19.7	4.6
YR1986	35.6	26.8	10.6	YR2005	39.3	7.8	4.0
YR1987	38.3	21.8	11.1	YR2006	39.7	11.4	5.2
YR1988	36.4	11.7	10.6	YR2007	41.9	12.6	5.1
				Average	31.5	15.1	6.9

Sources: World Bank, WDI.

Nearly three times larger than Korea, at 748 sq km, Malaysia has rich natural resources (Data source: U.S. Department of State) and primary goods (raw material and agricultural plants) as main export goods in the early stage of the export-oriented policy (Jomo, 2003, p. 28). Since the 1980s, resource-processing exports have fallen, and exports of manufacturing goods have increased significantly. Table 20 illustrates the changes in Malaysia's export structures from 1970 to 1995. In 1968, exports of metal accounted for 65.8%; however, in 1995, those exports fell to just 2.5 %. Exports of electronics accounted for only 0.7% in 1968, but have increased to 67.5% in 1995, and are dominated by foreign capital.

Table 20: The Component of Malaysian Exports on Manufacturing, 1970-1995 (%)

Industries	**1968**	**1973**	**1980**	**1985**	**1990**	**1995**
Food	17.5	19.6	5.7	6.2	3.8	1.8
Beverages and tobacco	0.9	2.9	0.3	0.2	0.2	0.3
Textile, clothing and footwear	1.4	6.1	10.5	11.9	8.8	4.6
Wood	3.4	9.7	5.7	3.2	3.4	4.4
Chemicals	3.0	5.2	2.0	3.8	2.9	4.0
Rubber	0.9	1.7	1.0	1.0	3.0	2.3
Non-metallic mineral	0.8	1.1	0.7	1.1	1.7	1.2
Iron and steel	0.5	1.9	0.4	1.2	1.4	0.9
Other metals	65.8	43.3	31.5	2.0	2.2	2.5
Machinery	2.5	3.8	2.6	5.8	8.1	7.0
Electrical machinery	0.7	2.1	32.8	51.4	50.5	67.5
Transport equipment	2.6	2.7	2.6	5.0	4.3	3.7
Other manufactures	NA	NA	4.2	7.2	9.7	NA
Total	100.0	100.0	100.0	100.0	100.0	100.0

Sources: UNCTAD (as cited in Jomo, 2003, p. 53)

According to Jomo (2003), foreign investment accounts for most manufacturing export sectors of Malaysia (p. 41), not just in the electronics industry, and foreign investment policy is tightly related to the export-oriented policy. Attracting FDI is the goal of promoting exports (Jomo, 2003, p. 28). In the 1970s and 1980s, the Malaysian government established ten Free Trade Zones (FTZs), which provided government infrastructure subsidies. Foreign firm or joint-venture companies located in the FTZs received pioneer status (PS), such as a ten-year tax exemption. The export share of FTZ firms in total manufacturing exports increased from 1% in 1972 to 75% in 1979 (Jomo, 2003, p. 97). In the 1980s, the Malaysia government enacted the new Promotion Investment Act, intended to promote exports by relaxing regulation of ownership of foreign capital firms. This law allowed 100% foreign-owned firms, if they exported more than 80% of their manufactured products (Jomo, 2003, p. 99). The above examples are consistent with the fact that in Malaysia, FDI and exports have had two-way causalities.

As in the above analysis, FDI goes into Malaysia to enjoy pioneer status, no import tax on intermediate goods and also capital goods. Foreign firms, therefore, have higher added value than domestic firms, because they can import intermediate goods from their country with lower prices and no import taxes. This shows that imports lead to push up FDI. In contrast, a higher FDI demands higher imports of intermediate goods and capital goods. In other words, Malaysian imports and FDI have a two-way causality.

Among second tiger ASEAN countries (Malaysia, Indonesia, Thailand and the Philippines), Malaysia is the leader in attracting FDI. Foreign investment accounts for most manufacturing export sectors of Malaysia, while the country's domestic investment only focuses on resource-based industries such as palm oil or timber products. FDI in Malaysia plays a leading role in high technology. The new Promotion Investment Act in the 1980s attracted FDI with high technology products. A foreign firm received pioneer status if it satisfied four criteria: a 30-50% value added; a 20-50% local content level, a high technological level and an FDI contribution to l of Malaysia's industrial structure (Jomo, 2003, p. 100). In the 1990s, Malaysia continued to promote high technology through FDI activities. The Malaysian government enacted the second industrial plan, which increased the technological level and the value added of the assembly-dominated export industries by encouraging investment in the production component, design and

R&D, as well as in trading, marketing and local brand development. An FDI project was awarded pioneer status if it satisfied three criteria: 30% or more value added, 15% local managerial, technical, or supervisory personnel, and a contribution level to Malaysia's industrial structure (Jomo, 2003, p. 100). FDI is preferred in high technology industries such as computers, LCDs (liquid crystal displays), medical equipment, bio-technology, automation equipment, advanced material, electronics, software, alternative energy and aerospace. In summary, FDI increased productivity through promoting technology and innovation, which then increased GDP. In contrast, when productivity increased, the cost per unit will decrease. This turns out to automatically lure FDI. This fact is consistent with two-way causality between FDI and Malaysian economic growth.

3.4.2 Korea

Korea is a smaller area, but has a larger population (48.63 million, which is nearly twice that of Malaysia) and poorer natural resources than Malaysia (data source: U.S. Department). Therefore, the Korean government chose their Growth-Industry Outward-Oriented strategy (GIO) (Song, 2003, p.113).

In the 1960s, Korea lacked foreign exchange, due to a decrease in US aid (Cho, 1994, p.153). Therefore, an export-oriented policy was central in their attempt to improve the payment imbalance. To promote exports, the Korean government provided tools, such as loans with low interests, permission in importing intermediate goods for export manufacturing and rewards for successful exporters. In the first five year plan (1960-1965), the export growth rate reached 44% (Cho, 1994, p.147), which was higher than the export growth rate of Malaysia in the same period.

At the beginning of the export-oriented policy, Korea was different from Malaysia. While in the 1960s, exports of primary goods dominated the export goods of Malaysia, exports of manufacturing goods accounted for two-thirds of the total Korean export goods. Labor-intensive manufacturing goods accounted for 70% of total export-manufacturing goods (Cho, 1994, p.147). While Malaysia has continued to consider export orientation as its leading policy, from the 1960s to the present, Korea realized that maximizing exports was not always a good policy, and made an adjustment in economic strategy. Hence, the Korean export share of GDP increased from 13.6% in 1970 to 32.1% in the 1980s (Table 21), and was then kept around 30%–40% up to the present. However, the Malaysian export share of GDP increased continuously from 41.4% in 1970 to 110.2% in 2007 and had a high average level of 74.5% (Table 21).

Since the 1960s, Korea has realized that the value added of export-manufacturing industry was low because intermediate goods and capital goods were imported (Cho, 1994, p.147) and therefore immediately inaugurated a change in its economic development strategy. In the 1970s, Korea focused on developing heavy industries and a chemical industry, for exports through "chaebol". Successful industrialization of Korea was represented by a change in the structure of export goods. The proportion of heavy industry exports, in total, increased from 14.2% in 1971 to 60.4% in 1992. Table 22 shows that the proportion of light industry products in total exports fell from 72.1% in 1971 to 32.4% in 1992. South Korea obtained a large market share for exporting ships and is a large exporter of automobiles, after the US, Japan and Western countries (Kim, 1998, p. 81). Industrialization success has enabled Korea to leave Malaysia behind. Due to lack of success in industrialization, the economic structure of Malaysia is unbalanced. Light industries dominate the Malaysia economy. Heavy industries are not developed.

Table 21: Export Share on GDP and Export Growth Rate of Korea, 1970 - 2007 (%)

Year	Export Share on GDP	Export Growth Rate	GDP Growth Rate	Year	Export Share on GDP	Export Growth Rate	GDP Growth Rate
YR1970	41.4	5	6.0	YR1989	71.4	15.2	9.1
YR1971	38.2	1.6	5.8	YR1990	74.5	17.8	9.0
YR1972	34	2	9.4	YR1991	77.8	15.8	9.5
YR1973	39.2	14.2	11.7	YR1992	76	12.6	8.9
YR1974	45.6	15.9	8.3	YR1993	78.9	11.5	9.9
YR1975	43	-3	0.8	YR1994	89.2	21.9	9.2
YR1976	48.9	17	11.6	YR1995	94.1	19	9.8
YR1977	47.4	4.2	7.8	YR1996	91.6	9.2	10.0
YR1978	48.3	7.6	6.7	YR1997	93.3	5.5	7.3
YR1979	55.2	18	9.3	YR1998	115.7	0.5	-7.4
YR1980	56.7	3.2	7.4	YR1999	121.3	13.2	6.1
YR1981	51.6	-0.8	6.9	YR2000	119.8	16.1	8.9
YR1982	50.1	10.7	5.9	YR2001	110.4	-6.8	0.5
YR1983	50.4	12.3	6.3	YR2002	108.3	5.4	5.4
YR1984	53.5	13.8	7.8	YR2003	106.9	5.1	5.8
YR1985	54.1	0.4	-1.1	YR2004	115.4	16.1	6.8
YR1986	55.5	11.8	1.2	YR2005	117.5	8.3	5.3
YR1987	62.9	14.6	5.4	YR2006	116.7	7	5.8
YR1988	66.4	10.9	9.9	YR2007	110.2	4.2	6.3
				average	74.5	9.4	6.7

Sources: World Bank, WDI.

In spite of the fact that export-oriented policy was not as appreciated in Korea as in Malaysia, the average Korean export growth rate from 1970 to 2007 was still 15.1% (Table 21), which is higher than the average Malaysian exports growth rate in the same period. The contribution of exports to Korean economic growth is not as great as in Malaysia, but the role of exports in Korean economic growth is still substantial. Therefore, the Korean economic model confirms the causality of exports on GDP.

In the 1980s, to expand exports, the Korean government created 12 General Trading Companies (GTCs) (Cho, 1994, p.150) from the largest firms, which satisfied some government criteria and gained cost advantages from economies of scale. The GCTs were successful in expanding exports and the companies became the leaders in Korean exports. The export share of GTCs in total exports in 1985 was 51.3% (Cho, 1994, p. 43). A characteristic of GCTs was that import volume was very small and the GCT import share on the total import of Korea was only 8.3% (Cho, 1994, p. 43). This showed that promoting Korean exports did not require an import increase as in Malaysian's economic model. In other words, in the Korean economic model, there was no causality of imports on exports—except at the beginning of the export-orientation policy in the 1960s. To promote GCT activities, the Korean government provided special benefits, such as low interest rates, priority on the foreign exchange, financial supports and others, if GCTs exceeded export goals. A GCT could borrow foreign capital with a low interest rate (Cho, 1994, p. 44); thus it did not use FDI to finance its activity, because it was afraid of losing market share. This explains why FDI did not promote exports in Korea and why there was no causality of FDI on Korean exports. In summary, exports become exogenous in that they do not depend on imports, FDI or, of course, GDP.

Table 22: The Component of Korean Exports, 1971 - 1992 (%)

Year	Manufacture Goods		Nonmanufacture Goods
	Light Industry	Heavy Industry	
1971	72.1	14.2	13.7
1972	66.6	21.3	12.1
1973	63.4	23.8	12.8
1974	54.1	32.5	13.4
1975	57.4	25.0	17.6
1976	59.0	29.2	11.8
1977	53.6	32.2	14.2
1978	54.5	34.7	10.8
1979	51.4	38.5	10.1
1980	49.4	41.5	9.1
1981	49.4	41.6	9.0
1982	45.0	46.9	8.1
1983	41.1	50.6	8.3
1984	39.5	52.5	8.0
1985	38.6	53.4	8.0
1986	44.0	48.4	7.6
1987	43.8	49.1	7.1
1988	41.8	52.1	6.1
1989	42.0	52.2	5.8
1990	41.1	53.6	5.3
1991	37.8	56.1	6.1
1992	32.4	60.4	7.2

Sources: Korea Foreign Trade Association, the Statistics of Foreign Trade (as cited in Cho, 1994, p. 146)

Success in export-oriented industrialization (EOI) led to an improvement in the Korean payment balance, as well as in firm and individual profits. Higher profits led to higher reinvestment in production, hence to an increase in imports of inputs. On the other hand, increases in individual income led to increased consumption spending, hence to increased importation of consumption goods. Therefore, an increase in exports led to an increase in imports; this explains the causality of exports on imports in the Korean economic model.

As mentioned above, in the 1960s, the Korean government provided export incentives, such as no import taxes on intermediate goods and capital goods, in order to promote export-oriented industrialization. In spite of that, there were still barriers to imports such as special laws, foreign exchange regulation, export obligation and import quotas (Cho, 1994, p.153-154). However, imports increased considerably, from 22 million in 1967 to 68 million in 1968 (World Bank, WDI). In the 1970s, the government gave priority to imports in order to promote industrialization in the heavy and chemical industries. Therefore, imports of intermediate goods and capital promoted exports and GDP. Table 23 shows the increase in the import proportion of input to total imports of Korea, from 79.3.3% in 1971 to 89.0% in 1982. On the other word, imports have causal relationship with GDP. However, in the 1960s and 1970s, the effective rate of protection was very high, due to low tariffs on primary goods and high tariffs on consumption goods (Cho, 1994, p.156).

Table 23: The Component of Imports of Korea, 1971 – 1992 (%)

Year	Food and Consumption Goods	Industrial Supplies	Capital Goods
1971	21.0	50.6	28.4
1972	18.5	51.6	29.9
1973	18.3	55.0	26.7
1974	15.4	57.7	27.0
1975	16.2	57.2	26.5
1976	12.0	60.5	27.5
1977	10.9	61.4	27.7
1978	10.6	55.6	33.8
1979	11.5	57.5	31.1
1980	12.1	65.0	23.0
1981	14.2	62.2	23.6
1982	10.2	64.1	25.7
1983	10.7	59.5	29.8
1984	9.5	57.5	33.0
1985	8.5	55.9	35.6
1986	9.8	54.2	36.0
1987	9.7	54.8	35.5
1988	9.8	53.5	36.8
1989	10.2	53.3	36.4
1990	10.0	53.6	36.5
1991	11.2	52.2	36.6
1992	10.5	52.1	37.4

Source: Korea Foreign Trade Association, The Statistics of Foreign Trade (as cited in Cho, 1994, p. 148)

The big difference between the Malaysian and Korean economic systems was the role of FDI. The Malaysia government considered FDI to be the leading industrialization program, while the role of FDI was not promoted in Korea, where the government chose the leading role. The Korean average share of FDI in GDP was 0. 5 %, while the Malaysian average share of FDI in GDP was 4% from 1976 to 2007. According to Tcha and Suh (2003), FDI was not a good match with the size of the Korean economy (p. 300). The share of FDI in gross domestic investment was very small compared with that of Malaysia. From 1976–1980, they were 0.4 and 10.5 for Korea and Malaysia, respectively. From 1991–1993, they were 0.6 and 24.6 for Korea and Malaysia, respectively (Table 24). Due to a very small contribution of FDI to domestic investment and industrialization in Korea, FDI inflows into the country did not cause economic growth from 1970–2007. This is consistent with the results from the Granger causality/Block exogeneity test.

Table 24: The Share of FDI in Gross Domestic Investment, 1977 - 1993 (%)

	1971-75	1976-80	1981-85	1986-90	1991-93
Korea	1.9	0.4	0.5	1.3	0.6
Malaysia	15.2	10.5	10.8	10.5	24.6

Source: UNCTAD (as cited in Jomo, 2003, p. 24)

Before the financial crisis, the role of FDI was not recognized by the Korean government. It gave no incentives to attract FDI, due to fear that a foreign company would dominate the market. On the other hand, as mentioned above, the domestic firms did not have any incentive to use FDI because they could receive a government benefits to borrow foreign capital with low interest rates.

The 1997 Asian financial crisis changed the Korean government notions about FDI and it was forced by the IMF to make some changes in FDI regulation. "Economic and financial crisis in Korea is necessary evil" (Tcha and Suh, 2003, p. 300) because thanks to the crisis, the Korean government realized the role of FDI in economic growth. By comparison, the Malaysian economy, which is based on FDI, can confront the economic crisis without interference from the IMF (Tcha and Suh, 2003, p. 300). Since 1998, the Korean government has carried out a series of activities to attract FDI, such as enacting a foreign investment promotion act, establishing a Korean trade investment and promotion agency (KOTRA), establishing six sophisticated free-investment zones (FIZs) to provide tax priority, infrastructure support and low rate of utilities. The government also established a Korean investment service center to help foreign investors obtain investment licenses, foreign land ownership and cross-border mergers and acquisitions (Tcha and Suh, 2003, p. 300 and p. 156). Therefore, in 1999, FDI reached a maximum of U.S. $9333.4 million and continued high in 2000. In the 2001 U.S. crisis, FDI inflows into Korea were down to $3525 million. FDI in Korea improved after 2001 and reached a high in 2004 (U.S. $9246.2 million). In 2007, Korean FDI decreased to U.S. $1578.8 million due to the U.S. financial crisis (Table 25). In general, the future Korean FDI trend will increase.

In spite of the rapid increase in FDI from 1997 to 2007, the proportion of FDI in Korean domestic investment is still small. On the other hand, successful Korean industrialization has provided import-substitution goods with high technology and reasonable prices, including intermediate input and equipment and machinery for domestic production, which can be seen in Table 23. In spite of the FDI's increase six times from 1984 – 1992, the proportion of imported capital goods in total Korean imports increased only 2% in the same period (Table 23). This shows that an increase in FDI does not seem to cause an increase in imports. In addition, when productivity increases, production cost per unit reduces, which is an important factor in attracting FDI. Therefore, an increase in productivity or in GDP will increase FDI. Finally, FDI in export-manufacturing industries will be higher than others since FDI projects in those industries will receive pioneer status. This explains the causality of exports on FDI.

Table 25: FDI inflows in Korea and Malaysia (USD million)

Year	Korea		Malaysia	
	FDI Share on GDP (%)	**FDI Inflows (Million USD)**	**FDI Share on GDP (%)**	**FDI Inflows (Million USD)**
1976	0.27	81	3.24	381.3
1977	0.25	94	2.90	405.9
1978	0.17	89	3.00	500.0
1979	0.05	35	2.65	573.5
1980	0.01	6	3.75	933.9
1981	0.14	102	4.97	1264.7
1982	0.09	69	5.12	1397.2
1983	0.08	68.5	4.11	1260.5
1984	0.12	110.2	2.31	797.5
1985	0.24	233.5	2.19	694.7
1986	0.41	459.6	1.73	488.9
1987	0.44	616.3	1.31	422.7
1988	0.54	1014.1	2.04	719.4
1989	0.49	1117.8	4.29	1667.9
1990	0.30	788.5	5.30	2332.5
1991	0.38	1179.8	8.14	3998.4
1992	0.22	728.3	8.76	5183.4
1993	0.16	588.1	7.48	5005.6
1994	0.19	809	5.83	4341.8
1995	0.34	1775.8	4.70	4178.2
1996	0.42	2325.4	5.04	5078.4
1997	0.55	2844.2	5.13	5136.5
1998	1.57	5412.3	3.00	2163.4
1999	2.10	9333.4	4.92	3895.3
2000	1.74	9283.4	4.04	3787.6
2001	0.70	3527.7	0.60	553.9
2002	0.42	2392.3	3.18	3203.4
2003	0.55	3525.5	2.24	2473.2
2004	1.28	9246.2	3.71	4624.2
2005	0.75	6308.5	2.87	3966.0
2006	0.38	3586.4	3.88	6063.6
2007	0.15	1578.8	4.53	8455.6
Average	0.5	2166.6	4.0	2685.9

Sources: World Bank, WDI.

4 CONCLUSIONS

This chapter applies the four-variable VAR model, which is constructed from four endogenous variables—the logarithm of real GDP, the logarithm of real exports, the logarithm of real imports and the logarithm of FDI—in order to observe the integrated relationship between trade, FDI and economic growth for Malaysia and Korea during the time period from 1970 to 2004 (Malaysia) and from 1976 to 2007 (Korea).

The estimated results suggest that the four variables are cointegrated for both Malaysia and Korea. Exports are a long-run source of both Malaysian and Korean economic growth. The exports-led growth hypothesis, imports-compression growth hypothesis and intertemporal budget constraint hypothesis are confirmed in the case of Malaysia, but only the exports-led growth hypothesis and the intertemporal budget constrain hypothesis are found in the case of Korea.

For Malaysia, there is evidence to support two-way causalities between each couple among the four variables, except for the absence of causality of GDP on exports. All causalities have positive signs. For Korea, there is one-way causality of exports, imports and GDP on FDI, of exports and imports on GDP, and of exports on imports. Only causalities of exports on GDP and FDI, of GDP on FDI and of exports on imports have positive signs. Exports are not affected by the three other variables. Trade liberalization has a positive effect on Malaysian economic growth. The causality from trade liberalization on economic growth can be seen through export channel.

The difference in the estimated results is explained by the difference in the economic policies of the two countries. Both countries have implemented export-oriented industrialization, but while the Malaysian government has given the role of leading industrialization to FDI, the Korea government has built an integrated national economy, thanks to the industrial conglomerate chaebol stucture, and has not strongly promoted the role of FDI.

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