

Economic Linkages Between Japan  
and East Asian NIEs: An Empirical Study

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### Abstract

A sustained recovery of the Japanese economy is generally considered vital for the sustained recovery of East Asian newly industrialising economies (NIEs). The underlying assumption is that Japan is a significant engine of growth in East Asia. The primary objective of our study is to use cointegration analysis of real GDP time series to examine growth linkages between the Japanese economy and four East Asian NIEs – Korea, Indonesia, Malaysia and Singapore. Our main empirical finding is that Japanese performance has at most only a limited impact on the performance of the four other economies. Therefore, our finding casts doubt on the Japan-as-an-engine-of-growth hypothesis.

## I. Introduction

Until quite recently, East Asia has been the fastest growing region in the world, giving rise to the term “East Asian Miracle”. However, the latest economic developments in the region have not been so favourable. Japan has been mired in a slowdown since a financial and property bubble burst in the early 1990s. The rest of East Asia has been experiencing a more pronounced downturn since the regional currency crisis triggered by the forced devaluation of the Thai baht in July 1997. Although the entire region is currently in the midst of an apparent recovery, some doubts remain as to whether the recovery is robust and sustainable.

According to conventional wisdom, Japan has acted as a powerful engine of growth in the course of the East Asian Miracle. After all, Japan is the second largest economy in the world and the only developed economy in Asia. Japan has become an increasingly important trade partner as well as source of capital, technology, managerial skills and foreign aid during the course of East Asia’s rapid economic growth and industrialisation. At the same time, the rest of Asia has been growing in importance as export markets for Japanese goods and services. There is, thus, a close and growing economic interdependence between Japan and the rest of Asia.

In the context of East Asia’s recent crisis and current recovery, such conventional wisdom suggests that a sustained recovery of the Japanese economy is essential for the sustained recovery of other economies in East Asia. Indeed, during the depths of the crisis, the governments of other developed countries, in particular the U.S., have been calling for Japan to jump-start its own economy to facilitate a speedier and more robust recovery

for the other countries in the region. A stronger Japanese economy would strengthen Japanese appetite for imports and thus reinforce an export-driven recovery across East Asia, as well as promote the flow of Japanese investment into the rest of the region.

The central objective of this paper is to empirically examine, using time-series techniques, whether Japan's economic performance has in fact significantly influenced the economic performances of its neighbours in the past. That is, we want to investigate the strength of the growth linkages between Japan and other East Asian economies in the past. Evidence of strong growth linkages would indirectly lend greater support and credibility to the popular Japan-as-an-engine-of-recovery view. We can expect the recovery of its neighbours, in turn, to further reinforce Japan's recovery.

## II. The Variables and Data Source

Our variable of interest is real gross domestic product (GDP) in US dollars. We used GDP as a proxy for overall economic performance. The GDP time series cover the period from 1960 to 1996. We denoted the GDP of Singapore, Malaysia, Indonesia, Korea, Hong Kong, Thailand, the US, Japan, the UK, Germany and Australia as S, M, I, K, H, T, US, J, UK, G and A respectively. Next, we drew the time-series data for our empirical analysis from the International Financial Statistics (IFS) database.

We limited our analysis to the economic impact of Japan on the following four countries – Korea, Indonesia, Malaysia and Singapore. Taiwan was excluded from this study due to the unavailability of IFS data. Thailand and Hong Kong were also excluded because, although IFS data are available for

those countries, we failed to find any meaningful cointegration relationships between their GDP series and those of other countries, including Japan. As such, we were unable to proceed any further to investigate the economic influence of Japan on those two countries. The principal objective of this paper is to investigate the economic impact of Japan on the four countries mentioned above. Therefore, we let the dependent variable of our regressions be the GDP of the country concerned and the explanatory variables be the GDPs of a set of other countries, including Japan.

### III. Econometric Analysis

Before our analysis, we had to check for the stationarity of our time-series and determine the order of integration for non-stationary variables. Cointegration requires that the relevant time series be integrated of the same order. There are various ways to test for unit roots and stationarity, and determine the order of integration. The more common tests are the Dickey-Fuller (DF) test, the augmented Dickey-Fuller (ADF) test and the Philips and Perron (PP) non-parametric test.

Dickey and Fuller (1979) pioneered the DF test, which assumes the underlying data generating process is a simple first order autoregressive process and is the basis for the other two tests. The ADF test is used if a simple first order autoregressive process cannot generate the data. The main advantage of the PP test, pioneered by Phillips and Perron (1988), over the DF tests is that it allows for fewer restrictions concerning the distribution of errors [Enders (1995)]. We used the PP test statistic in our unit root test in this paper.

We also adopted the methodology developed by Dickey and Pantula (1987) to test for multiple unit roots. We first tested for the presence of two unit roots

in all the GDP series and then for the presence of a single unit root, before testing the significance of the time trend and the drift term. Our PP test results indicate that the logarithms of the GDP time series of Singapore, Malaysia, Korea, Hong Kong, Thailand, the United Kingdom and Germany are integrated of order one - i.e.  $I(1)$  - and contain only a drift term while the logarithms of the GDP time series of Indonesia, the United States, Japan and Australia are also integrated of order  $I(1)$  but contain both a time trend and a drift term.

Since most of our variables are non-stationary, regression involving these variables could lead to spurious results unless the dependent variable is combined with other non-stationary variables to form a stationary cointegrated relationship. If a set of time series is cointegrated, then there exists an equilibrium long-run relationship among them which contains useful information and allows for meaningful interpretation. On the other hand, if it is not possible to form a stationary cointegration relationship among the time series, results suggesting a statistically significant relationship among the series in the regression model can merely reflect contemporaneous correlations rather than meaningful causal relationships.

Engle and Granger (1987) and Johansen (1988) developed the two main methodologies to test for cointegration and estimate the cointegrating vectors. The primary difference between the two methodologies is that the Engler-Granger technique is in single-equation whereas the Johansen technique is in multi-equation. As such, the Johansen technique is less restrictive in its assumptions and applicability. Nevertheless, we relied on the simpler Engle-Granger technique in this paper. The four economies that we examined –

Korea, Indonesia, Malaysia and Thailand – are all small, open economies with only limited influence on the rest of the world, so it is reasonable to assume that other GDP time series are weakly exogenous with respect to their own GDP time series. In particular, we expect Japan to have a more significant impact on the four economies rather than the reverse. Using the Johansen technique would detract from our main purpose of examining the effect of Japan’s economic performance on smaller East Asian economies.

The results of the standard two-step Engle-Granger procedure for the four countries are shown in Tables 1 and 2. Results for the long run model are shown in Table 1 and for the error correction model in Table 2. The independent variables include not only Japan but also other countries with which the economy is expected to have significant economic relationships. For example, for Singapore, the independent variables are the GDP of Japan, the United States, the United Kingdom, Indonesia, Malaysia and Hong Kong.

Table 1: Results for Long Run Relationship

Models For:	Singapore	Malaysia	Indonesia	Korea
Independent Variable	Dependent Variable			
	S <sub>t</sub>	M <sub>t</sub>	I <sub>t</sub>	K <sub>t</sub>
C	-3.17 (-0.909)	9.03 (4.97)	17.3 (2.01)	-62.7 (-2.77)
J <sub>t</sub>	-0.00125 (-0.74)	-0.00244 (-2.08)	0.00369 (0.576)	0.00007 (0.005)
US <sub>t</sub>	-0.00262 (-1.86)	-0.000115 (-0.1)	0.00138 (0.328)	-0.00161 (-1.27)
UK <sub>t</sub>	0.0194 (3.67)	-0.0119 (-2.44)	-0.0275 (-1.24)	0.214 (3.92)
G <sub>t</sub>	-	-	0.00223 (1.76)	0.0008 (0.028)
A <sub>t</sub>	-	-	-	-0.257 (-1.01)
H <sub>t</sub>	0.186 (2.93)	-	0.424 (2.55)	1.04 (2.26)
T <sub>t</sub>	-	0.0326 (0.94)	-0.193 (-1.04)	2.11 (4.64)
K <sub>t</sub>	-	-	-	-
I <sub>t</sub>	-0.205 (-1.92)	0.310 (5.98)	-	0.822 (1.92)
M <sub>t</sub>	1.14 (6.22)	-	-	-
S <sub>t</sub>	-	0.427 (3.01)	2.23 (6.57)	-2.07 (-1.55)
R <sup>2</sup>	0.9992	0.9994	0.9966	0.9985
D.W.	1.751	1.906	1.351	1.468

\*All the variables are in logarithm form.

\*\*Figures inside parentheses are t-statistics.

Table 2: Results for Error Correction Model

Models For:	Singapore	Malaysia	Indonesia	Korea
Independent Variable	Dependent Variable			
	$S_t$	$M_t$	$I_t$	$K_t$
C	-0.00419 (-1.49)	0.00215 (0.585)	-0.00782 (-1.13)	0.0745 (4.77)
$\xi_{t-1}$	-0.0151 (-4.72)	-0.0113 (-2.45)	-0.0376 (-2.91)	0.349 (4.10)
$US_t$	-0.618 (-4.63)	0.436 (2.52)	-	2.17 (6.38)
$US_{t-2}$	-	-	-	-0.418 (-1.89)
$J_t$	0.259 (2.68)	-0.360 (-2.44)	-	0.362 (2.65)
$J_{t-1}$	-0.671 (-7.03)	0.591 (4.45)	0.181 (1.42)	-
$J_{t-2}$	0.416 (4.58)	-0.512 (-4.22)	-	-
$UK_t$	0.521 (6.87)	-0.558 (-5.15)	0.340 (2.57)	0.950 (4.36)
$UK_{t-1}$	0.202 (2.66)	-0.233 (-2.37)	-	-0.728 (-2.80)
$UK_{t-2}$	-	0.196 (1.71)	-0.546 (-4.10)	1.65 (5.90)
$G_t$	-	-	-	1.18 (5.27)
$G_{t-2}$	-	-	-0.319 (-2.56)	-
$A_{t-1}$	-	-	-	-0.959 (-3.94)
$H_t$	0.171	-	-	-0.427 (-3.28)
$H_{t-1}$	-	-	-	0.219 (2.39)
$H_{t-2}$	-	-	-	-0.658 (-5.82)
$T_t$	-	-	-	-2.23 (-5.22)
$T_{t-1}$	-	-	-	2.38 (6.74)
$T_{t-2}$	-	-	0.611 (3.77)	-2.28 (-7.25)
$S_t$	-	0.581 (4.07)	-	1.16 (6.41)
$S_{t-1}$	-	-	0.199 (2.29)	-0.646 (-3.41)
$S_{t-2}$	-	-	-0.290 (-1.66)	0.909 (6.40)
$M_t$	1.06	0.518 (2.52)	-	-
$I_t$	-	-	-	-0.794 (-2.90)
$I_{t-2}$	-	-	0.566 (3.59)	0.727 (3.59)
$K_{t-1}$	-	-	-	-0.892 (-5.55)

\*All the variables are in difference of logarithm form.

\*\*Figure inside parentheses are t-statistics.

For all four countries, the logarithm of their respective GDP is cointegrated with the other time series in the long run relationship shown in Table 1. For example, the logarithm of GDP of Singapore is cointegrated with the logarithm of the GDP of Japan, the US, the UK, Hong Kong, Indonesia and Malaysia. The t-ratios for the lag of the disturbance term -  $\varepsilon_{t-1}$  - in the error correction models in Table 2 are all significant, implying the short-run adjustments are significant and will converge to long-run equilibrium.

To determine the relative importance of each of the independent variables, we examined the sign and magnitude of the coefficients reported in Table 1.

The coefficient of 1.14 for  $\text{Log}(M_t)$  in the equation for  $\text{Log}(S_t)$  suggests a strong, positive impact of the Malaysian economy on the Singaporean economy. What interests us here is the coefficient for  $\text{Log}(J_t)$  for the four countries because the central issue is the economic impact of Japan. These are  $-0.00125$ ,  $-0.00244$ ,  $0.00369$  and  $0.0000734$  for Singapore, Malaysia, Indonesia and Korea respectively. All the coefficients are small, implying only a limited economic impact of Japan on these countries.

#### IV. Concluding Remarks

We considered single equation methods and performed cointegration analysis on the GDP time series of eleven countries in order to examine the impact of Japan's economic performance on that of four other East Asian countries. Our findings fail to lend indirect support to the Japan-as-an-engine-of-recovery hypothesis. They indicate that Japan's GDP has a negligible impact on the GDP of Korea, Indonesia, Malaysia and Thailand. While our findings are far from conclusive and more rigorous analysis is required, they are nevertheless interesting and somewhat surprising in that they weaken the conventional wisdom that Japanese economic growth and recovery is essential for East Asia.

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