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THE IMPACT OF US MONETARY POLICY AND STOCK MARKETS TOWARD INDONESIA STOCK MARKETS

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Abstract

The aim of this paper is to examine the interdependence revulsion of Indonesia Stock Markets (JCI) with the changes in US Monetary policy and Stock Markets (DJCI). The methodology used in this study is time series econometric techniques i.e. the unit root test, cointegration test, Granger's causality and Vector Error Correction Model (VECM). The result reveals a short-term and long-term dynamic relationship between the US stock markets and the Indonesia one. A 1 percent increase in US stock markets contributes to Indonesia stock markets by 0.4 percent over the next 10 months. One of the policy implications is that the authority of Indonesia stock markets should strengthen and improve their regulations so that the susceptible of the stock markets can be minimized.

Keywords: Indonesia, United States, Error Correction Model, Granger Causality.

I. Introduction

Understanding how monetary policy is transmitted to the economy by the way it affects the stock market and other macroeconomic magnitudes remains one of the most important challenges among economists. The significance of this issue is underscored by the following scenario. Assume a change in one of the monetary policy instruments, such as the money supply or the instrumental rate (i.e., the federal funds rate [FFR]). Such a change leads to changes in market interest rates which, in turn, forces investors to revalue their equity holdings. This happens because the value of their wealth, given by the sum of the discounted future cash flows (or dividends), is affected by an easing or tightening of monetary policy through either expected earnings or through the discount rate.

Therefore, a shift in monetary policy stance will induce changes in the consumption patterns of individuals and in the investment plans of firms, causing changes in real economic activity and ultimately affecting inflation. Simply put, the transmission of monetary policy via changes in the short-term interest rates influences asset prices which, in turn, affect borrowing costs, private wealth, and ultimately real economic activity (Laopodis, 2006).

There are many views about how monetary policy might cause an asset price boom. For example, a traditional view focuses on the response of asset prices to a change in money supply. In this view, added liquidity increases the demand for assets, thereby causing their prices to rise, stimulating the economy as a whole. A second view (see Bordo and Wheelock, 2004), voiced by Austrian economists in the 1920s and more recently by economists of the Bank for International Settlements (BIS), argues that asset price booms are more likely to arise in an environment of low, stable inflation. In this view, monetary policy can encourage asset price booms simply by credibly stabilizing the price level. Still another view, coming from the dynamic general-equilibrium macroeconomics literature, argues that asset price bubbles can result from the failure of monetary policy to credibly stabilize the price level.

Nowadays, Asian markets have felt the full force of the shock wave from the latest financial meltdown in the United States, with the collapse of the one of the most respected American investment banks, Lehman Brothers. Stock markets plunged throughout Asia, New Zealand and Australia, as authorities issued calming messages that had little effect.[i]

As reported in MalaysiaSun[ii], Taiwan's stocks shed 4.09 percent on reports that US investment banker Lehman Brothers Holdings Inc would declare bankruptcy, and that Merrill Lynch would be bought out by Bank of America. The Weighted Price Index of Taiwan Stock Exchange opened sharply lower and continued its downward trend to close at 6052.45 points, down 258.23 points, or 4.09 percent. All eight major sectors dropped, with construction falling 6.8 percent to become the day's biggest loser, followed by cement's 6.1 percent and financials' 6 percent. Stocks on the Singapore Exchange slumped 3.29 percent, with the benchmark Straits Times Index dropping 84.4 points to 2,486.21. The Stock Exchange of Thailand (SET) index ended at 642.39, down 11.95 points, or 1.8 percent. Indonesia's stock market plunged by 4.7 per cent, as the Indonesia Composite Index closed at 1,719.254 points, or down 84.808 points.

Very interesting to know and understand the relationship between the US monetary condition and other country’s stock market reaction. This paper, however, tries to examine only the linkage between the 1-month interest rate of the Federal Reserves of US as one of her monetary policy’s instrument and the movement of her stock market as revisit study toward Indonesia stock market.

II. Literature Review

Many journal articles have been written under the discussion about the association between stock market and monetary policy for both domestic monetary policy and international monetary policy. Chen (2007) focuses on domestic news in the USA and use modified versions of the Markov-switching model developed by Hamilton (1989) to present a strong and negative effect of a contractionary monetary policy on stock returns while Hamid et.al (2005) examine the impact of both domestic and foreign interest rate policy on stock returns across seven selected national equity markets using VAR model specifications and Johansen’s cointegration analysis. Besides Chen (2007), there are also Nissim and Penman (2003), Reilly et.al (2007), Gangopadhyay (2008), which examine the association between 1-month Fed interest rate as US monetary policy and stock market return in the US.

Bredin et.al (2005) examine the association between Irish stock market volatility and the US monetary policy announcement that result in an asymmetric volatility of Irish stock return as US tightening her monetary policy. Ozun and Cifter (2007) employed the Wavelets analysis and Granger Causality tests to come to conclusion that the changes in the US interest rates affect the return on the Istanbul Stock Exchange National 100 Index. Laopodis (2006) examines the dynamic linkages between the federal funds rate and the S&P500 index for the 1970-2003 periods, decade by decade, using cointegration and error-correction methodologies.

Cheung and Mak (1992) and Dunnis and Shannon (2005) find the evidence of cointegrating relationship between ASEAN and central Asia emerging markets with the US markets. By contrast, Daly (2003) that incorporates three developed markets-namely, Australia, Germany, and United States-find no evidence that those three developed markets share long-run relationship with the markets in ASEAN. Ibrahim (2005) also finds no evidence of long-run relationship between ASEAN markets and the US markets. After Asian financial crisis 1997, ASEAN markets have motivated some researchers to focus on financial integration among them and between them and some established markets (US and Japan). In the case of Indonesia, Ibrahim (2005) finds that the Indonesian market does not share a long-run relationship with other ASEAN and advanced markets pre-crisis and post-crisis, furthermore, it becomes more responsive to the advanced markets during the post-crisis period.

Goh et al. (2005) examine long-run relations of five ASEAN stock indices during the financial crisis, i.e. Singapore, Malaysia, Indonesia, Thailand, and the Philippines. Applying Vector Autoregression model and pursued with Granger-causality test, Goh et al find that there is no long-run equilibrium exists during the crisis. In the causality test, they find that the causality runs one-way from Singapore, Malaysia, Indonesia and Thailand to the Philippines. However, since Indonesia being one of the worst affected economies in the region by the financial turmoil, leads the price movements of all other stock markets in the region during the crisis.

III. Data and Methodology

We used monthly data covering 134 months from July 1997 to August 2008 for all endogenous variables, Indonesian stock markets, Dow Jones stock markets, and 1-month fed interest rate. The measure of stock prices, Jakarta Composite Index (JCI), Dow Jones Composite Index and 1-month fed interest rate are taken from the *econstats* website (*www.econstats.com*).

To study the relationship between the Indonesia stock markets and the US monetary policy and stock markets, the following model is derived:

$$S_t = \beta_0 + \beta_1 Fed + \beta_2 DJ + u_t \qquad (1)$$

Where,

S = Indonesia stock markets index (JCI)

Fed = 1-month Federal funds market rate

DJ = US stock markets index (DJCI)

Step 1: Stationary test

A unit root is tested with Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) test. Do the variables observed have a tendency to return to the long-term trend following a shock or the variables follow a random walk? If the variables follow a random walk after a temporary or permanent shock, the regression between variables is spurious. Hence, the OLS will not produce consistent parameter estimates.

All series should be stationary at the same level. ADF test is can be determined as in Equation (2).

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \alpha_i \sum_i^m \Delta Y_{t-1} + \varepsilon_t \qquad (2)$$

The hypothesis tested:

H_0: δ = 0 (contains a unit root, the data are not stationary)

H_1: δ < 0 (does not contains a unit root, the data are stationary)

While PP test can be determined as in Equation (3).

$$\Delta Y_t = \eta_0 + \eta_1 t + \delta Y_{t-1} + v_t \qquad (3)$$

The hypothesis tested:

H_0: δ = 0 (contains a unit root, the data are not stationary)

H_1: δ < 0 (does not contains a unit root, the data are stationary)

The equations presented above include both drift term and deterministic trend.

Step 2: Cointegration test

Cointegration means that even though the variables are not stationary individually, the linear combination between two or more variables may be stationary. To test cointegration, Johansen cointegration test is used.

Components in vector Y_t is said to be cointegrated at *d*,*b* degree, presented by *CI* (*d*,*b*) if:

(i) All components of Y_t is *I*(*d*)
(ii) There is a non-zero vector β = (β_1, β_2, …, β_n) so that the linear combination of $\beta Y_t = \beta_1 Y_{1t} + \beta_2 Y_{2t} + \ldots + \beta_n Y_{nt}$ will be cointegrated at (*d* – *b*) degree where *b*>0. Vector β is the cointegration vector. In the case of *b*=*d*=1, Y_t is *I*(1) and their linear combination is *I*(0).

Johansen (1991) and Johansen and Juselius (1990) produce the maximum likelihood approach using the VAR model to estimate the cointegration relationship amongst components in vector *k* variable Y_t. Consider VAR model for y_t:

$$A(L)x_i = \varepsilon_t \tag{4}$$

The parameter can be presented in the form of Vector Autoregressive Error Correction Mechanism:

$$\Delta Y_t = \sum_{i=1}^{p-1} \Pi_i \Delta Y_{t-i} + \alpha\beta Y_{t-p} + \varepsilon_t \tag{5}$$

Where vector β = (-1, β_2, …, β_n) that contain r cointegration vectors, and speed of adjustment parameter is given as α = (α_1, α_2, …, α_n) when rank β=r<k, k is the number of endogenous variables. If the number of cointegration relations is known, hypothesis testing on α and β can be performed. Lag length specification for the model can be determined by VAR equation using the AIC and SBC criteria.

Step 3: Granger's Causality test and Vector Error Correction Model (VECM)

Cointegration techniques of Granger (1986), Engle and Granger (1987), and Johansen and Juselius (1990) have given a significant contribution to Granger's Causality test. If cointegration is found from the variable series, error correction term (ECT) obtained from cointegration regression must be taken into consideration in the causality test to avoid the problem of miss-specification (Granger, 1981).

When two or more variables are cointegrated, they will show the existence of long-term relationship if the variables contain mutual stochastic trend. If this is the case, there exists at least one Granger's causality either in one or bi-directional (feedback effect). The result from the cointegration relationship between variables has set aside the probability of spurious estimation. Nevertheless, cointegration only shows the existence or non-existence of Granger's causality, but does not indicate the direction of causality between variables.

VECM is a restricted VAR designed and used for non-stationary variables known to be cointegrated. VECM specification restricts the long-run behavior of endogenous variables to converge to their cointegrating relationship whilst allowing for short-run adjustment dynamics. Engle and Granger show that if the variables, say Y_t and X_t, are found to be cointegrated, there will be an error representative which is linked to the said equation, which gives an implication that changes in dependent variable are a function of the imbalance in cointegration relation; represented by the error correction term and by other explanatory variables. Intuitively, if Y_t and X_t have the same stochastic trend and current variable of Y_t (dependent variable) is in part, the result of Y_t moves in line with the trend value of X_t (independent variable). Through the ECT, VECM allows the discovery of Granger's causality relation.

The VAR constraint model may derive a VECM model as shown below:

$$\Delta Y_t = \mu_i + \sum_{i=1}^{n} A_i \Delta Y_{t-i} + \sum_{i=1}^{n} \xi_i \Theta_{t-i} + v_t \tag{6}$$

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where

Y_t : in the form of (n x 1) vector

A_i and ξ_i : estimated parameters

Δ : different operator

v_t : reactional vector which explains unanticipated movements in Y_t and Θ (error correction term)

In the Granger's causality test, the degree of exogeneity can be identified through the t-test for the lagged error correction term, or through the F-test applied to the lags of the coefficients of each variable separately of the non-dependent variable. In addition, VECM method allows the differentiation of short-term and long-term relationships. Error term with lagged parameter ($ECT_{(e1,t-1)}$) is an adaptive parameter measuring the short-term dispersal from long-term equilibrium. In short-run, the variables may disperse from one another which will cause system inequilibrium. Hence, the statistical significance of the coefficient associated with ECT provides us with evidence for an error correction mechanism that drives the variables back to their long-term relationship.

Step 4: Impulse Response Function (IRF) and Variance Decomposition (VDC)

F- and t- tests in VECM can be classified as causality tests within sampling period. Those tests will only determine the degree of endogeneity or exogeneity of dependent variables in the estimated period. They do not provide indicators for the dynamic nature of the system. Furthermore, they do not indicate the degree of exogeneity between variables outside of the sampling period.

Variance Decomposition (VDC) can be described as the causality test outside of the estimated period. VDC decomposes variation in an endogenous variable into component shocks to the endogenous variables in the VAR. the VDC gives information about the relative importance of each random shock to the variable in the VAR. in other words, VDC shows the percentage of forecast error variance for each variable that may be attributed to its own shocks and to fluctuations in the other variables in the system.

Information gathered from VDC can also be presented with Impulse Response Function (IRF). Both are obtained from Moving Average (MA) model acquired from the original VAR model. IRF measures the predictable response to a one standard deviation shock to one of the system's variables on other variables in the system. Therefore, the IRF shows how the path of these variables changes in response to the shock. In fact, they can be viewed as dynamic multipliers giving about the size and the direction of the effect. The IRF is normalized to zero to represent the steady state of the variable reacted upon. As the VAR model used is under-identified, the Choleski's clarification method is utilized to orthogonalize all innovations/shocks.

IV. Empirical Results

Step 1: Stationary test

The results of the ADF (Augmented Dickey Filler) and PP (Phillip Perron) tests for the unit root test are presented in Table 1. The value of ADF t-statistic and PP z-statistic will be compared to the critical value given by Mackinnon (1991). From the results, it is found that the null hypothesis of non-stationarity at level for all the time series fails to be rejected. Nevertheless, all null hypotheses are rejected for every test at first difference. It indicates clearly that all variables are stationary at I(1).

Table 1. Stationary tests at level and first difference

Variables	ADF		PP	
	Level	1st Difference	Level	1st Difference
JCI	-2.1529	-10.7730	-2.9384	-10.9043
DJ	-2.4521	-11.9801	-2.3747	-12.1600
Fed	-1.5927	-4.3338	-1.4145	-7.9376

Notes: ADF and PP t-statistic with trend have -3.44 as their critical value at 5% significance level.

Step 2: Cointegration test

After knowing that those three variables are non-stationary and they have the same order of integration. Then, we proceed to test whether the linear combination of the series is stationary. In other words, it is to test the cointegration among the variables in the model. The test to be employed is the cointegration test of Johansen and Juselius (1990).

The results of analysis are reported in Table 2. After ensuring that there is no autocorrelation exist in the residuals, it is clearly indicate that, at lag interval equal to 2, at least one cointegration exists at 10 percent level of significance. Accordingly, the Indonesia stock markets seem has a long-run co-movement with the advanced Dow Jones markets in the US and or the 1-month Fed interest rate. Stated differently, Indonesia markets can drift arbitrarily closer to the advanced Dow Jones markets in the long run. These results conform well to those documented by Cheung and Mak (1992) and Dunnis and Shannon (2005). They conformed that cointegrating relationship exist between ASEAN and central Asia emerging markets with the US markets, including Indonesia stock markets.

Table 2. Johansen and Julesius' Cointegration Test

Lag Intervals	Null Hypothesis	Trace	Max.
1	r = 0	16.31	14.43
	r = 1	1.89	1.84
	r = 2	0.05	0.05
2	r = 0	28.133[b]	24.80[a]
	r = 1	3.33	3.33
	r = 2	0.0012	0.0012

a) Rejection of the hypothesis at the 0.05 level

b) Rejection of the hypothesis at the 0.1 level

Step 3: Granger's Causality test and Vector Error Correction Model (VECM)

The long-run relationship exists between the fundamental variables, as the error correction term is significant. The general to specific technique is used to get the optimum lags, and the results are presented in Table 3. The statistical significance of the coefficients associated with the ECT provides evidence of an error correction mechanism driving the variables back to their long-run relationship. There is also short-term relationship between Indonesia stock markets and US stock markets. However, the feedback effect does not exist between the variables. In other words, the movements in US stock markets will Granger's causes the movement in Indonesia stock market but not as reverse.

Only US stock markets influences Indonesia stock markets, while the Fed's policy for short-term interest is not statistically significant influencing the movement in Indonesia stock markets.

Table 3. Vector Error Correction Model Results for Variables S (JCI)

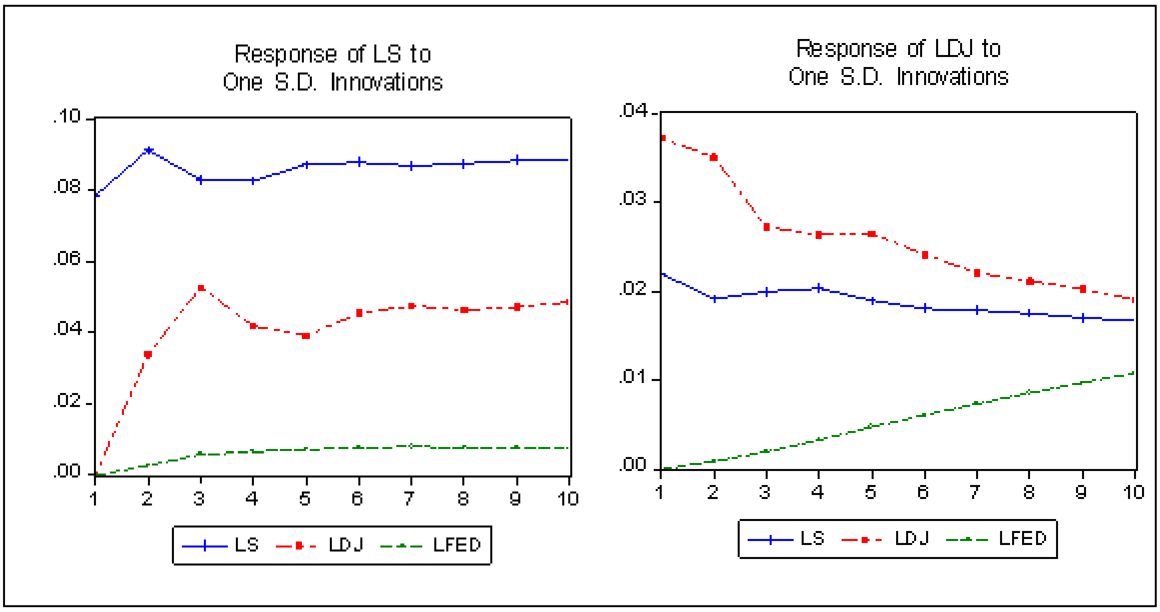
	Dependent Variable: ΔS	
Explanatory Variables	*Coefficient*	*t-statistic*
ECT	-0.022528	-2.552845**
ΔS(-1)	-0.070279	-0.741820
ΔS(-2)	-0.216792	-2.552144**
ΔDJ(-1)	0.723411	4.086112*
ΔDJ(-2)	0.459395	2.491750**
ΔFED(-1)	0.068264	0.658242
ΔFED(-2)	0.051794	0.507069
Diagnostics	R^2 = 0.24	
	F-Statistic = 5.53	
	LM = 0.7 (0.5)	
	RESET = 0.22 (0.64)	
	ARCH = 0.57 (0.45)	

Notes: (i) *indicates significance at less than 1%, **indicates significance at less than 5%; (ii) LM refers to the Lagrange Multiplier statistic for serial correlation, RESET refers to Ramsey's test of misspecification of the functional form, and ARCH represents the test for Autoregressive Conditional Heteroscedasticity; (iii) the probability value of each diagnostic test is given in brackets and is within the acceptable norms (iv) The ECM term emanates from the cointegrating equation of the unique vector.

Step 4: Impulse Response Function (IRF) and Variance Decomposition (VDC)

Dynamic simulations are used to compute VDC and visualize the IRF in order to strengthen the results obtained through VECM. An analysis of IRF is presented in Figure 1, and the accumulated response of Indonesia stock markets and US stock markets toward the independent variables' shocks is presented in Table 4. A ten-period horizon is employed to allow the dynamics of the system to work out. A shock to variables in particular US stock markets has an impact on Indonesia stock markets, and there is relatively persistent effect on Indonesia stock markets. Therefore, the IRF appears to be broadly consistent with earlier VECM results.

Figure 1. Impulse Response Functions of One Standard Deviation Shocks/Innovations



As far as US stock markets (DJCI) shocks are concerned, it confirms that an increase in DJCI leads to an increase in Indonesia stock markets (JCI) in the short-run. At the same time, the accumulated response over 10 months is 0.4 percent which is almost seventh times the impact of 1-monthFed shock.

Table 4. Accumulated GIRFs for the VEC Model

Period	Accumulated Response of JCI:		Accumulated Response of DJCI:	
	DJCI shock	1-monthFed shock	JCI shock	1-monthFed shock
1	0.000000	0.000000	0.022032	0.000000
2	0.033891	0.002797	0.041221	0.000882
3	0.086618	0.008669	0.061212	0.002854
4	0.128522	0.015273	0.081575	0.006159
5	0.167637	0.022458	0.100577	0.010932
6	0.213212	0.030167	0.118660	0.017028
7	0.260762	0.038068	0.136546	0.024393
8	0.307172	0.045819	0.154083	0.032992
9	0.354333	0.053368	0.171123	0.042747
10	0.402970	0.060679	0.187824	0.053560

The results of VDCs are reported in Table 5. A ten-period horizon is employed to convey a sense of a system dynamics. Granger's causal chain implied by the analysis of VDC tends to suggest that the FED variable is the leading variable, being the most exogenous of all. For instance, in the model, even after five and 10-month horizons, about 96 percent of the forecast error is explained by its own shocks compared to the other variables. Decomposition of variance in S, besides being explained by its own variable, can be explained also by DJ.

Table 5. Variance Decompositions (VDCs)

VD of S:

Period	S.E.	S	FED	DJ
1	0.078690	100.0000	0.000000	0.000000
2	0.125264	92.62986	0.020721	7.349418
3	0.159447	84.38025	0.086418	15.53333
4	0.184571	83.06088	0.149272	16.78985
5	0.208052	83.01465	0.201674	16.78368
6	0.230567	82.15098	0.240559	17.60846
7	0.251112	81.26750	0.269925	18.46257
8	0.270092	80.77293	0.289265	18.93781
9	0.288200	80.36676	0.299820	19.33342
10	0.305503	79.93592	0.303911	19.76016

VD of FED:

Period	S.E.	S	FED	DJ
1	0.063738	0.306810	99.69319	0.000000
2	0.103570	0.154061	99.72314	0.122803
3	0.150185	0.426214	99.03777	0.536017
4	0.194081	0.582823	98.42528	0.991898
5	0.237128	0.773520	97.88651	1.339968
6	0.277874	0.960047	97.39555	1.644398
7	0.316708	1.117239	96.91229	1.970471
8	0.353369	1.245773	96.49563	2.258597
9	0.388026	1.359445	96.13196	2.508596
10	0.420799	1.459979	95.80319	2.736832

VD of DJ:

Period	S.E.	S	FED	DJ
1	0.043260	25.93818	0.063488	73.99833
2	0.058936	24.57610	0.034820	75.38908
3	0.067980	27.11937	0.055894	72.82474
4	0.075782	29.04264	0.156527	70.80083
5	0.082641	29.70865	0.365249	69.92610
6	0.088191	30.29190	0.693750	69.01435
7	0.092951	30.97122	1.146422	67.88236
8	0.097314	31.50431	1.717591	66.77810
9	0.101319	31.89096	2.401455	65.70758
10	0.105008	32.21944	3.188141	64.59242

V. Conclusion

In this study, using the VEC model we have empirically demonstrated the effects of US monetary policy and stock markets on the Indonesia stock markets covering 134 months from July 1997 to August 2008 for all endogenous variables. The analysis leads to the finding that a 1 percent increase in US stock markets contributes to Indonesia stock markets by 0.4 percent over the next 10 months. However, the results are not conformed on the immediate effect of US monetary policy through 1-monthFed interest rate to the fluctuations of Indonesia stock markets. Notwithstanding the sample size, this research may offer some insight into the relationship between US monetary policy and stock markets towards Indonesia stock markets. One of the policy implications is that the authority of Indonesia stock markets should strengthen and improve their regulations so that the susceptible of the stock markets can be minimized.

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[i] ABC (Australian Broadcasting Corporation) reported this story on Tuesday, September 16, 2008, entitled "*Fallout from US financial crisis hits Asia hard*".

[ii] MalaysiaSun.com. Monday, September 15, 2008, entitled "*Asian markets fall as US financial crisis deepens*".