An Investigation of Economic Linkages among the ASEAN Group of Countries

Habib Ahmed and Jose L. Tongzon

This study investigates existence of any economic linkages among the five founding members of the Association of Southeast Asian Nations (ASEAN), and explores the nature of these linkages. Based on the Vector Autoregression, variance decomposition and impulse response function analyses applied to quarterly real GDP data for the 1975–93 period, the results show the leading role of Indonesia and the significant economic linkages among them. The direction of causation and transmission is from Indonesia to the Philippines to Thailand to Malaysia and to Singapore. A two-way causation is found between Singapore and Malaysia. The study also finds the economic vulnerability of the ASEAN group of countries to changes in U.S. output, and the competitive nature between the Japanese and the ASEAN economies. These findings have important policy implications.

1. Introduction

This article examines the issue of economic linkages among the ASEAN group of countries, and assesses the strength and the direction of these linkages.[1] Although much has been written about the growing economic interdependence among these countries, so far no study has been undertaken to quantify and explore the nature of their interdependence. To achieve this objective, we utilize vector autoregression (VAR) techniques used to study regional linkages (Cargill and Morus 1988; Cromwell 1992; Sherwood-Call 1988). We examine the regional and international spillover effects on the ASEAN economies. Specifically, we investigate these questions:

Which ASEAN country drives the ASEAN region? Do economic shocks in a member country spill over to other member countries? If yes, what is the direction of shocks transmitted among the ASEAN countries? Are these economic shocks external to the ASEAN economies?

Understanding how economic shocks are transmitted among the ASEAN countries is important because of policy implications. If ASEAN economies are susceptible to spillovers from each other (which can be positive or negative) and if we can identify the source of transmission, then the effectiveness of one's macroeconomic policy setting will greatly be enhanced. Under this scenario, policy coordination for the mutual benefit of the ASEAN

member countries may be called for. In light of growing intra-ASEAN trade and investments under a more liberal economic environment, the ASEAN countries are expected to share common economic linkages so that a recession in one member country may spill over into other member countries in terms of output and employment decline. The 1985 recession and the 1997 currency crisis, for example, which hit all the ASEAN group of countries, could be a reflection of these economic linkages.

The questions of which ASEAN country drives the ASEAN region and how the economic shocks are transmitted among different economies are answered by employing vector autoregression (VAR) techniques using quarterly data on real GDP for ASEAN countries, Japan and the United States for the period of 1975 to 1993. The results can be used to identify leading and lagging relationships between variables and, with further identifying restrictions, to measure the economic importance of these dynamic relationships. Variance decomposition method is used to measure the economic importance of these relationships and impulse response functions are used to trace the direction of the effects of a shock in one country on the other countries. The objective is to examine the extent to which economic fluctuations in a country are driven by its own economy, or by linkages to other countries.

This article complements other work that study linkages among the ASEAN economies. Ariff (1996) studies the external effects on financial liberalization in four ASEAN members and finds that external effects induces efficiency in the financial systems. Manzur and Ariff (1995), on the other hand, examine the relationship of prices in five ASEAN economies and find that a long-run relationship holds. This article studies the linkages among the ASEAN economies by examining the relationship of their outputs. This article is organized as follows: Section 2 reviews the possible sources and types of ASEAN economic linkages. Section 3 explains the empirical approach used to study the linkages and presents the basic results. Section 4 concludes the article by summarizing the results followed by

policy implications and recommendations for future research.

2. Sources and Types of ASEAN Economic Linkages

ASEAN countries may be linked through several ways. This study is mainly concerned with economic linkages. These linkages, through which an economic shock in one country can be transmitted to its neighbours, may be in the form of trade flows, labour and capital flows.[2]

It is argued that labour flows do not constitute a significant mechanism for ASEAN economic linkages mainly because of the large barriers to labour mobility among the ASEAN countries. Although these countries have been importing foreign labour from each other (particularly Singapore and Malaysia which have been constrained by domestic labour shortages), these labour flows are highly regulated and subjected to quota requirements. Positive shocks to Malaysia, for example, that may increase the demand for labour, may lead to labour inflows from other ASEAN labour-surplus countries like Indonesia and the Philippines, but these flows should not be significant enough to offset the positive impact on other ASEAN countries caused by increased demand for imports.

Trade flows of goods and services are the most obvious mechanisms for transmission of economic shocks among the ASEAN countries. An increase (decrease) in economic activity could be external or internal. The international oil crisis of the early 1970s (outside the control of the ASEAN countries) which affected all the ASEAN countries is an example of a negative external shock. Supply constraints induced by infrastructure bottlenecks, and other domestic-related factors are possible sources of negative internal shocks. Furthermore, the effects of changes in output of one country on the other will depend on the relative sizes of the economies. For example, a certain quantity of trade flows between Singapore and Indonesia may affect Singapore's relatively smaller economy much more than Indonesia's larger economy.

The spillover effects through trade can be positive or negative. When an increase (decrease) in economic activity in one ASEAN country increases (decreases) its demand for imports from other ASEAN neighbouring countries, this could lead to an increase (decrease) in economic activity in these countries. In this case, the economies complement each other so that an increase in output in one country affects the output of the latter positively. If two countries, however, export to the same market (country) and compete with each other, then an increase in output (export) of one country may cause negative spillover effect on the output (export) of the other country. It is also expected that more trading links exist between countries in close geographic proximity; thus more spillover effects should occur between Singapore and Malaysia than between Singapore and the Philippines. The next section explores these relationships.

3. Data, Empirical Models, and Results

This study uses quarterly data from 1975 to 1993 on real GDP for ASEAN countries, Japan and the United States. Quarterly data on real real gross domestic product (GDP) for Japan and the United States are taken from International Financial Statistics (IMF) and from Singapore Department of Statistics, for Singapore. For Malaysia, real GDP figures are supplied by Abeysinghe and Lee (1994). For the other countries, quarterly data are generated from annual data from International Financial Statistics using the Otani-Riechel's procedure used by the IMF. Appendix 1 describes the Otani-Riechel procedure. We use logarithmic values of all the variables used in the analysis. The choice of only one variable, GDP, to the exclusion of other important and more disaggregated variables such as trade, investment, labour and the like, and of the time period was based solely on data availability.

Table 1 provides the GDP figures for countries included in the study. Compared to the large economies (Japan and the United States), the members of ASEAN are relatively small. Among ASEAN economies, Indonesia is the largest economy followed by Thailand. The GDPs of Malaysia, the Philippines, and Singapore are almost half that of Thailand.

TABLE 1
Gross Domestic Products of ASEAN Members, Japan and
the United States, 1991

Country	GDP (USD billions)	As a Percentage of ASEAN[a]	Openness[b] (%)
Indonesia	116.48	34.1	47.1
Malaysia	46.98	13.8	147.9
Philippines	44.91	13.1	46.5
Singapore	39.98	11.7	312.3
Thailand	93.31	27.3	70.4
Japan	3,362.28		16.1
USA	5,610.80		16.3

NOTES
a. Includes only the five countries in the study.
b. Exports plus imports as a percentage of GDP.
SOURCE: *World Development Report* (1993).

In order to address the questions of linkages among the ASEAN economies and investigate whether external shocks affect output in these economies and their source, we analyse two groups of economies: first, we examine the linkages between the five ASEAN economies (Indonesia, Malaysia, the Philippines, Singapore, and Thailand). In the second group, we study the external spillover effects by examining the linkages between the ASEAN economies as a whole and two major economies, Japan and the United States.

We use vector auto-regression (VAR) methods to identify the direction and strengths of linkages of countries within the ASEAN group and the economies of ASEAN, Japan and the United States. VARs, though a simple method to determine the interrelationships between variables, have many advantages. Short-run spillover effects of a shock in one country on the others can be examined, and countries that lead or cause (in the temporal sense) output in other countries identified. Two other VAR-related estimations developed by Sims (1980a; 1980b, and 1982) give a better understanding of the interactions and spillover effects. First, variance decomposition of error forecasts enable us to identify forecast errors attributed to different sources (countries) and give a measure of the importance of these relationships. Decomposition of the forecast error to different variables indicates the relative importance of diferent variables in explaining the forecast beyond the sample period. Second, impulse response functions (derived from estimated VARs) trace out the dynamic paths of the effects of a one standard-deviation shock in one country's output on the other countries' outputs. The results using these methods are discussed next.

VAR and Granger Causality

A VAR model is a non-structural model where the data, rather than theory, identifies the dynamics of a model. A VAR model consists of a set of reduced form dynamic equations where variables are regressed on their own and each other's lagged variables. Granger causality test in VAR involves examining if the lags of one variable significantly affects another variable by using standard F-tests (Granger 1969).

The first step in VAR is to determine whether to use the variables in levels or differences. If the series are stationary, VAR is estimated in levels. If the variables are non-stationary, however, the variables are used in levels only if they have long-run relationships, that is if the variables are cointegrated.[3] Accordingly, we test for the stationarity of the output series of different countries. Using augmented Dickey-Fuller (ADF) tests we find all the series to be I(1), that is non-stationary in their first differences (Table 2a). We then test if the variables in the series are cointegrated by using Johansen's multivariate cointegration technique (Johansen 1988; Johansen and Juselius 1990). We find that there is at least one cointegrating vector, indicating a long-run relationship among countries in two groups under consideration.[4] Thus, we use the variables in levels in the VARs.

Next step in the VAR modelling is to identify the optimum number of lags to be used in

TABLE 2a
Tests of Stationarity of Variables

| Variables | Aug. Dickey-Fuller Values | |
	Levels	Differences
Indonesia	−0.76	−3.23*
Malaysia	0.06	−3.12*
Philippines	−1.68	−2.60**
Singapore	0.08	−2.65**
Thailand	0.79	−2.9*
ASEAN	−0.74	−3.20*
Japan	−1.51	−3.03*
USA	−0.41	−2.95*

NOTES
* 5 per cent level of significance.
** 10 per cent level of significance.

TABLE 2b
Johansen's Test for Cointegrating Vectors

Null Hyp. (H_0)	Intercept/No trend		Intercept/Trend	
	Eigen-value	Likelihood Ratio	Eigen-value	Likelihood Ratio
Group 1 (indo, thai, mala, phil, sing)				
r = 0	0.3999	89.94*	0.3667	97.27*
r ≤ 1	0.2312	52.71	0.2838	63.92**
r ≤ 2	0.1833	33.52	0.2205	39.55
r ≤ 3	0.1352	18.74	0.1652	21.37
r ≤ 4	0.1055	8.14	0.1061	8.19
Group 2 (usa, japan, asean)				
r = 0	0.3698	44.17*	0.3261	49.06*
r ≤ 1	0.0962	10.47	0.1858	20.26
r ≤ 2	0.0412	3.07	0.0695	5.26

NOTES
r indicates the number of cointegrating relationships.
* 1 per cent level of significance.
** 5 per cent level of significance.

estimations. We use the likelihood ratio statistic (Sims 1980c; Enders 1995) to determine six lags to be the optimum number in our analysis. For the second group of economies (that is ASEAN, Japan, and the United States) the following VAR is estimated:

$$ASEAN_t = a_0 + \Sigma\ a_{1i}\ ASEAN_{t-i} + \Sigma\ a_{2i}\ USA_{t-i} + \Sigma\ a_{3i}\ Japan_{t-i} + \varepsilon_{1t}$$
$$USA_t = b_0 + \Sigma\ b_{1i}\ ASEAN_{t-i} + \Sigma\ b_{2i}\ USA_{t-i} + \Sigma\ b_{3i}\ Japan_{t-i} + \varepsilon_{2t}$$
$$Japan_t = c_0 + \Sigma\ c_{1i}\ ASEAN_{t-i} + \Sigma\ c_{2i}\ USA_{t-i} + \Sigma\ c_{3i}\ Japan_{t-i} + \varepsilon_{3t} \quad (1)$$

where $ASEAN_t$, USA_t, and $Japan_t$ are real GDPs in the respective economies in period t. We can test if output in one country Granger causes that in another by using the standard F-tests. If the off-diagonal coefficients are significant, then the country/region causes the other. For example, if Σa_{2i} is significantly different than zero, then it implies that changes in output in the United States can predict output in ASEAN. We report the results of our Granger causality tests for the two groups in Tables 3 and 4, respectively.

Table 3 reports the F-statistic values for five member countries of ASEAN. Based on the F-test results, it is evident that only output in Indonesia, the largest economy in ASEAN, is not affected by output changes in any other economy in the region. Indonesia has a predictive power for Malaysia and the Philippines. The Philippines has Granger causal effects on Thailand and Singapore. On the other hand, Thailand Granger causes Malaysia. Malaysia and Singapore appear to be jointly determined, with output in each country having predictive power for the other. These seem to indicate that Indonesia affects (either directly or indirectly) all other ASEAN economies. Two directions of causation and transmission can be identified. First, from Indonesia to the Philippines to Thailand to Malaysia and then to Singapore, and second from Indonesia to Malaysia to Singapore, while there is a two-way transmission between Malaysia and Singapore. The first direction of transmission with causation running from the Philippines to Thailand to Malaysia

TABLE 3
F-Statistics for ASEAN Members: Granger Causality Tests

Dep. Var.	indo	thai	mala	phil	sing
indo	89.57*	1.39	0.85	1.11	0.08
thai	1.00	325.40*	0.85	3.61*	0.31
mala	2.69**	3.10**	10.82*	1.07	2.23**
phil	2.33***	0.29	0.59	114.26*	0.68
sing	1.14	0.44	2.21***	3.22**	26.81*

NOTES
* 1 per cent level of significance.
** 5 per cent level of significance.
*** 10 per cent level of significance.

before Singapore may look surprising particularly as the Philippines is probably the least integrated member with the rest of the ASEAN countries. However, since the 1980s the importance of the Philippines and Thailand in intra-ASEAN economic linkages must have risen due to the growth in trade between themselves, between these countries and the rest of the ASEAN countries, greater ASEAN investment flows into the Philippines and growing openness of the Philippine economy. For example, the Philippine export trade intensity index to Thailand increased from 0.65 in 1977 to 3.08 in 1995 (Tongzon 1998, p. 49). Trade between Malaysia and Thailand, on the other hand, has risen strongly since 1989, reflecting mainly the robust growth in exports and growth in intra-industry trade (ESCAP 1994). It is interesting to note the diminishing dominance of Indonesia-Malaysia-Singapore trade in total intra-ASEAN trade, as reflected in their declining trade indexes (Tongzon 1998, p. 50).

Table 4 shows the inter-linkages between ASEAN, Japan and the United States. Changes in U.S. output Granger causes the ASEAN output, and changes in ASEAN output significantly affect the Japanese output. The U.S. output is not affected by the Japanese or ASEAN output. This result is not surprising given the large size of the U.S. economy and its relatively low degree of openness. As a somewhat unexpected result, the Japanese output is not significantly affected by U.S. economic activity. These results suggest that the U.S. economy is predetermined. They also indicate that output fluctuations in ASEAN could be largely explained by U.S. output fluctuations.

Variance Decomposition of Forecast Errors

To investigate further the extent to which the U.S. output could explain changes in ASEAN output and the economic importance of these linkages, variance decomposition of the forecast errors is used.[5] It shows the percentage of forecast error variance due to its own and other countries' shocks. The results for the two groups of countries

TABLE 4
F-Statistics for ASEAN, USA, and Japan: Granger Causality Tests

Dep. Var.	USA	Japan	ASEAN
USA	82.95*	0.78	0.46
Japan	1.00	1616.72*	2.07**
ASEAN	2.00**	0.41	286.45*

NOTES
* 1 per cent level of significance.
** 10 per cent level of significance.

are reported in Tables 5 and 6. The numbers in the tables show the percentage of forecast error at the end of 24 quarters that is attributed to the different economies. The larger the number, the stronger is the linkage.

Table 5 reports the variance decomposition of forecast errors for the U.S., Japan and ASEAN group of economies. Column 1 in Table 5 reports the proportion of the forecast error at 24 quarters attributable to the United States. For the ASEAN group of countries, a significantly large percentage of forecast error variance (more than 70 per cent) is attributable to the United States, and for Japan, a relatively smaller but still considerable percentage (28 per cent) is due to the U.S. output. These results could be largely explained by the fact that the United States has been the largest export market for the ASEAN group of countries. It has also been ASEAN's top source of imports until recently. Despite increasing trends towards trade and investment diversification, the United States is still ASEAN's main trading partner and source of foreign direct investment. Thus, it is not surprising that changes in U.S. output would have significant impact on ASEAN output.

In contrast, Japan accounts for around one-fifth of the U.S. forecast error variance and one-tenth of the ASEAN output forecast error variance, as colum 2 of Table 5 shows. ASEAN output accounts for similar portion (one-fifth) of the forecast error variance of the Japanese output, as can be seen from column 3 of Table 5. The variance decomposition results in Table 5 support the previous findings of the economic dominance of the U.S. economy in these linkages.

Table 6 reports the variance decomposition results for individual ASEAN countries. Column 1 shows the proportion of the forecast error at 24 quarters attributable to Indonesia. More than half (54.1 per cent) of Indonesia's forecast error is attributed to itself. Among the other ASEAN countries, Thailand exhibits the largest degree of linkage (36.4), followed by the Philippines (25.1), Malaysia (12.2) and then Singapore (6.7), which shows relatively small linkage to Indonesia. Reversing the ordering of the equations, row 1 of

TABLE 5
Variance Decomposition for the United States, Japan and ASEAN (% of Forecast Error Variance Attributed to Different Economies after 24 Quarters)

Country/Region	Variance Decomposition (%)		
	USA	Japan	ASEAN
USA	74.1	19.5	6.4
Japan	28.0	61.6	10.4
ASEAN	71.1	10.6	18.3

Table 6 shows reduced magnitudes of the linkages: Thailand accounting for 19.7 per cent, followed by Malaysia (16.4 per cent), Philippines (7.1 per cent) and Singapore (2.6 per cent) of Indonesia's forecast error.

Impulse Response Functions

An alternative measure to investigate the direction of the effects of output changes in one country on other countries is to use impulse response functions. Impulse response functions give visual representations of the output changes in different economies in response to a one standard deviation shock in the output in one country. We only report the charts most relevant to our queries.

Figure 1 depicts the changes in output in other ASEAN economies when there is one standard error shock in Indonesia's output. The effect on Thailand's output is positive and that on Malaysia's and Singapore's output negative for more than 15 quarters. The effect on Philippines' output is initially negative, and then becomes positive after 8 quarters. Negative effects can imply that these countries export similar products and compete with each other. Positive effects mean that the economies are complementary.

Figure 2 shows the effects on outputs of different countries when there is a shock in Malaysia's output. The responses in outputs of Indonesia, the Philippines, and Thailand are

TABLE 6

TABLE 6
Variance Decomposition for ASEAN-5 (% of
Forecast Error Variance Attributed to Different
Economies after 24 Quarters)

Country	Variance Decomposition (%)				
	Indo	Thai	Mala	Phil	Sing
Indonesia	54.1	19.7	16.4	7.1	2.6
Thailand	36.4	30.6	5.5	27.4	0.2
Malaysia	12.2	12.9	37.3	30.5	7.2
Philippines	25.1	5.5	16.9	46.0	6.5
Singapore	6.7	6.0	26.8	46.6	13.9

negative. Singapore's response closely mimics that of Malaysia, which has a cyclical effect. Figure 3 shows the impulse response functions arising due to a shock in Singapore's output. The effect on Indonesia's and Philippines' output is negative (though lesser in the former case). The effect on Thailand's output moves around zero and then becomes positive after 12 quarters. Malaysia's output follows more closely to Singapore's, though with some lag(s).

Figure 4 shows that a positive shock in the U.S. output affects outputs in both ASEAN and Japan positively. Figure 5 shows the impulse response function resulting from a shock in the Japanese output. A shock in Japanese output has a negative impact on the ASEAN output. Similarly, a shock in ASEAN output has a negative impact on Japanese output, as shown by Figure 6. These results imply that Japanese and ASEAN economies do not benefit from each other's growth through spillover effects. They appear to be competitors in third-country markets.

The proposition that Japan and the ASEAN economies are competitive rather than complementary is consistent with the growing importance of such capital-intensive products as machinery, transport equipment and other manufactured products in the structure of ASEAN exports since 1980. These products have accounted for more than half of the total exports

of Singapore, Malaysia and Thailand, and have more than doubled their shares in Malaysia and the Philippines' total exports since 1980 (Tan 1996, p. 84). The same products are also Japan's main exports, accounting for about 70 per cent of its total exports. Further, although Japan is still ASEAN's main source of imports, its importance as a market for ASEAN exports has been substantially declining since 1980 so that by 1995 the United States has replaced Japan as ASEAN's largest export market. This finding has certainly challenged our usual assumption about the relationship between Japan and the ASEAN countries, and deserves further attention in future research.

4. Summary of the Results and Conclusion

Based on the VAR approach, it appears that Indonesia is the dominant economy that influences the other ASEAN economies. Indonesia, the largest economy in ASEAN, has no significant spillover effects from other members. The Malaysian and Singapore economies are most closely linked due to their geographical proximity, and economic and cultural factors. These economies are also affected by the other economies in ASEAN, though to a lesser extent. These findings are confirmed by the variance decomposition analysis and impulse response functions.

The results further show that the ASEAN economies are vulnerable to the changes in the U.S., rather than in the Japanese, output and the Japanese output to changes in ASEAN output; this is an interesting finding which further supports the importance of the U.S. market to the ASEAN economies. The impulse response functions also indicate that an increase in output in Japan (ASEAN) affects output in ASEAN (Japan) negatively, implying that ASEAN and Japan are competitors in the third country markets.

The above findings have important policy implications. The significant intra-ASEAN linkages, especially between Malaysia and Singapore, point to the limitation of pursuing independent policy, especially exchange rate, fiscal, and monetary policies. Greater co-ordination in policy making is required if these countries are to exploit

FIGURE 1

Response of ASEAN Members to One-standard Deviation Shock in Indonesia's Output
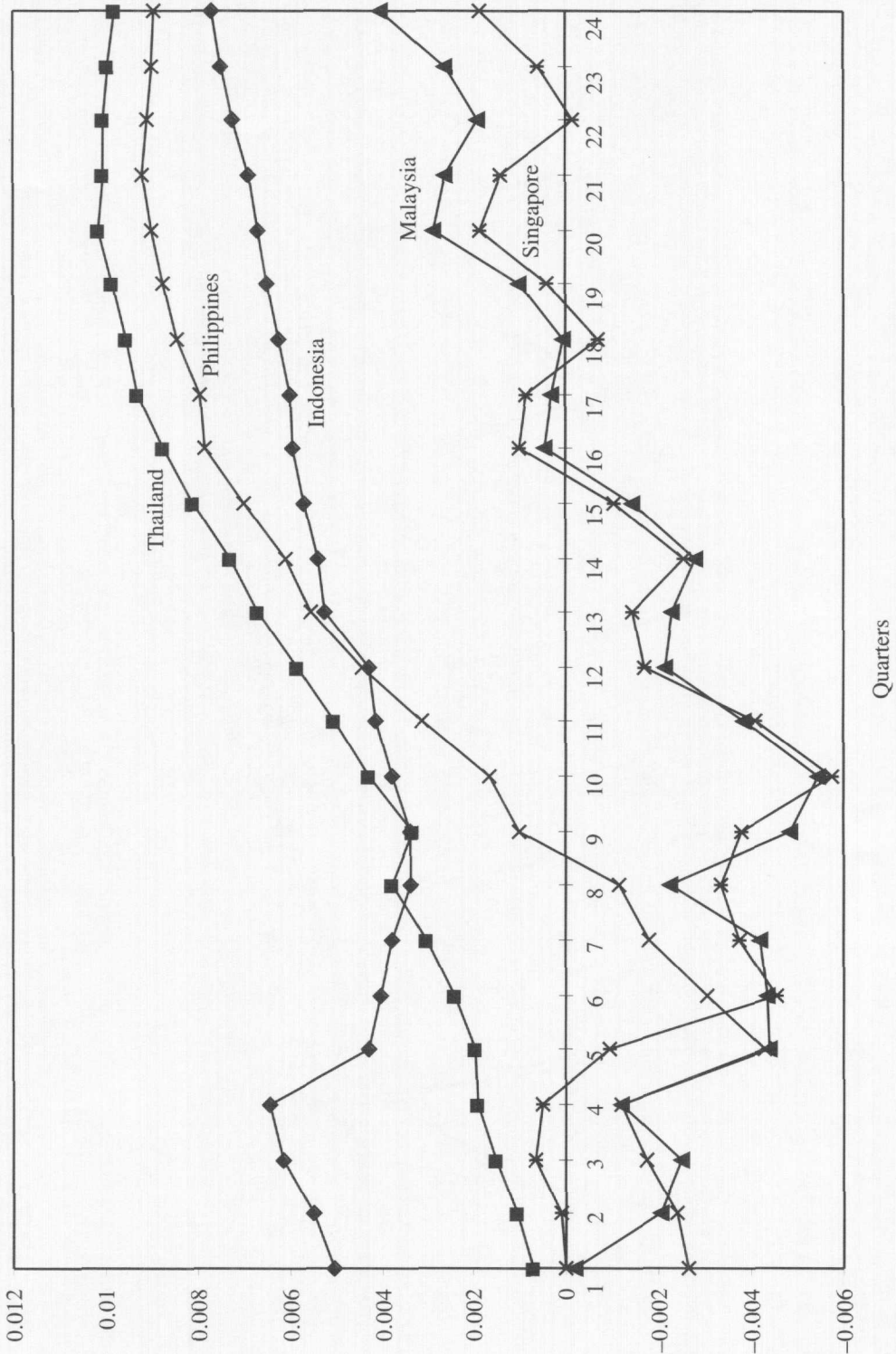
FIGURE 2

Response of ASEAN Members to One-standard Deviation Shock in Malaysia's Output
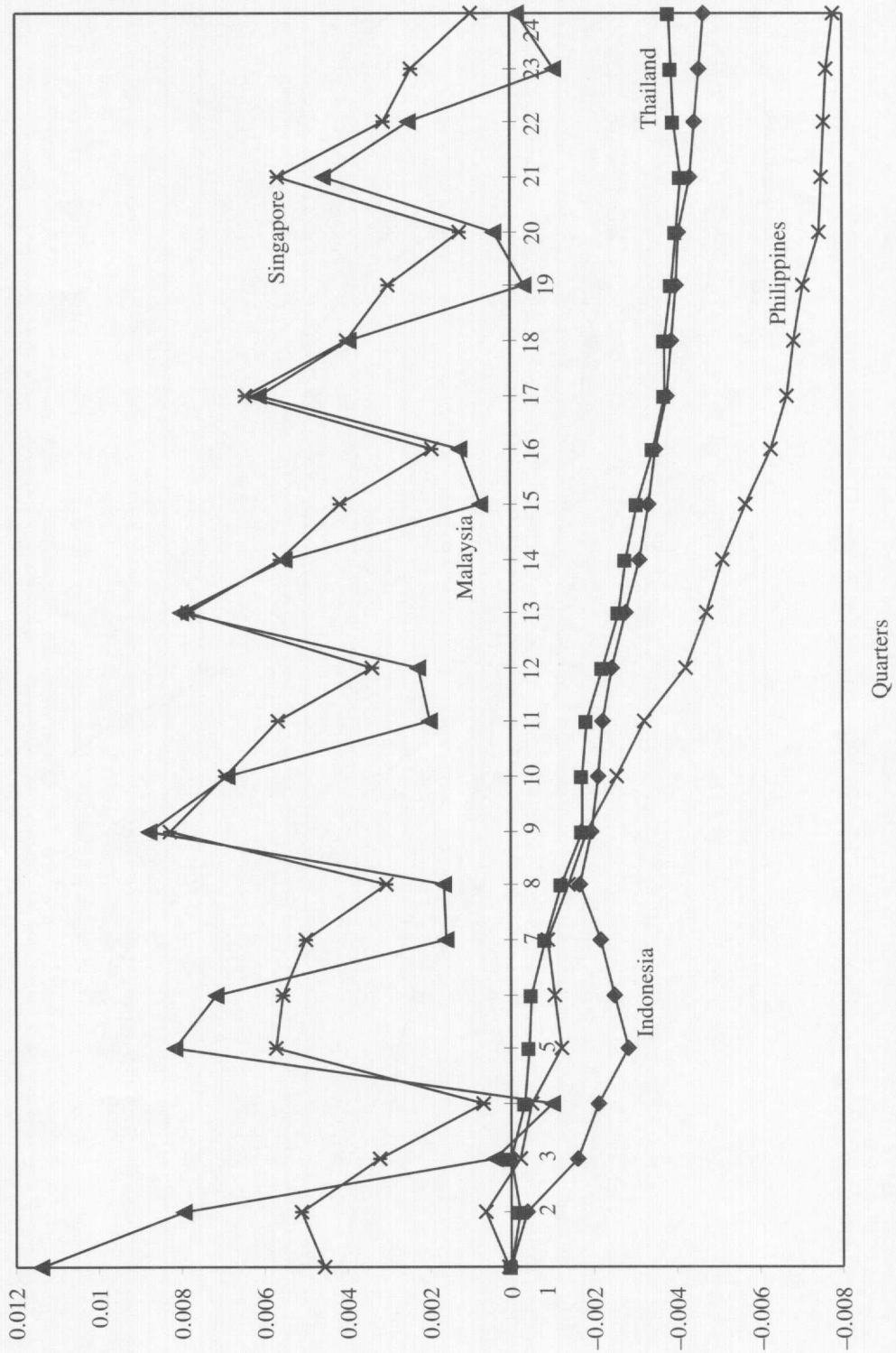
FIGURE 3

Response of ASEAN Members to One-standard Deviation Shock in Singapore's Output
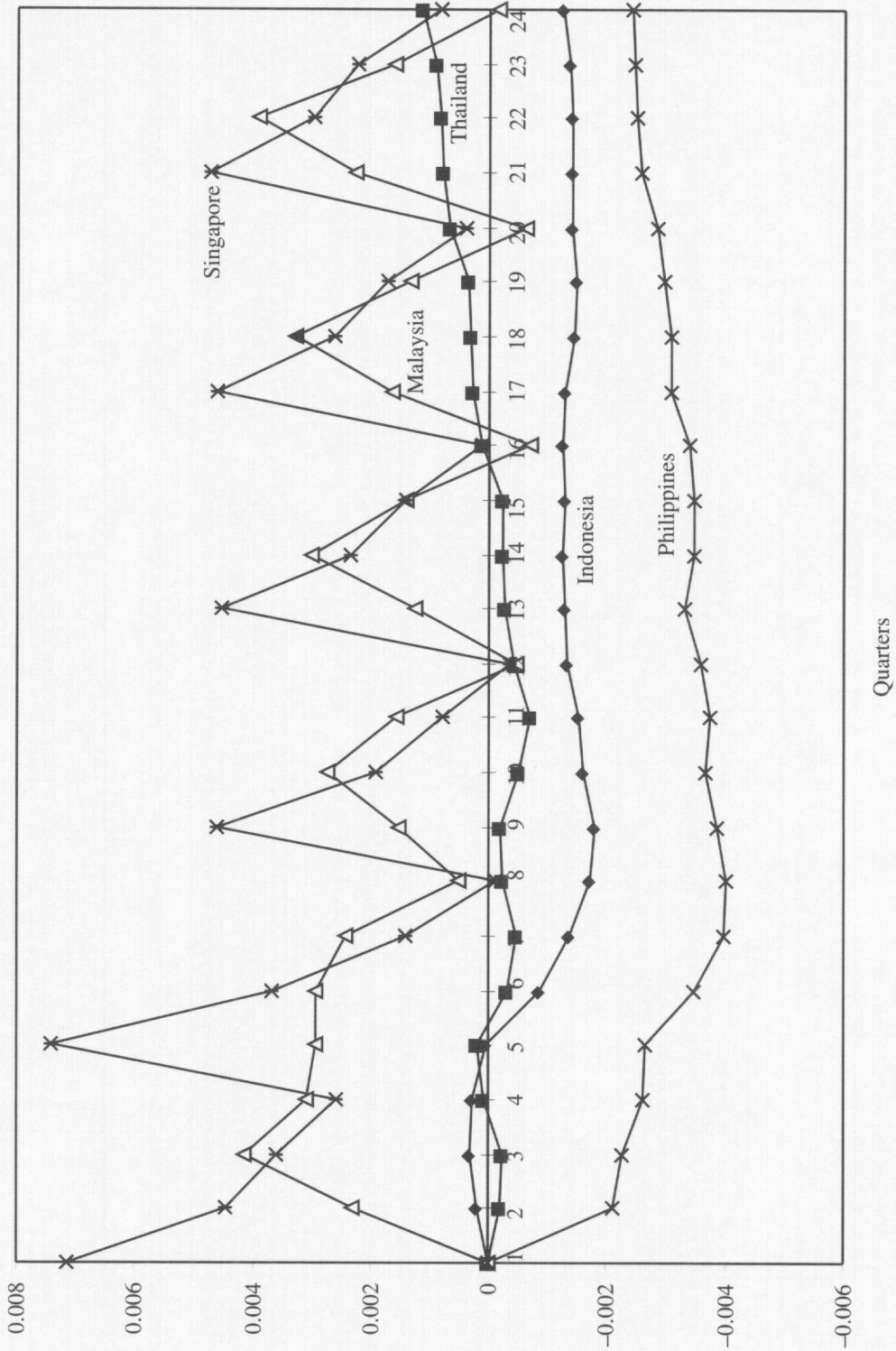
FIGURE 4

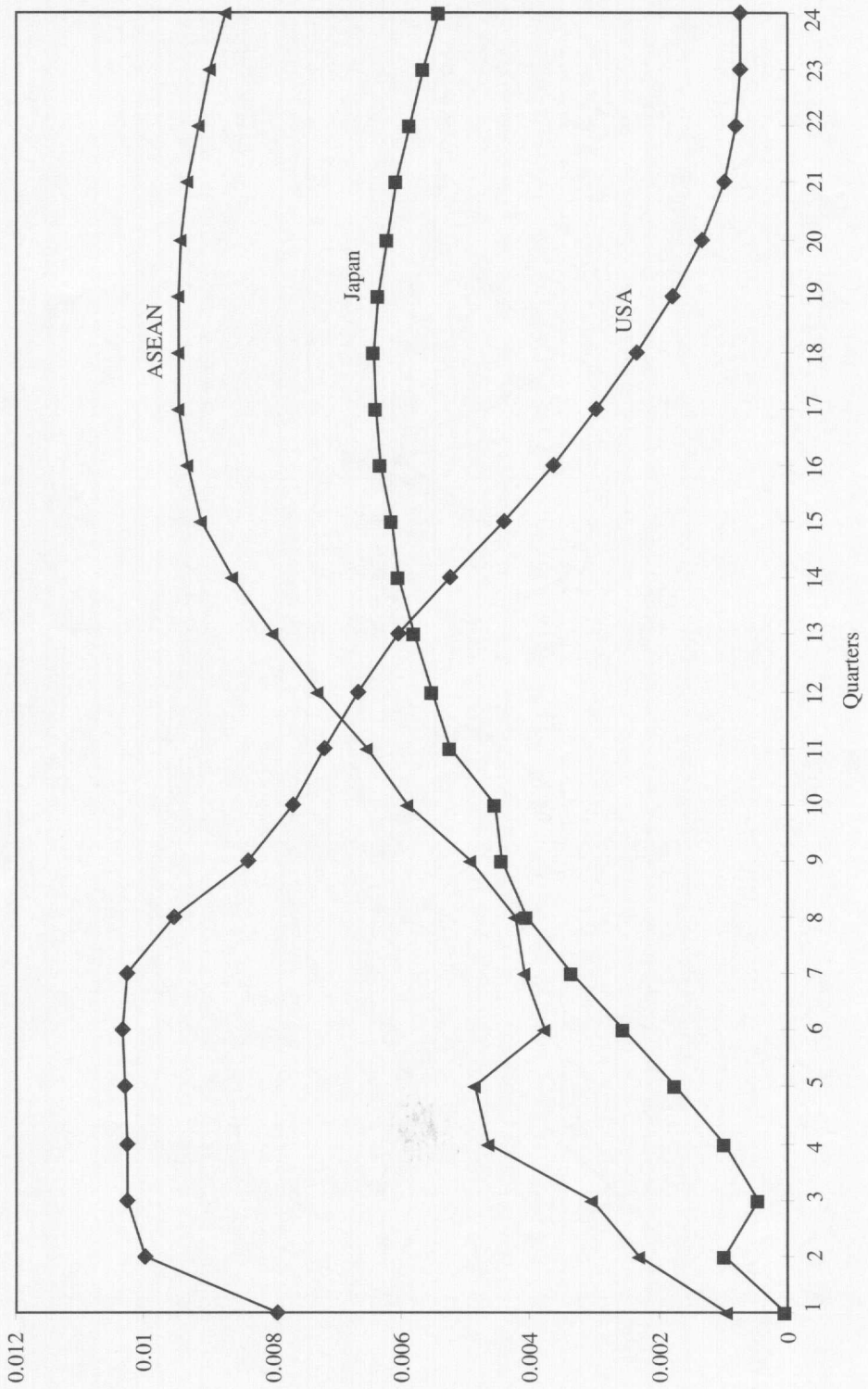Response of ASEAN and Japan to One-standard Deviation Shock in USA's Output

FIGURE 5

Response of ASEAN and USA to One-standard Deviation Shock in Japan's Output
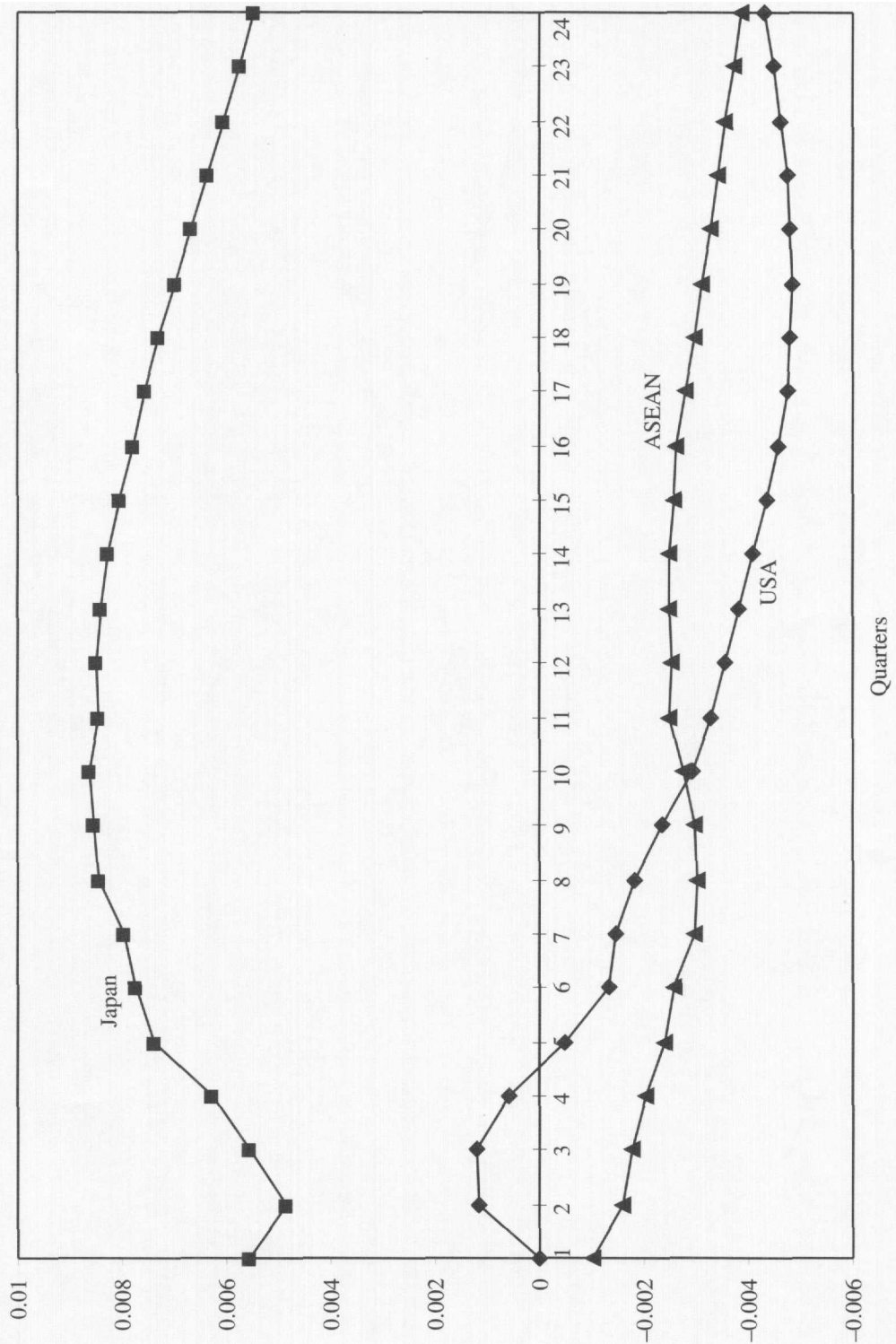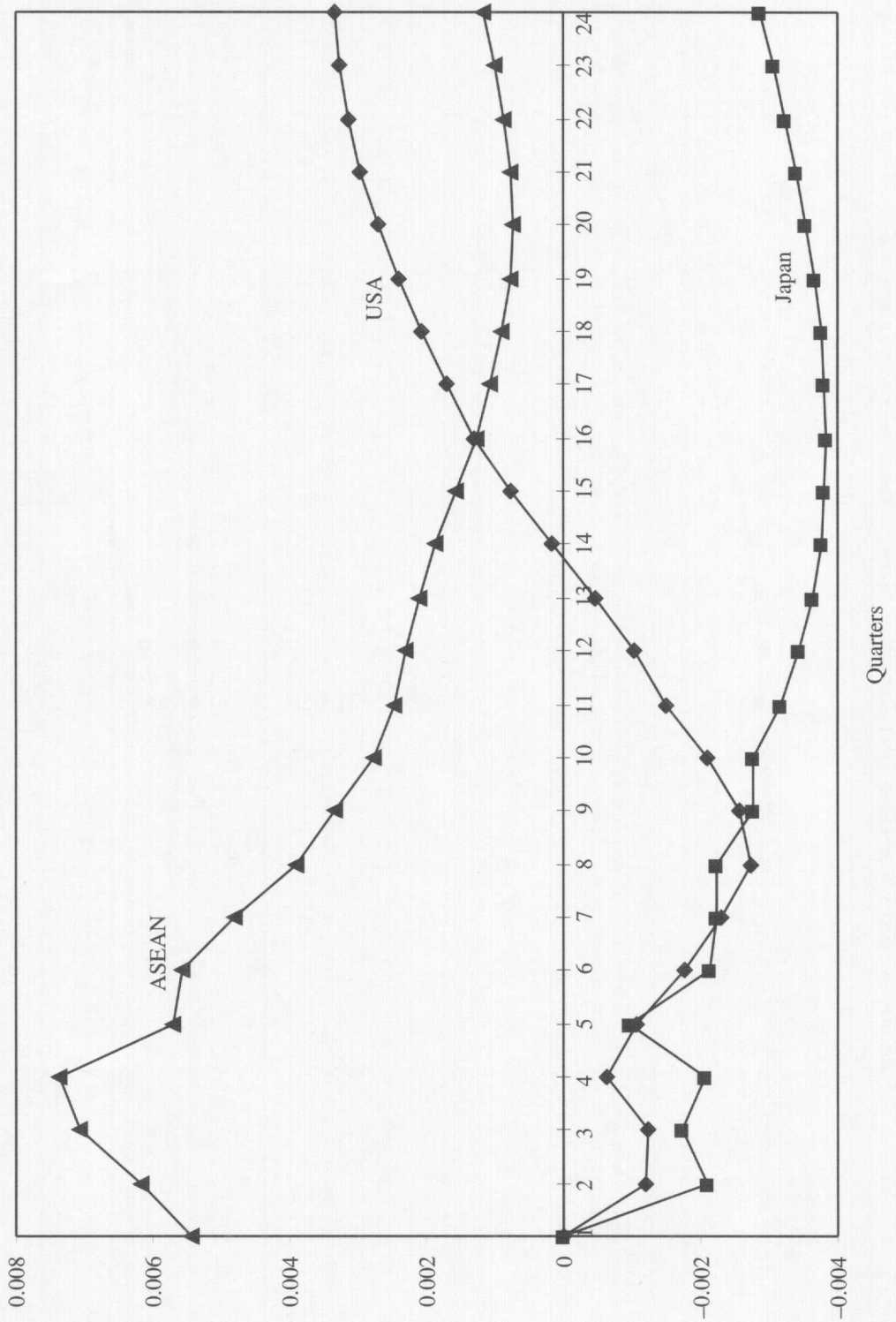
FIGURE 6

Response of Japan and the United States to One-standard Deviation in ASEAN's Output

the advantages of greater interdependence.[6] The leading role of Indonesia in these economic linkages implies the vital importance of Indonesia for a successful policy co-ordination.

The findings have important implications for the regional trading arrangements envisioned by the Asia Pacific Economic Co-operation forum. The study lends empirical support for a strong economic relationship between the United States and the ASEAN group of countries. This points to a natural trading relationship which includes the United States. Japan can contribute to the enhancement of trade in the Pacific region by importing more from ASEAN and the United States. Japan's lack of imports from this group of countries partly explains the lack of significant spillover effects from Japan to the United States and ASEAN. The growing competitiveness of some members of ASEAN in many product lines that Japan has been producing (such as machinery, transport equipment and other manufactures) also partly explains the growing competitive nature of their economies. More efforts must be spent in looking for complementary economic activities to increase mutually beneficial trade between Japan and ASEAN.

The findings in this study may be considered by some as preliminary and at best indicative due to the lack of analytical framework to address the topic: an inherent limitation of the VAR approach.[7] Due to the unavailability of quarterly data on trade, labour, capital flows and other factors, the relative importance of the possible sources of economic linkages cannot be quantified using the VAR approach. Moreover, there is a need to substantiate further the lack of a positive link between the Japanese and ASEAN economic activities. Clearly, more research at a micro level is required to substantiate further some of the findings in this study. The evidence provided in this article suggests some directions that future research can follow.

APPENDIX 1

Otani-Riechel Smoothing Technique

Y_t = annual GNP for the current year; Y_{t-1} = annual GNP for the previous year.

First estimate for first quarter: $[(3 \times Y_{t-1}) + (Y_t)] / 16$

First estimate for second quarter: $[(2 \times Y_{t-1}) + (2 \times Y_t)] / 16$

First estimate for third quarter: $[(1 \times Y_{t-1}) + (3 \times Y_t)] / 16$

First estimate for fourth quarter: $[(4 \times Y_t)] / 16$

Sum of the first estimates for all four quarters: y_t

Final estimate for first quarter: first estimate $\times Y_t / y_t$

Final estimate for second quarter: first estimate $\times Y_t / y_t$

Final estimate for third quarter: first estimate $\times Y_t / y_t$

Final e zstimate for fourth quarter: first estimate $\times Y_t / y_t$

NOTES

We are very grateful to the anonymous referee for his/her very useful comments. However, we alone are responsible for any errors and omissions made in this article.
1. ASEAN stands for Association of Southeast Asian Nations, and is comprised of Brunei, Indonesia, Malaysia, Philippines, Singapore, Thailand, Vietnam, Laos and Myanmar. This study only covers the five founding members of ASEAN (Indonesia, Malaysia, the Philippines, Singapore and Thailand) due to the insufficiency of data for the other member countries.
2. Other linkages may also exist such as multilateral institutions and multinational firms, information flows, physical flows of pollutants and external shocks. See Cromwell (1992).

3. Toda and Phillips (1993) assert that if non-stationary variables that are not cointegrated are used in VARs, then the test statistics have non-standard distributions. If the variables are non-stationary and not cointegrated, then VAR should be estimated in differences. First differencing makes variables integrated of order one stationary, which can be used in the VARs.
4. Johansen's cointegration tests are done using different specifications. We find at least one cointegrating vector in all specifications and report the results from two of these in Table 2b.
5. Variance Decomposition and Impulse Response Function analysis are sensitive to the ordering of the countries as the system is triangularized by orthogonalizing the errors through Choleski decomposition. To triangularize the system, the ordering of the countries were done by looking at the size of the GDP, assuming that the larger the size of the economy, the smaller is the outside influence. Accordingly, the ASEAN economies were ordered as Indonesia, Thailand, Malaysia, the Philippines, and Singapore, while the second group was ranked as USA, Japan, and ASEAN.
6. For a discussion of the benefits from policy co-ordination, see Cooper (1985).
7. Due to the limitations inherent in the Granger causality tests, the conclusions reached in this article may be interpreted as indicative and preliminary subject to further investigations. For an exposition of the Granger causality test's inherent limitations, see Hendry (1995).

REFERENCES

Abeysinghe, Tilak and Christopher Lee. "Best Linear Unbiased Intrapolation of Quarterly GDP: The Case of Malaysia". Department of Economics and Statistics, National University of Singapore, mimeo., 1994.
Ariff, Mohamed. "Effects of Financial Liberalisation on Four Southeast Asian Financial Markets, 1973–94". *ASEAN Economic Bulletin* 12, no. 3 (1996): 325–38.
Cargill, Thomas F. and Steven A. Morus. "A Vector Autoregression Model of the Neveda Economy". *Federal Reserve Bank of San Francisco Economic Review* (Winter 1988): 21–32.
Cooper, R.N. "Economic Interdependence and Coordination of Economic Policies". In *Handbook of International Economics*, vol. 2, edited by R.W. Jones and P.B. Kenen, pp. 1195–223. New York: North Holland, 1985.
Cromwell, Brain A. "Does California Drive the West? An Econometric Investigation of Regional Spillovers". *Federal Reserve Bank of San Franciso Economic Review* no. 2 (1992): 13–23.
Doan, Thomas. *RATS User Manual*. Estima, Evanston, Ill: 1992.
Enders, Walter. *Applied Econometrics Time Series*. New York: John Wiley & Sons, 1995.
Economic and Social Commission for Asia and the Pacific (ESCAP). Steering Group of the Committee for Regional Economic Cooperation, Fifth Meeting, 29 August–1 September 1994, Kunming, China.
Granger, C.W.G. "Investigating Casual Relations by Econometric Models and Cross-Spectral Methods". *Econometrica* 37 (1969): 24–36.
Hendry, D. *Dynamic Econometrics*. Oxford: Oxford University Press 1995.
Johansen S. "Statistical Analysis of Cointegration Vectors". *Journal of Economic Dynamics and Control* 12 (1988): 231–54.
Johansen, S. and K. Juselius. "Maximum Likelihood Estimation and Inference on Cointegration with Application to Money Demand". *Oxford Bulletin of Economics and Statistics* 52 (1990): 169–210.
Manzur, M. and M. Ariff. "Purchasing Power Parity: New Methods and Extensions". *Applied Financial Economics* 5 (1995): 19–26.
Sherwood-Call, Carolyn. "Exploring the Relationship between National aand Regional Economic Fluctuations". *Federal Reserve Bank of San Francisco Economic Review* (Summer 1988): 15–25.
Sims, Christopher A. "Comparison of Interwar and Postwar Business Cycles: Monetarism Reconsidered". *American Economic Review* 70 (1980a): 250–57.
——. "Models and Their Uses". *American Journal of Agricultural Economics* 71 (1980b): 489–94.
——. "Macroeconomics and Reality". *Econometrica* 48 (1980c): 1–49.
——. "Policy Analysis with Econometric Models". *Brookings Papers on Economic Activity* 1 (1982): 107–52.
Tan, Gerald. *ASEAN Economic Development and Cooperation*. Singapore: Times Academic Press, 1996.
Toda, H.Y. and P.C.B. Phillips. "Vector Autoregressions and Causality". *Econometrica* 61 (1993): 1367–393.
Tongzon, J.L. *The Economies of Southeast Asia: The Growth and Development of ASEAN Economies*. UK: Edward Elgar, 1998.
World Bank. *World Development Report 1993*. New York: Oxford University Press, 1993.

Habib Ahmed and **Jose L. Tongzon** are with the Department of Economics, National University of Singapore.