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Macroeconomic Linkages between Selected East Asian Economies and the US*

by

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Abstract
The paper will assess the extent of transmission of output shocks from the United States (US) to a number of East Asian economies. Quarterly data series spanning from the early 1990s would be mobilized for the purpose. The existing pattern of global economic recovery from the 2007 US sub-prime crisis would allude to the ability of East Asian economies to grow quite independently of the U.S. Indeed, certain quarters would even hail the region as a potential savior of the global economy. Greater intra-regional trade and domestic demands are perceived as the factors responsible for this de-coupling phenomenon. However, this notion of decoupling has also met with much skepticism. The detractors would contend that most of the intra-regional trade is generated by international production fragmentation that drives trading in parts and components. They are then assembled into final products especially in China to be exported extra-regionally. However, this paper would address the issue of de-coupling based not upon trade and production but macroeconomic data as an alternative front.

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I. Overview

Decoupling of Asian economies from the United States (US) economy was topical at the 2008 World Economic Forum in Davos, Switzerland. Despite, the recent affliction of East Asia by the US-originated sub-prime crisis, some still regard it as a potential savior of the world or as having at least partially decoupled from the US. Greater intra-regional trade and domestic demands are said to provide it with the buffer against the impact of a US economic slump (see Eichengreen and Park, 2008; The World Bank, 2007).

However, the notion of decoupling has also met with skepticism. Most of the intra-regional trade is due to international production fragmentation that spurs trading in parts and components. They are then assembled into final products particularly in China to be exported extra-regionally (Athukorala & Yamashita, 2006). Hence East Asian (EA) nations apart from China are actually enjoying a derived demand from the US and the European Union (EU). Extra-regional trade in final goods may then remain crucial to their growth trajectories. The ability of China to assume the engine-of-growth role for the region is thus doubted (ADB, 2008; Haltmaier et al, 2007; and Ahearne, et al, 2006).

Against this backdrop, this study is aimed at assessing the possible transmission of output shocks from the US to some of the EA economies, namely Malaysia, Singapore, Thailand, Philippines, Indonesia, Japan and South Korea. Specifically a bivariate VAR analysis of the natural logarithm of the real gross domestic product (GDP) of the US and of each of the EA economies is pursued, generally akin to the study of Canova (1995) in respect of the US, Japan and Germany. Cointegration, Granger causal relations and contemporaneous correlations of output shocks are explored. To conserve space, a description of the widely known econometric methodology of cointegration and vector autoregression is omitted herein.

All the required data are drawn from the International Financial Statistics of the International Monetary Fund with the sample period generally starting from 1990 as dictated by availability. The other regional economies including China are inevitably excluded due to the absence of their quarterly GDP series of adequate length. There is no known prior study that has utilized a similar approach and that involved individual country estimates for this group of countries. The study is also pertinent in addressing the question of whether these countries are already well-positioned to sustain their growth momentum in the event of a structural adjustment made by the US to redress its twin deficit.

In the subsequent section of this paper, the econometric analysis is presented and discussed. The paper concludes with remarks in Section III.

II. Empirical Evidence

Prior to testing for cointegration between the real GDP of the US and of each of the EA economies, the order of integration of the data series has to be established. Table 1 presents the results of the Dickey-Fuller-based unit root tests for the individual country real GDP series in terms of level, first and second differences. The optimal order of lag augmentation for conducting such tests is determined based upon the Akaike Information Criterion (AIC). The test statistics suggest that all the series have a unit root, thus are integrated of order one, I(1). A higher order of integration is ruled out by tests based upon second differences. This permits explorations for possible long run relationships between the real GDP of the US and of each of the EA countries.

The Johansen's maximum likelihood procedure is adopted for the purpose. Table 2 presents the trace statistics concerned. A difficult question arises as to whether an intercept and trend should enter the short- and or long run models. Johansen (1992) advocates testing of the joint hypotheses of both the rank order and the deterministic components by applying the Pantula principle. In this exercize, three models are estimated, namely with restricted intercepts and no trends in the VAR (M1), unrestricted intercepts and no trends in the VAR (M2) and unrestricted intercepts and restricted trends in the VAR (M3). The test procedure involves moving from the most restrictive to a less restrictive model, stopping only at the very first time the null hypothesis is accepted. To double-check on the accuracy of inferences made, both full and sub-sample (pre- and post-1998) estimations are attempted. The year 1998 was one when the Asian financial crisis was at its height. This is to acknowledge the possibility that structural changes that the EA economies might have undergone could bias the inferences made. However in the case of Indonesia and Thailand, no pre-1998 sample estimation is pursued as their quarterly data series are only available from 1991 and 1993 respectively. It appears that the null hypothesis of no cointegration between the real GDP of the EA countries and of the US cannot be rejected as all the trace statistics do not exceed their 95 per cent critical values.

Given the absence of cointegration, it is only appropriate to resort to the traditional Vector Autoregression (VAR) modeling in first differences for establishing causality rather than the Vector Error Correction (VECM) modeling. Table 3 presents the Granger causality test outcomes. Problems are encountered with the full sample estimations of Indonesia, Malaysia, Thailand and South Korea as regardless of the lag order provided for and the incorporation of dummies for outliers, serial correlation and non normality of errors persist. Hence, they are classified as indeterminate in the table. Nevertheless, sub-sample estimates for these countries and all the estimates for the others could yield meaningful inferences as they could withstand a battery of diagnostic tests surrounding the error term. It is noteworthy from the table that the log-likelihood ratio statistics allude to the existence of unidirectional Granger causal relations flowing from the US to the Malaysian (1990Q1-1997Q4 &1999Q1-2008Q2) and Japanese (1999Q1-2008Q2) economies, consistent with a priori expectations. With respect to Indonesia and Singapore, Granger causal relations are completely ruled out. The results pertaining to the Philippines, Thailand and South Korea appear perverse. In the case of the Philippines, unidirectional causality emanating from the Philippines to the US is suggested based upon data, 1990Q1-2008Q2 and 1999Q1-2008Q2. While, bi-directional causality is indicated between the US on the one hand and Thailand and South Korea on the other in 1999Q1-2008Q2. For these smaller economies to exert any influence on the US is unimaginable.

Since distinct unidirectional causal links from the US to Japan and Malaysia exist, it may be of interest to assess the strength of the links via reference to impulse response functions. This is met by examining the impact on the output growth of Japan and Malaysia of a unit shock (equal to one standard error) administered to the US output growth equation. In the bivariate VAR systems estimated over the period 1999Q1-2008Q2, the US output growth variable is ordered first. Figures 1 and 2 are plots of the impulse responses of the output growth of Japan and Malaysia respectively over a 24-period horizon. The figures highlight that a unit shock to the US output growth has only a nominal impact on that of Japan and Malaysia. However, the effect on Malaysia is slightly more pronounced in the immediate periods following the shock and is more lingering.

While the preceding analyses represent attempts to establish whether long-run and Granger causal relations exist between the EA economies and the US, it may also be worthwhile examining the possibility of contemporaneous correlations. This concerns the extent to which shocks in different output growth equations are contemporaneously correlated. It involves testing the hypothesis that

$$H_0: \sigma_{ij} = 0$$

against the alternative that $H_1: \sigma_{ij} \neq 0$

where σ_{ij} represents the contemporaneous covariance between the shocks in the output growth equations of countries i and j. The null hypothesis is that the shocks are contemporaneously uncorrelated and the log-likelihood ratio statistic for the hypothesis-testing is computed as follows:

$$LR(H_0 I H_1) = 2(LL^U - LL^R)$$

where LL^U and LL^R refer to the maximized values of the log-likelihood function under H_1 and H_0 respectively. The statistic is asymptotically distributed as a χ^2 variate with m(m-1)/2 degrees of freedom where m refers to the number of equations in the VAR.

Table 4 presents the related log-likelihood ratio statistics. It appears that the null hypothesis of the absence of contemporaneous correlations with shocks in the US growth can only be rejected with respect to Malaysia (1999Q1-2008Q2), Singapore (1990Q1-2007Q4 and 1999Q1-2007Q4) and Thailand (1999Q1-2008Q2). Hence it can be deduced that only the output growth shocks of Malaysia, Singapore and Thailand are contemporaneously correlated with that of the US. However, the correlation coefficients computed based upon the product-moment formula for the period 1999Q1-2008Q2 merely range from 0.338 in the case of Malaysia to 0.495 in the case of Thailand.

Henceforth, the results of all the analyses taken as a whole would suggest a weak link if any between the EA and the US economies.

III. Concluding Remarks

The paper dwells upon the possible transmission of output shocks from the US to a number of EA economies. On the whole, the empirical results would suggest weak links between the EA and the US economies. Long-run relationships between the output of the US economy and of the EA economies are found to be non- existent. Though unidirectional causal links running from the US to Japan and Malaysia do prevail, such links seem weak by inspection of the corresponding impulse response functions. A unit shock administered to the US output growth only has a nominal impact on that of Japan and Malaysia. The possibility of Granger causal relations from the US to Indonesia and Singapore is dismissed. Analyses for possible contemporaneous correlations of output growth shocks suggest that only a low degree of correlation exists between the US on the one hand and Malaysia, Singapore and Thailand on the other.

Such an overall evidence of weak links may not be deemed contradictory to the recent reeling of these economies from the effects of the US financial crisis. They are now in recession because the US crisis has degenerated into a global economic crisis, dubbed by some as the Great Recession. Hence, in the light of the econometric findings, it may be deduced that they are poised to continue growing quite independently of the US, barring an economic crisis of catastrophic proportions.

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Table 1

Augmented Dickey-Fuller Test Statistics of Real GDP

	Level	1st Difference	2nd Difference
Malaysia (MAL)	-2.457 (6)	-3.946* (5)	-5.931* (6)
Philippines (PHI)	-3.360 (8)	-3.002* (7)	-5.643* (6)
Singapore (SIN)	-2.358 (8)	-4.368* (4)	-7.282* (6)
Thailand (THA)	-1.769 (5)	-3.144* (4)	-4.486* (3)
Indonesia (IND)	-2.969 (4)	-3.424* (4)	-9.058* (2)
South Korea (SK)	-2.298 (6)	-4.653* (5)	-5.550* (6)
United States (US)	-1.261 (2)	-4.401* (1)	-7.510* (2)
Japan (JAP)	-2.399 (3)	-3.772* (3)	-11.465* (1)

Note: (.) – Lag order determined by the Akaike Information Criterion (AIC)

Table 2

Trace Statistics (Null Hypothesis: No Cointegration)

IND	1993Q1-2008Q1 – M2 (3) 9.252 1999Q1-2008Q1 – M1 (3) 18.622
MAL	1990Q1-2008Q2 – M2 (6) 16.425 1990Q1-1997Q4 – M2 (4) 8.128 1999Q1-2008Q2 – M2 (8) 17.488
PHI	1990Q1-2008Q2 – M2 (8) 16.030 1990Q1-1997Q4 – M1 (4) 17.379 1999Q1-2008Q2 – M2 (7) 15.959
SIN	1990Q1-2007Q4 – M2 (8) 10.422 1990Q1-1997Q4 – M2 (4) 6.387 1999Q1-2007Q4 – M2 (1) 11.837
THA	1993Q1-2008Q2 - M1 (5) 19.380 1999Q1-2008Q2- M2 (7) 17.221
SK	1990Q1-2008Q2- M3 (8) 22.750 1990Q1-1997Q4- M2 (4) 9.255 1999Q1-2008Q2 - M2 (4) 14.702
JAP	1990Q1-2008Q2 - M2 (4) 8.411 1990Q1-1997Q4 - M2 (5) 17.255 1999Q1-2008Q2 - M2 (8) 17.495

Notes: M1 – Restricted Intercepts and No Trends in the VAR
M2 – Unrestricted Intercepts and No Trends in the VAR
M3 – Unrestricted Intercepts and Restricted Trends in the VAR
(.) – Lag order determined by AIC
The 95 per cent critical values for M1, M2 and M3 are 20.18, 17.86 and 25.77 respectively

Table 3

Granger Causality
Log Likelihood Ratio Test Statistics (χ^2)

IND	1991Q1-2008Q1 – Indeterminate			
	1999Q1-2008Q1	(1)	US→ IND	0.556 [0.456]
			IND→ US	3.113 [0.078]
MAL	1990Q1-2008Q2 – Indeterminate			
	1990Q1-1997Q4	(3)	US→MAL	8.123[0.044]
			MAL→US	2.239[0.524]
	1999Q1-2008Q2	(5)	US→MAL	27.130[0.000]
			MAL→US	4.081[0.538]
PHI	1990Q1-2008Q2	(12)	US→PHI	19.103[0.086]
			PHI→US	26.766[0.008]
	1990Q1-1997Q4	(4)	US→PHI	8.236[0.083]
			PHI→US	6.960[0.138]
	1999Q1-2008Q2	(9)	US→PHI	9.917[0.357]
			PHI→US	25.961[0.002]
SIN	1990Q1-2007Q4	(9)	US→SIN	12.636 [0.180]
			SIN→US	6.124 [0.727]
	1990Q1-1997Q4	(5)	US→SIN	10.591[0.060]
			SIN→US	6.258[0.282]
	1999Q1-2007Q4	(3)	US→SIN	6.792[0.079]
			SIN→US	1.147[0.766]
THA	1993Q1-2008Q2 – Indeterminate			
	1999Q1-2008Q2	(7)	US→THA	27.662[0.000]
			THA→US	17.643[0.014]
JAP	1990Q1-2008Q2	(10)	US→JAP	13.560[0.194]
			JAP→US	11.639[0.310]
	1990Q1-1997Q4	(1)	US→JAP	0.871[0.351]
			JAP→US	0.274[0.601]
	1999Q1-2008Q2	(1)	US→JAP	4.578[0.032]
			JAP→US	0.412[0.521]
SK	1990Q1-20008Q2 – Indeterminate			
	1990Q1-1997Q4	(4)	US→KOR	8.281[0.082]
			KOR→US	8.822[0.066]
	1999Q1-2008Q2	(7)	US→KOR	20.450[0.005]
			KOR→US	21.177[0.004]

Notes: (.) - Lag order determined by the AIC
[.] - Marginal significance level

Table 4

Contemporaneous Correlations

Log-Likelihood Ratio Test Statistics (χ^2*)

IND	1991Q1-2008Q1 – Indeterminate 1999Q1-2008Q1 – 0.795
MAL	1990Q1-2008Q2 – 1.652 1990Q1-1997Q4 – 0.082 1999Q1-2008Q2 – 4.610** r= 0.338
PHI	1990Q1-2008Q2 – 1.986 1990Q1-1997Q4 – 0.540 1999Q1-2008Q2 – 3.120
SIN	1990Q1-2007Q4 – 4.170** r=0.247 1990Q1-1997Q4 – 3.498 1999Q1-2007Q4 – 5.935** r=0.390
THA	1993Q1-2008Q2 – Indeterminate 1999Q1-2008Q2 – 10.693** r=0.495
JAP	1990Q1-2008Q2 – 0.827 1990Q1-1997Q4 – 2.584 1999Q1-2008Q2 – 0.002
SK	1990Q1-2008Q2 – Indeterminate 1990Q1-1997Q4 – 2.185 1999Q1-2008Q2 – 0.899

Notes: * 95% critical value with 1 degree of freedom =3.84

** Statistically significant

r = Correlation coefficient

Figure 1 Japan - Impulse Responses to a Shock in the US Equation

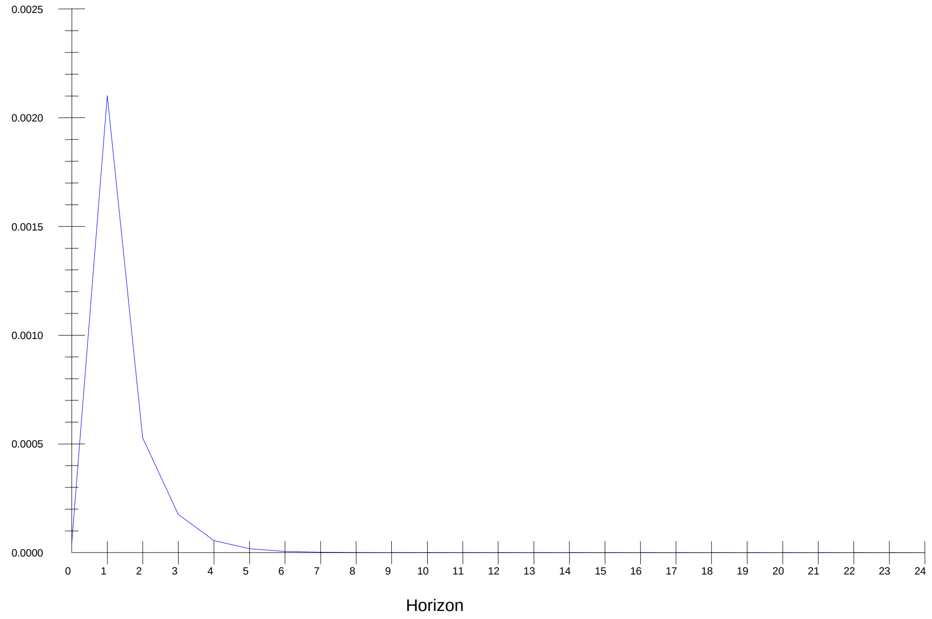

Figure 2 Malaysia - Impulse Responses to a Shock in the US Equation