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Causal Relationship Between Gold Price, Oil Price, Exchange Rate and International Stock Markets

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ABSTRACT

This paper analyze the impact of rising crude oil price, gold Price and fluctuation of exchange rate to stock price indices in the context of US, Japan, Hong Kong, Singapore and Malaysia using weekly data and time series method for the period of January 2000 to December 2010. The methodology employed uses various unit root test and Johansen's co-integration test followed by vector error correction model, variance decompositions, and impulse response function in order to capture both within-sample and out-of-sample Granger-causal relationship among crude oil price, gold price, exchange rate and stock price indices. Results obtained from these tests show that price of oil, price of gold, exchanges rates and stock markets are interrelated among each other.

Keyword: Crude oil price, gold price, exchange rate, stock markets

INTRODUCTION

Recent rise in the prices of commodity has become a major concern for the world economy. From January of 2009 to December of 2010, price of WTI crude oil rose by more than 118%. Rising crude oil price can increase the cost of production and thus decrease the aggregate supply. Historical data shows the fluctuation of crude oil have greater adjustment speed to equilibrium than other commodities. Price of oil and inflation rate has close cause and effect relationship and they tend to follow each other[1].

Gold, seen as a commodity that can maintain purchasing power and hedge against inflation well, historically has negative relationship with stock market slump and positive relationship with rising inflation. With the rising of commodity prices and continuously expansionary monetary policy maintained by central banks, global inflation is expected to rise, thus make gold an attractive investment tools[2].

Fluctuation in exchange rate will affect international trade and economy, thus, affect stock markets. When domestic currency appreciates, domestic importers enjoy lesser cost dealing with same amount of goods thus enjoy greater profit. This will have positive effect on the domestic stock price of the said importers.

Understanding the relationship of oil price, gold price, exchange rate and stock market prices thus is important in global economy perspective.

OBJECTIVES

The Objectives of this study is to examine the relationship between price of crude oil, price of gold, exchange rate and stock indices in Hong Kong, Malaysia, Japan, US and Singapore. It also examines the long run and short run interactions among these variables from January of 2004 to December of 2010.

LITERATURE REVIEW

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[1] Refer to Hammoudeh et al. (2007)
[2] Historically the price of gold has been intimately wed to the value of the currency, as the currency loses value, gold against it.

Many researches have been done in the study of the relationship between oil price, exchange rate and stock market prices. (Basyer et. al.) using structural vector autoregressive model in investigating the dynamic relationship between oil price, exchange rate and emerging stock markets found that positive shock of oil prices tend to depress the emerging market stock prices and US dollar exchange rate in the short term. There is also evidence that increase in emerging market stock prices increase the prices of oil.

Huang, Masulis and Stoll (1996) applied vector autocorrelation models to find the time-series relationship and concluded that crude oil futures lead stock prices of oil companies. However, they were unable to indicate any significant relationship to other stock prices. In addition, the volatilities of crude oil futures lead the volatilities of oil industry stock index. A related study (Sadorsky, 1999) had different conclusion. It showed that oil prices as an important factor which predicts stock prices very well. Sadorsky (2003) used vector autocorrelation model to verify the importance of oil price, fed fund rate, CPI, foreign exchange as variables to describe the performance of technology stock prices.

Pindyck and Rotemberg (1990) found that prices of important commodities, such as oil and gold, has close relationship as crude oil price spikes often associated with inflationary pressure and this will increase the demand (and hence price) of gold since gold is regarded as a more secure way for storing wealth.

Gogineni (2008) in his research on the effect of oil price fluctuation to stock market found evidence that oil price changes caused by supply shock have negative impact on stock prices on the same day while oil price changes caused by shifts in aggregate demand have positive impact on stock prices on the same day. Different result yielded by Kilian and Park (2007). They found evidence that oil supply shock have no significant effect on the US stocks returns.

Anoruo and Mustafa (2007) used cointegration technique and modified VECM found evidence that oil price and stock market return are cointegrated and causality runs from stock market to oil market but not vice versa. Similar research done by Adebiyi et. al. (2009) using multivariate VAR analysis yields different result. Granger causality test indicates that causation run from oil price shocks to stock returns, implying that variation in stock market is explained by oil price volatility. Besides, they also concluded that causation run from stock returns to real exchange rate, indicate that domestic economic policies can be used to stabilize the stock market.

Filis, Chatziantoniou and Beneki (2010) analyzed the relationship of oil, inflation and stock market conclude that in general, oil price tend to have negative impacts on stock markets.

Relationship between exchange rate and price of commodities studied by Harri, Nallay and Hudson found that exchange rate and price of commodities, particularly price of oil are interrelated. This result also supported by Nikbakht (2009) using data from seven OPEC members.

DATA AND METHODOLOGY

Monthly data from January of 2004 to December of 2010 will be used for the analysis of this study. As seen in table 1, data will be divided into 5 groups with each consist of price of oil, price of gold, exchange rate of that nations in relation with US dollar (except for US which real effective exchange rate will be used), and stock market index of that particular nation. List of symbols used are shown in table 2.

Augmented Dickey-Fuller (ADF) test and Phillip-Perron (PP) test will be used in order to examine the stationarity of the time series of the study and to find the order of integration between them. The ADF unit root test will be performed by estimating the regression:

$$y_t = \rho y_{t-1} + \delta_1 \Delta y_{t-1} + \ldots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t \qquad (1)$$

Where
Y is a time series, t is a linear time trend, □□is the first difference operator, □0 is a constant, n is the optimum number of lags in the dependent variable and □ is the random error; and the Phillip-Perron (PP) equation is thus:

$$y_t = \alpha + \beta t + \rho y_{t-1} + \varepsilon_t \qquad (2)$$

Under both unit root tests, the unit root hypotheses is

H0 : ρ=0
H0 : ρ=1

Next, Johansen's cointegration test will be applied to check whether the long run equilibrium exists between variables. the maximum likelihood estimation co-integration procedure proposed by Johansen is adopted to test whether co-integrations exist among variables, and to find the number of co-integration vector groups. The following two statistics are used to test the number of co-integration vector groups:

Method 1: the diagonal elements and trace test
Trace test is also known as trajectory test, its test statistic is:

$$-T\sum_{h_0+1}^{n}\log(1-\hat{\lambda}_i) = \lambda\text{trace} \tag{3}$$

H0: rank ($\prod$) $\leq$ r, at most r groups of co-integration vectors
H1: rank ($\prod$) > r

Where, □□is the number of groups of independent vector-matrices, namely, the number of Eigen values that are different from 0; T is the number of samples; r is the number of groups of cointegrated vectors; λi is the estimated value of the i th Eigen value; n is the resulted number of Eigen values that obey chi-square distribution and that are under examination.

Method 2: The maximum Eigen value test:
The test statistic is as follows:

$$-T\log(1-\hat{\lambda}_{h_0+1}) = \lambda\max \tag{4}$$

H_0: rank ($\prod$) = r
H_1: rank ($\prod$) = r + 1

Where, T is the number of samples; r is the number of groups of co-integrated vectors; □i is the estimated value of the i th Eigen value that obey chi-square distribution and that are under examination.

Vector error correction (VEC) model approach will be used to distinguish between short run and long run Granger causality. When the variables are cointegrated, then in the short run, deviation from this long run equilibrium will be feed back on the changes in the dependent variable in order to force the movement towards the long run equilibrium.

Using Malaysia as an example, the error correction model used in this study when stock market index is the dependable variable is as follows:

$$\Delta\ KLCI_t = \alpha + \beta\ (e_{t-1}) + \Sigma\ a_i\ \Delta KLCI_{\ t-i} + \Sigma\ b_i\ \Delta\ Oil_{\ t-i} + \Sigma\ c_i\ \Delta\ Gold_{\ t-i} + \Sigma\ d_i\ \Delta\ ER_{\ t-i} + \varepsilon_t \tag{5}$$

where KLCI is the stock market index for Malaysia, β is the rate adjusting parameters, namely, the long term error correction adjusting factors, oil is price of crude oil, gold is the price of gold, ER is the exchange rate of Ringgit Malaysia to US Dollar, a_i to d_i are the short term dynamics adjustment factors, and ε is white noise.

Hypotheses

The null hypotheses based on equation 1 are:

H_0: $\beta = 0$. if H_0 is rejected, the Malaysia stock index (KLCI) will move toward the long term equilibrium at a specific rate.

H_0: $a_i = 0$. If H_0 is rejected, the Malaysia stock index (KLCI) can be explained by the past stock index.

H_0: $b_i = 0$. If H_0 is rejected, crude oil price is the cause of changes in Malaysia stock prices, that is, Malaysia stock prices are affected by oil price.

$H_{0:}$ $c_i = 0$. If H_0 is rejected, gold price is the cause of changes in Malaysia stock prices, that is, Malaysia stock prices are affected by gold price.

$H_{0:}$ $d_i = 0$. If H_0 is rejected, the exchange rate from Ringgit to US Dollar is the cause of changes in Malaysia stock prices, that Malaysia stock price are affected by the exchange rate from Ringgit to US Dollar.

The hypotheses tested can be expanded to other forms of error correction model.

Variance decompositions (VDC) will be used to determine the out-of-sample causality tests, by partitioning the variance of the forecast error of a certain variable into proportions attributable to innovations or shocks in each variable in the system, including its own, can provide an indication of these relativities. A variable that is optimally forecast from its own lagged values will have all its forecast error variance accounted for by its own disturbances.

Impulse Response Funtions (IRF) can be quivalently representing the information contained in the VDCs. IRF essentially map out the dynamic response path of a variable due to a one-period standard deviation shock to another variable. The IRF are normalized such that zero represents the steady state value of the response variable.

EMPIRICAL RESULT AND ANALYSIS

Unit root tests

As seen in Table 3, under the original level, either using Augmented Dickey-Fuller (ADF) or Phillip-Perron (PP) unit root tests, the null hypotheses H0 : g = 0 cannot be rejected except for HKDUSD which indicates except HKDUSD, all variables are not stationary at original level. After the first difference operation, all test results of variables under a 1% significant level reject the null hypotheses. This indicates that variables can only make the data in the steady state after a first-order difference.

Co-integration test

Before Cointegration test can be performed, optimum lag length should be identified to ensure the reliability of results. Table 4 shows the EVIEWS output of optimum lag length determination. 1 lag length will be used for all 5 groups represented by minimum values of AIC and SC.
Table 5 below shows the Johansen Cointegration test for all 5 groups of variables. Cointegration exists for all groups except for the case of Singapore. There for four other groups, the results based on Johansen's (Johansen, 1988; Johansen and Juselius, 1990) multivariate cointegration tests as seen in table 5 tend to suggest that variables within those groups are bound together by long run equilibrium relationship(s).

For the case of Hong Kong group, both trace test and max-eigen test indicates that 2 cointegration exist at 1 % significance level. For the case of Malaysia group, one cointegration exists using either trace test or max-eigen test at 5 % significance level. Japan group however shows one cointegration exists at 5 % significance level using max-eigen test but no cointegration using trace test. For the case of US group, both tests shows 1 cointegration exists at 5 % significance level. For the case of Singapore, no cointegration using either trace test or max-eigen test indicates that no long run relationship among variables within Singapore group.

Based on Johansen cointegration test, conclusion can be made that oil price, gold price, exchange rate and stock market have long run relationship(s) with the exception in the case of Singapore.

Vector error correction model

To determine the direction of Granger causality among variables within each group, within sample vector error correction (VEC) model (for the case of Hong Kong group, Malaysia group, Japan group and US group) and vector autoregressive (VAR) (for the case of Singapore group) will be used. (Table 6 to 10)

For the case of Hong Kong group (table 6), results shows price of oil, price of gold and price of Hang Seng Index (HSI) long run Granger-caused exchange rate of Hong Kong Dollar to US Dollar (HKDUSD) at 1 % significance level. Granger causality test shows that price of Hang Seng Index short run Granger-caused price of oil at 1 % significance level. Besides, price of oil short run Granger-caused exchange rate of Hong Kong Dollar at 1 % significance level.

For the case of Malaysia group (table 7), price of gold, exchange rate of Malaysia Ringgit to US Dollar (RMUSD) and price of FBMKLCI long run Granger-caused price of oil at 1 % significance level. Besides, price of oil, price of gold and exchange rate RMUSD also Granger-caused price of Malaysia stock market at 1 % significance level. Granger causality test shows that KLCI short run Granger-caused both price of gold (at 10 % significance level) and exchange rate of Ringgit (at 1 % significance level). Price of oil (at 10 % significance level) and price of gold (at 1 % significance level) also short run Granger-caused Malaysia stock markets

For the case of Japan (table 8), VEC model shows that at 5 % significance level, price of gold, Yen exchange rate and Nikkei index long run Granger-caused price of oil and at 1 % significance level, price of oil, price of gold and Yen exchange rate long run Granger-caused Japanese stock market. Granger Causality test shows that there is no short run causality exists for the variables within Japan group.

For the case of US (table 9), VEC model shows that at 1 % significance level, price of gold, US real effective exchange rate and S / P 500 long run Granger-caused price of oil and at 5 % significance level, price of oil, price of gold and US REER long run Granger-caused US stock market. Granger causality test shows that price of gold short run Granger-caused US REER (at 1 % significance level) and S / P 500 (at 1 % significance level). US REER short run Granger-caused price of oil (at 5 % significance level), and S / P 500 short run Granger caused US REER. (at 1 % significance level)

or the case of Singapore group (table 10), since there is no cointegration, long run relationship does not exists among variables within Singapore group. Using Vector Autoregressive (VAR), short run dynamic relationship can be analyzed. STI short run Granger-caused price of oil (at 1 % significance level) and exchange rate of Singapore Dollar (at 1 % significance level). Besides, price of gold short run Granger-caused exchange rate of Singapore Dollar (at 1 % significance level) and price of oil short run Granger-caused index of Singapore stock market.

Variance decompositions

The analysis of dynamic interactions of various shocks in the post sample period is analyzed using Variance Decompositions (VDC) and generalized impulse response function (GIRF). The VDC result for the case of Hong Kong (table 11) support our result in previous parts that Exchange rate of Hong Kong Dollar is the dependable variable Granger-Caused by other variables within the Hong Kong group. The same conclusion can be made for the case of Malaysia (table 12) as after 10 years, around 60% of the variance of KLCI is explained by other variables within Malaysia group. For the case of Japan (table 13), result of VDC is again consistent with the result of VEC model where around 30% and 25% of forecast error variance of price of oil and Nikkei index are explained by other variables within the Japan group. For the case of US (table 14), only 40% and 60% of forecast error variance of price of oil and S / P 500 are explained by its own shock indicating the same result as VEC model. For the case of Singapore (table 15), after 10 years, only 13% of forecast error variance of exchange rate of Singapore Dollar is explained by its own shock indicating inconsistence result than VEC model.

CONCLUSION AND IMPLICATION

Research results in this paper show except for Singapore, the rest of the groups have one to two co-integration relations which indicate that there exist long term stable equilibrium relationships among the national stock index and crude oil prices, gold price and exchange rates. Granger causality shows that multiple short run relationships between prices of oil, price of gold, exchange rate and stock indices. It proves that stock market, Forex market and commodity market (represented by oil and gold) are interrelated among each other. Policy makers that tried to stimulate the stock market during stock market crises may need to include Forex market and commodity market into their considerations.

REFERENCE

Anoruo E. and Mustafa. (2007). An Empirical Investigation into the Relation of Oil to Stock Market Prices. *North American Journal of Finance and Banking Research Vol. 1. No. 1*.

Filis G., Chatziantoniou I., Beneki C. (2010). Oil, Inflation And The Stock Market: Transmission Mechanisms For Oil- Importing And Oil-Exporting Countries. 2010 EABR & ETLC Conference Proceedings

Gogineni S. (2008). The Stock Market Reaction to Oil Price Changes. Retrieved: 12 February 2011. Available at www.syedbasher.org/wp/Basher&Haug&Sadorsky.pdf

Hammoudeh S., Yuan Y. (2007). Metal volatility in presence of oil and interest rate shocks. *Energy Economics 30 (2008) 606–620*

Harri A., Nalley L., Hudson D. (2009). The Relationship between Oil, Exchange Rates and Commodity Prices. Retrived: 15 February 2011. Available at www.aaec.ttu.edu/acc/Published%20Papers/ Presentations/OilExchangeRatesCommodityPrices.pdf

Huang R., Masulins R., Stoll H. (1995). Energy Shocks and Financial Markets. Working paper 93-11

Nikbakht L. (2009). Oil Prices and Exchange Rates: The Case of OPEC. Retrieved: 15 February 2011. Available at http://www.saycocorporativo.com/saycoUK/BIJ/journal/Vol3No1/Article_6.pdf

Pindyck, R. and J. Rotemberg, 1990, The excess co-movement of commodity prices, *Economic Journal, 100, 1173-1189.*

Syed Basyer, Haug A., Sadorsky P. (2010). Oil Prices, Exchange Rates and Emerging Stock Markets.

TABLE 1: List of Groups

Groups	Variables within Group
Hong Kong	Oil, Gold, HKDUSD, HSI
Malaysia	Oil, Gold, RMUSD, KLCI
Japan	Oil, Gold, JPYUSD, Nikkei
US	Oil, Gold, US REER, S/P 500
Singapore	Oil, Gold, SGDUSD, STI

TABLE 2: List of Symbols

Symbol	Variable
Oil	Price of WTI crude oil
Gold	Price of New York gold
HKDUSD	Exchange rate from Hong Kong Dollar to US Dollar (HKD / USD)
RMUSD	Exchange rate from Malaysia Ringgit to US Dollar (RM / USD)
SGDUSD	Exchange rate from Singapore Dollar to US Dollar (SGD / USD)
JPYUSD	Exchange rate from Japanese Yen to US Dollar (Yen / USD)
HSI	Hang Seng Index
KLCI	FBM Kuala Lumpur Composit Index
STI	Straight Time Index
Nikkei	Nikkei 225 Index
S/P 500	Standard and Poor 500 Index
US REER	Real Effective Exchange Rate for US Dollar

TABLE 3: Tests of the Unit Root Hypothesis

Variable	ADF test statistic		PP test statistic	
	Original level	First-order difference	Original level	First-order difference
Gold	0.626464	-10.25511***	1.353724	-10.47039***
Oil	-3.301030	-5.439913***	-2.351783	-5.563568***
HKDUSD	-1.225035	-7.23945***	-1.226581	-8.065247***
RMUSD	-0.873357	-6.328476***	-0.590860	-6.249588***
SGDUSD	-1.141167	-11.26867***	-0.880460	-11.49874***
JPYUSD	-0.229295	-9.155878***	-0.249832	-9.156075***
HSI	-1.433592	-7.687061***	-1.632929	-7.733262***
KLCI	-0.588452	-7.499819***	-0.966941	-7.634548***
STI	-1.613260	-7.213942***	-1.692631	-7.266680***
Nikkei	-1.017244	-7.369039***	-1.310401	-7.403142***
S/P 500	-1.663778	-6.774498***	-1.632614	-6.774498***
US REER	-1.862379	-6.704099***	-1.585802	-6.739903***

TABLE 4: Optimum Lag-length Determination

Group Name	Optimum Lag Length	AIC	SC
Hong Kong Group	Lag 1	65.17830*	65.80102*
Malaysia Group	Lag 1	23.68444*	24.29322*
Singapore Group	Lag 1	26.07439*	26.69711*
Japan Group	Lag 1	37.52748*	38.15020*
US Group	Lag 1	30.91022*	31.53294*

TABLE 5: Johansen's Test for Multiple Cointegrating Vectors

Group Name	Null Hypothesis	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
Hong Kong Group	None	82.75166***	39.89	45.58	49.87455***	23.80	28.82
	At most 1	32.87711***	24.31	29.75	24.57771***	17.89	22.99
	At most 2	8.299395	12.53	16.31	6.780680	11.44	15.69
	At most 3	1.518715	3.84	6.51	1.518715	3.84	6.51
Malaysia Group	None	52.20580**	47.21	54.46	28.22121**	27.07	32.24
	At most 1	23.98458	29.68	35.65	16.35395	20.97	25.52
	At most 2	7.630634	15.41	20.04	6.993721	14.07	18.63
	At most 3	0.636913	3.76	6.65	0.636913	3.76	6.65
Singapore Group	None	44.78961	47.21	54.46	25.04972	27.07	32.24
	At most 1	19.73989	29.68	35.65	13.80635	20.97	25.52
	At most 2	5.933540	15.41	20.04	5.675093	14.07	18.63
	At most 3	0.258447	3.76	6.65	0.258447	3.76	6.65
Japan Group	None	39.00660	39.89	45.58	27.14923**	23.80	28.82
	At most 1	11.85737	24.31	29.75	8.769885	17.89	22.99
	At most 2	3.087480	12.53	16.31	3.085818	11.44	15.69
	At most 3	0.001662	3.84	6.51	0.001662	3.84	6.51
US Group	None	43.60661**	39.89	45.58	29.24572***	23.80	28.82
	At most 1	14.36090	24.31	29.75	10.66711	17.89	22.99
	At most 2	3.693787	12.53	16.31	3.328261	11.44	15.69
	At most 3	0.365527	3.84	6.51	0.365527	3.84	6.51

Note: ** and *** represent significant under 5% and 1% confidence levels respectively.

TABLE 6: Temporal Causality Results Based on Vector Error-Correction Model (VECM) (Hong Kong)

	Δ Oil	Δ Gold	Δ HKDUSD	Δ HIS	~
Dependable Variable	P-Value (significance levels)				t-statistic
Δ Oil		0.9226	0.6639	0.0008***	0.93623
Δ Gold	0.4565		0.2718	0.6337	0.24745
Δ HKDUSD	0.0088***	0.1705		0.7541	7.78811***
Δ HSI	0.0278	0.4092	0.7291		0.27830

*, ** and *** represent significant under 10%, 5% and 1% confidence levels respectively with critical values of 1.65, 1.96 and 2.58.

TABLE 7: Temporal Causality Results Based on Vector Error-Correction Model (VECM) (Malaysia)

	Δ Oil	Δ Gold	Δ RMUSD	Δ KLCI	~
Dependable Variable	P-Value (significance levels)				t-statistic
Δ Oil		0.5439	0.2675	0.8181	3.01414***
Δ Gold	0.1769		0.5551	0.0568*	0.75960
Δ RMUSD	0.2008	0.5109		0.0040***	-0.51711
Δ KLCI	0.0828*	0.0082***	0.3934		3.87361***

*, ** and *** represent significant under 10%, 5% and 1% confidence levels respectively with critical values of 1.65, 1.96 and 2.58.

TABLE 8: Temporal Causality Results Based on Vector Error-Correction Model (VECM) (Japan)

	Δ Oil	Δ Gold	Δ JPYUSD	Δ Nikkei	~
Dependable Variable	P-Value (significance levels)				t-statistic
Δ Oil		0.8687	0.2414	0.1293	-2.36590**
Δ Gold	0.3499		0.5112	0.5576	-1.89321
Δ JPYUSD	0.9845	0.0929*		0.4456	-0.55279
Δ Nikkei	0.5315	0.3226	0.8547		-2.6100***

*, ** and *** represent significant under 10%, 5% and 1% confidence levels respectively with critical values of 1.65, 1.96 and 2.58.

TABLE 9: Temporal Causality Results Based on Vector Error-Correction Model (VECM) (US)

	Δ Oil	Δ Gold	Δ US REER	Δ S/P 500	~
Dependable Variable	P-Value (significance levels)				t-statistic
Δ Oil		0.7036	0.0101**	0.1262	3.59215***
Δ Gold	0.6478		0.6896	0.9401	1.55590
Δ US REER	0.1934	0.0431***		0.0018***	-0.58705
Δ S/P 500	0.4193	0.0050***	0.5144		2.01541**

*, ** and *** represent significant under 10%, 5% and 1% confidence levels respectively with critical values of 1.65, 1.96 and 2.58.

TABLE 10: Temporal Causality Results Based on Vector Auto Regressive (VAR) (Singapore)

	Δ Oil	Δ Gold	Δ SGDUSD	Δ STI
Dependable Variable	P-Value (significance levels)			
Δ Oil		0.3950	0.5110	0.0001***
Δ Gold	0.0736*		0.5788	0.2054
Δ SGDUSD	0.3665	0.0000***		0.0065***
Δ STI	0.0013***	0.2339	0.6078	

*, ** and *** represent significant under 10%, 5% and 1% confidence levels respectively with critical values of 1.65, 1.96 and 2.58.

TABLE 11: Decompositions of Variance (Hong Kong)

Years	Percentage of Forecast Variance Explained by Innovations in:			
	Δ Oil	Δ Gold	Δ HKDUSD	Δ HSI
Relative Variance in Δ Oil				
1	92.29163	7.708368	0.000000	0.000000
5	82.62198	6.319842	2.110756	8.947421
10	80.71781	6.000627	2.468722	10.81284
Relative Variance in Δ Gold				
1	0.000000	100.0000	0.000000	0.000000
5	0.482758	98.72949	0.667997	0.119753
10	0.832113	98.72621	0.366479	0.075201
Relative Variance in Δ HKDUSD				
1	0.063246	1.189339	98.74742	0.000000
5	3.969855	5.951308	88.62068	1.458159
10	8.590533	5.860308	84.15875	1.390406
Relative Variance in Δ HSI				
1	1.414669	0.864910	1.823635	95.89679
5	13.28652	0.746669	3.210762	82.75605
10	16.77751	0.880024	3.445195	78.89727

TABLE 12: Decompositions of Variance (Malaysia)

Years	Percentage of Forecast Variance Explained by Innovations in:			
	Δ Oil	Δ Gold	Δ RMUSD	Δ KLCI
Relative Variance in Δ Oil				
1	100.0000	0.000000	0.000000	0.000000
5	95.11939	0.087405	4.276171	0.517031
10	75.81317	1.765471	21.95440	0.466962
Relative Variance in Δ Gold				
1	5.727437	94.27256	0.000000	0.000000
5	1.503283	90.35414	7.517221	0.625353
10	1.080816	88.88670	9.349936	0.682548
Relative Variance in Δ RMUSD				
1	10.29935	3.982152	85.71850	0.000000
5	7.560128	6.422875	81.55225	4.464749
10	3.620492	7.496608	84.90656	3.976339
Relative Variance in Δ KLCI				
1	0.010850	1.103099	23.01096	75.87509
5	5.597262	0.395262	29.20924	64.79824
10	28.66566	0.759347	30.84836	39.72663

TABLE 13: Decompositions of Variance (Japan)

Years	Percentage of Forecast Variance Explained by Innovations in:			
	Δ Oil	Δ Gold	Δ JPYUSD	Δ Nikkei
Relative Variance in Δ Oil				
1	100.0000	0.000000	0.000000	0.000000
5	81.64812	0.387043	0.688999	17.27584
10	68.26786	0.409011	2.540572	28.78256
Relative Variance in Δ Gold				
1	5.921951	94.07805	0.000000	0.000000
5	2.071947	86.71344	4.929493	6.285117
10	1.125235	85.39270	6.243681	7.238383

Relative Variance in Δ JPYUSD				
1	0.205975	9.267174	90.52685	0.000000
5	1.437872	14.24697	69.79407	14.52108
10	1.045842	15.36703	49.62242	33.96470
Relative Variance in Δ Nikkei				
1	3.788996	1.132338	25.25513	69.82354
5	7.438106	2.185921	17.05252	73.32345
10	7.606372	2.205877	13.68402	76.50373

TABLE 14: Decompositions of Variance (US)

	Percentage of Forecast Variance Explained by Innovations in:			
Years	Δ Oil	Δ Gold	Δ US REER	Δ S/P 500
Relative Variance in Δ Oil				
1	100.0000	0.000000	0.000000	0.000000
5	77.26205	0.323155	11.11925	11.29554
10	39.63877	4.431344	41.98805	13.94183
Relative Variance in Δ Gold				
1	5.002510	94.99749	0.000000	0.000000
5	1.536662	96.47985	1.830936	0.152557
10	1.832628	94.99910	3.079062	0.089214
Relative Variance in Δ US REER				
1	21.79112	4.833754	73.37513	0.000000
5	22.86466	5.364618	61.95427	9.816457
10	11.09257	7.311328	71.39400	10.20210
Relative Variance in Δ S/P 500				
1	0.157973	0.026862	17.86601	81.94916
5	1.449355	0.264033	24.23969	74.04692
10	3.354943	0.620252	35.22665	60.79815

TABLE 15: Decompositions of Variance (Singapore)

	Percentage of Forecast Variance Explained by Innovations in:			
Years	Δ Oil	Δ Gold	Δ SGDUSD	Δ STI
Relative Variance in Δ Oil				
1	100.0000	0.000000	0.000000	0.000000
5	87.19345	0.788052	0.608711	11.40979
10	60.25839	3.284053	0.563585	35.89397
Relative Variance in Δ Gold				
1	1.905938	98.09406	0.000000	0.000000
5	0.772730	97.71805	0.678733	0.830490
10	3.382953	93.67238	1.249345	1.695326
Relative Variance in Δ SGDUSD				
1	4.958678	1.413059	93.62826	0.000000
5	6.496971	29.35759	57.48704	6.658400
10	5.618363	49.55570	30.94171	13.88423
Relative Variance in Δ STI				
1	6.180987	0.173228	0.214647	93.43114
5	3.931474	1.687929	0.046300	94.33430
10	16.13555	3.730634	0.131594	80.00222