

Contagion and Globalization meets in the crisis

by

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Abstract

On 15 September, 2008, Lehman Brothers announced its bankruptcy protection is filed. It is the day starting the subprime crisis which lasts as the worldwide financial crisis. Years after Lehman Brothers' bankruptcy, the impact of the financial crisis seems far from dismiss as expected. Yet the impact has not been concluded because of a vary performance in worldwide financial markets. Like many emerging markets, especially in Asian countries, perform well than forecasted after the crisis anniversary. Does this imply the crisis only affect the G7 itself? Does the globalization mean nothing in financial markets? Even so, how the contagions among markets change along the crisis? Meanwhile, gold is once again considered as the most popular investment. Does it imply that Gold is a safety haven in the crisis? In this study, I find that the crisis affects G7 countries, but it may not do the same for the rest of the world. Certainly, the market volatility contagion happens among countries because of the globalization, however, the impact would not last long anymore, like the market volatility for OA and EM countries are almost back to normal.

Key words: Financial Markets, Financial Crisis, Gold, Stock Market Volatility

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1. Background and Literature Review

Globalization would not be a new topic for everyone because this trend changes everyone's living every day. Does everyone benefit from this foreseeable change? May or may not; in contrast, a benefit of the globalization from country A may morph to a loss from country B. But, that may not seem like happen in the financial markets. Instead, the financial markets movement among countries is clearly shown via the globalization. Contagion, a product of globalization, is reckoned as an indicator that relationships among markets via transmit a shock from one market to another. This explains why studies in contagion always link with crisis (G.B., C.R.H. and A. N., 2005; R.F., V.L.M. and C.T., 2008; F.G., C.R.C. and Y.S.H., 2010). Subprime crisis, yet it is believed an unsolved risk, is the latest textbook example of the financial crisis, no doubt to be our study for contagion.

Two days after the bankruptcy of Lehman Brothers, the U.S. Treasury Department introduces a Supplementary Financing Program, in order to supply cash for the Federal Reserve. The action was not only applied in U.S. The Federal Open Market Committee

(FOMC) establishes or/and expands swap lines with the Bank of Japan, Bank of England, Bank of Canada, the Reserve Bank of Australia, the Sveriges Riksbank, Denmark's National Bank, the Norges bank and Swiss National Bank up to total US\$620 billion. Thus, central banks can maintain financial markets functioning smoothly with capital liquidity available. FOMC collaborated with other central banks quickly, to restrain the influence of the crisis via the impact of globalization. Obviously, this financial crisis was not a local issue anymore.

Contagion has always focused in country by country or countries in the same region. There are not many studies based on economics zone. In reality, to fight for enemies and to balance the world power, countries prefer to set up their own party to strength their power. United States has a long time history in joining numerous of world organization, then, Japan was the first Asia country following. Now, Russia and China keen to expand their power with nearby countries. Number of papers in contagion studies the differences between developed and emerging markets. Different from the past studies, in this paper, I examine the influence from the subprime crisis across three groups: G7, other advanced economies; and other emerging economies. United States is the origin of the crisis. Most

likely, G7 members¹ are be involved. Consider globalization, how about the rest of world be involved?

A contagion that had been well studied for years because of the growing globalization the influence among countries is more and more. Four main study areas in a contagion to tackle the influence are widely accepted. First, the capital flow; second, the economic variable; third, using ARCH or GARCH to evaluate the variance-covariance transmission mechanisms between variables (Hamao, Masulis, and Ng, 1990; Edwards, 1998); and the last one, the cross-correlation (K.J. Forbes and R. Rigobon ,2002; Calvo and Reinhart, 1996; Karolyi and Stulz, 1996; Pindyck and Rotemberg, 1993; Pindyck and Rotemberg, 1990; King and Wadhvani, 1990; Bertero and Mayer, 1990).

Recall the comment from Joseph Stiglitz², the recipient of the 2001 Nobel Memorial Prize in economics, “Policymakers did not see the crisis coming and, once the bubble burst, thought the consequences would be short-lived.” Surely, it is believed that the investors focus on any instant sign from volatile markets happened in the crisis. Now, not only the

¹ The G7 is formed by seven industrialized nations in 1976, the member countries include Canada, France, Germany, Italy, Japan, United Kingdom, and United States.

² Joseph Stiglitz, xx August 30, 2010, “Needed: a new economic paradigm”, Financial Times.

investors eye on the short-term influence, but also the regulators do. This is probably because the rapid changes in the financial markets, the regulators should tackle the short-term risk, rather planning the long-term issues like in the past. Comparing those four main measures in contagion, the last two areas help us to track the rapid consequences among countries and thus, it would be the framework of this study.

Contagion has been widely study whenever crisis incur, like a number of studies in contagion for the subprime crisis happened in 2007. Most of those studies focus in volatility and recently the researches go beyond to attain high momentum, in order to dismiss time-varying robustness. The findings certainly state the volatility changes pre-and post-crisis ignoring any robustness, while those findings based on past data for empirical studies, and the volatility changes vary crisis by crisis. Under the globalization, how the volatility changes result? Lead-lag relationship among countries shows the cause-effect between each other that links to the contagion. Thus, in contrast to the majority of other studies, I focus in lead-lag effect among the three economics zone this is the second contribution of this paper.

Another majority of contagion study draw in study across different asset markets. Recently publication for study in subprime crisis test a contagion effect switch from the stock market to other related markets, such as real estate market, credit default market and energy market (F. Guo, C.R. Chen and Y. S. Huang, 2010). For the financial crisis happen in 2008, it is an unsolved chain effect from the subprime crisis and it does not totally link to real estate market, interest rate market or others. In another view, the gold market becomes the spot of investors since the crisis incur. Experience should remind investors to swap their money in Gold market while a boom would soon explore in other financial markets. Gold, hence, involve in this study. Applying the same methodologies in gold markets, I aim to reckon the relationship among the Gold and stock markets. This comes up the third contribution of this paper.

Does this imply the crisis only affect the G7 itself? Does the globalization mean nothing in financial markets? Even so, how the contagions among markets change along the crisis?

These three contributions of this research are structured as follows: Section 2 describes the

database, Section 3 outlines the research design and includes the corresponding results.

Finally, Section 4 provides the analysis and concludes this research.

2. Data

This research presumes the subprime crisis starts at the day of an announcement of Lehman Brothers in Chapter 11 Bankruptcy on 15 September, 2009. The study period covers across a year before and after the event, from 17 September, 2007 to 17 September, 2009. Relative to the crisis, there are two relative period windows: (1) Pre-crisis period window (17 September, 2007 – 12 September, 2008) and (2) Post-crisis (16 September, 2008 – 17 September, 2009).

As a view of market practitioners, I refer 43 stock indexes from the Economic and Financial Indicators list of the weekly Economist magazine to tackle this study in worldwide financial market contagion. Those indexes from 41 countries represent almost the worldwide markets and are available in DataStream. As shown in Table 1, I classify all 41 countries into 3 groups to examine the contagion among three groups: Major advanced economies (G7), other advanced economies (OA); and other economies (EM).

This study focuses in market volatility, hence, all market indexes are firstly transferred into return series. Table 2 includes the return series via descriptive statistics under two crisis period windows. It is interesting to see that mean returns of all markets are not only in negative at the post-crisis period, but also at the pre-crisis period; and this is probably a sign of crisis. While the standard deviation and the minimum returns are higher and smaller, respectively, at the post-crisis period, all Jarque–Bera test results are significantly and these are not at the pre-crisis period.

In order to focus the contagion study among three economics groups, I averaged the return series in each group. The return series resulted represents the overall performance of the corresponding group. The weighted index of each economic zone is measured as below:

$$RI_{EZ} = \frac{\sum_{i=1}^j RINDEX_{i,t}}{\sum_{i=1}^j 1_i} \quad (1)$$

where EZ is the economic zone, $RINDEX_{i,t}$ is the return of a market index of a country and j is the number of market indexes of an economic zone.

Refer to Table 3, there is a trend that stock markets perform worse before the crisis although this trend is not significant in G7. However, the stock markets seem to recover

quickly after the crisis. Although the standard deviation are all higher in value at the post-crisis than those at the pre-crisis, the mean returns from G7 rise from (-0.000925) to (-0.000555). The recovery is even quicker in EM and the gold market, positive and higher returns are existed in both markets. Both of Kurtosis and Jarque-Bera results show that all groups perform normal before and after the crisis while an extremely deviation in Jarque-Bera happened in G7 in the pre-crisis period. This is a hints that the markets in G7 are abnormal and hence, cause the crisis.

3. Empirical Results

3.1. Correlation and Cointegration

Correlation results from Table 4 are consistent in the above statistics observation. Short-term relationships among three economic groups are very after the crisis happened with all results are around 0.9. This change does not incur in the gold market, the gold market is less correlated with all three economic zones at the post-crisis period. In the long-term, I adopt the Engle-Granger cointegration tests to examine the long-run equilibrium relationships among the markets. The regression model applies in this paper is without constant and trend:

$$RI_t = \gamma RI_{t-1} + \varepsilon_t \quad (2)$$

Table 4 reports the cointegration among four groups are significant for both of periods window. Eigenvalue results are consistent, all results at the pre-crisis period are higher than all at the post-crisis period. These results match with the correlation findings.

3.2. Pairwise Granger-Causality

Meanwhile, I like to examine how the temporal ordering of each pair of group is. Hence, the Pairwise Granger-Causality tests are employed. From the results in Table 5, significant rejection are marked in ‘G7 does not Granger Cause GOLD’, ‘G7 does not Granger Cause OA’, and ‘EM does not Granger Cause OA’. Among all three period windows, OA is not just independent from either G7 or EM; OA affects the market performance in G7 and EM as a middle man of the world. Similarly, the Gold market performs well at the post-crisis periods, and its performance influences G7 indeed.

3.3. Tests for stationary

Before implement the GARCH test, we confirmed all variable to be stationary. The results of stationary tests are based on the Augmented Dickey-Fuller unit root test and the

Phlips-Perron. Thus, not only all returns of market indexes in time series are verified, but also the autocorrelation in the standard ADF test in a non-parametric way is examined. Both tests results are shown in Table 6. All return series proves to be stationary and is appropriate to be further applied by any long-term relations tests.

3.4. ARCH and VAE

To assess the market volatility, I apply the model of GARCH(1,1) by Arize (1995,1997) , thus, the return of market index follows an AR(1) process and the GARCH(1,1) model is generated as follows:

$$RI_{G7,t} = \rho_{G7,0} + \rho_{G7,1} RI_{G7,t-1} + \varepsilon_t$$

$$\mu_t = \gamma_{G7,0} + \gamma_{G7,1} \varepsilon_{t-1}^2 + \sigma_1 \mu_{t-1} \quad (3)$$

$$RI_{EM,t} = \rho_{EM,0} + \rho_{EM,1} RI_{EM,t-1} + \varepsilon_t$$

$$\mu_t = \gamma_{EM,0} + \gamma_{EM,1} \varepsilon_{t-1}^2 + \sigma_1 \mu_{t-1} \quad (4)$$

$$RI_{OA,t} = \rho_{OA,0} + \rho_{OA,1} RI_{OA,t-1} + \varepsilon_t$$

$$\mu_t = \gamma_{OA,0} + \gamma_{OA,1} \varepsilon_{t-1}^2 + \sigma_1 \mu_{t-1} \quad (5)$$

$$RI_{GOLD,t} = \rho_{GOLD,0} + \rho_{GOLD,1} RI_{GOLD,t-1} + \varepsilon_t$$

$$\mu_t = \gamma_{GOLD,0} + \gamma_{GOLD,1} \varepsilon_{t-1}^2 + \sigma_1 \mu_{t-1} \quad (6)$$

where RI_t is the return of market index G7, OA, EM and the Gold market, μ_t represents volatility of return or market index of the particular market and is the heteroscedastic variance, ε_t is the error term, ρ , γ , and σ denote the coefficients. In Table 9, the result of G7 is significantly before the crisis and this dismiss after the crisis. The dismiss is probably due to the crisis which changes the original relationships among the markets. However, results of EM and the Gold market are significantly after the crisis, but not before the crisis. Globalization puts all markets together, all markets are affected by the crisis and hence, EM and OA are affected. For the remaining OA, either of the results before and after the crisis is not significantly.

3.5. Impulse Response

To supplement the ARCH and VAE results, I adopt impulse response test as the last part in this paper. Impulse respons traces the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables; and reckons the

feedback of the market indexes in the VAR to the related error term. To tackle the unit shock in market indexes, I consider the following trivariate VAR(1) system:

$$\begin{bmatrix} 1 & \beta_{12} & \beta_{13} \\ \beta_{21} & 1 & \beta_{23} \\ \beta_{31} & \beta_{32} & 1 \end{bmatrix} \begin{bmatrix} RI_{1t} \\ RI_{2t} \\ RI_{3t} \end{bmatrix} = \begin{bmatrix} \beta_{10} \\ \beta_{20} \\ \beta_{30} \end{bmatrix} + \begin{bmatrix} \beta_{11} & \beta_{12} \\ \beta_{21} & \beta_{22} \\ \beta_{31} & \beta_{32} \end{bmatrix} \begin{bmatrix} RI_{1t-1} \\ RI_{2t-1} \\ RI_{3t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \end{bmatrix} \quad (7)$$

While ε_{1t} changes RI_1 immediately, not only RI_2 is changed, but also RI_1 in the next moment.

From the Graph 1, it shows the post-crisis contagion of EM from either G7 or OA is different in the pre-crisis. It is due to the crisis nature of this subprime crisis is different from the past crisis. Also, a part of EM countries, like China, actually has larger influence in worldwide even being an emerging and developing country.

4. Summary and Conclusion

Is the crisis incurred by the Lehman Brothers same as other crisis? We all know that every crisis is unique. This led to enquiries from the practitioners because the findings from those academic contagion studies seem once off and would not happen again. This paper fills in this linkage between the market practitioners and the academic. Studying 41 country markets across the financial crisis period since the bankruptcy of Lehman

Brothers, this paper aims to exam any contagion or/and how the contagion happened among these countries underlying three economies groups and the gold market.

I find that the contagion happens significantly for all economies groups after the crisis, meanwhile, the EM and OA are automatically adjusted to recovery from this crisis, the market volatility for OA and EM countries are almost back to normal. The gold market plays a more important role after the crisis and thus, this tells why the gold price increases dramatically these days. It is no doubt that this financial crisis affects G7 countries, but it may not do the same for the rest of the world. Certainly, the market volatility contagion happens among countries because of the globalization, however, the effect will not last long anymore.

References

- [1] Arize, A. C. (1995) “The effect of exchange-rate volatility on U.S. exports: an empirical investigation”, *Southern Economic Journal*, 62: 34-43.
- [2] Arize, A. C. (1997) “Conditional exchange rate volatility and the volume of foreign trade: evidence from seven industrialized countries”, *Southern Economic Journal*, 64: 235-54.
- [3] Bekaert, G., Harvey, C.R. and A. Ng (2005) “Market Integration and Contagion”, *Journal of Business*,
- [4] Bowman, R. G., Chan, K.D. and M.R. Comer (2009), “Diversification, rationality and the Asian economic crisis”, *Pacific-Basin Finance Journal*, Forthcoming.
- [5] Chandar, N., Patro, D.K. and A. Yezegel (2009), “Crises, contagion and cross-listing”, *Journal of Banking & Finance*, 33 (9): 1709-1729.
- [6] Claessens, S., Demirgüç, A.D. and F. Moshirian (2009), “Global financial crisis, risk analysis and risk measurement”, *Journal of Banking & Finance*, Forthcoming.
- [7] K.J. Forbes and R. Rigobon (2002), “No contagion, only interdependence: Measuring stock market comovements”, *The Journal of Finance*, 57(5): 2223-2261.
- [8] Fry, R., Martin, V.L. and C. Tang (2010), “A new class of tests of contagion with applications”, *Journal of Business and Economic Statistics*, 28: 423-437.

- [9] Guo, F., Chen, C.R. and Y.S. Hung (2010), “Markets contagion during financial crisis: A regime-switching approach”, *International Review of Economics and Finance*, Forthcoming.
- [10] Hong, K., Lee, J.W. and H.C. Tang (2009), “Crises in Asia: Historical perspectives and implications”, *Journal of Asian Economics*, Forthcoming.
- [11] H. Sander and S. Kleimeier (2003), “Contagion and causality: an empirical investigation of four Asian crisis episodes”, *Journal of International Financial Markets, Institutions and Money*, 33(2): 171 – 186.
- [12] Khan, S. and K.W. Park (2009), “Contagion in the stock markets: The Asian financial crisis revisited”, *Journal of Asian Economics*, Forthcoming.
- [13] Segot, T.L. (2009), “Financial reforms and time-varying microstructures in emerging equity markets”, *Journal of Banking & Finance*, 33(10): 1755-1769.
- [14] T. Yang and J.J. Lim (2004), “Crisis, Contagion, and East Asian Stock Markets”, *review of Pacific Basin Financial Markets and Policies*, 7(1): 119 – 151.

Table 1 List of Major Advanced Economies (G7), Other Advanced Economies (OA) and Other Economies (EM) by country

Major Advanced Economies (G7)	Other Advanced Economies (OA)	Other Economies (EM), including other economies; and emerging and developing
Canada	Australia	China
France	Czech Republic	Austria
Germany	Denmark	Belgium
Italy	Hong Kong	Greece
Japan	Israel	Hungary
United Kingdom	Norway	Poland
United States	Singapore	Russia
	Sweden	Turkey
	Switzerland	India
	South Korea	Indonesia
	Taiwan	Malaysia
		Pakistan
		Thailand
		Argentina
		Brazil
		Chile
		Colombia
		Mexico
		Venezuela
		Egypt
		Saudi Arabia
		South Africa

Table 2 Descriptive Statistics. This table includes the descriptive statistics of daily return of market indices from 41 countries: Canada, France, Germany, Italy, Japan, United Kingdom, United States, Australia, Czech Republic, Denmark, Hong Kong, Israel, Norway, Singapore, Sweden, Switzerland, South Korea, Taiwan, China, Austria, Belgium, Greece, Hungary, Poland, Russia, Turkey, India, Indonesia Malaysia, Pakistan, Thailand, Argentina, Brazil, Chile, Colombia, Mexico, Venezuela, Egypt, Saudi Arabia and South Africa. The financial crisis with the sample is from 17 September 2007 to 17 September 2009.

	<u>Pre-Crisis</u>						
	Mean	Std. Dev.	Max	Min	Skewness	Kurtosis	Jarque-Bera
G7							
Canada	-0.00302	0.01226	0.04113	-0.04872	-0.55085	4.20374	28.73523 *
France	-0.00191	0.04346	0.42865	-0.46223	-0.86572	86.95381	76094.64000 *
Germany	-0.00127	0.01070	0.02987	-0.04314	-0.19936	3.91525	10.75564 *
Italy	-0.00080	0.01473	0.06307	-0.07401	0.01473	6.30080	119.36950 *
Japan	-0.00106	0.01655	0.04302	-0.05844	0.01655	3.34072	2.69065
United Kingdom	-0.00051	0.01411	0.04641	-0.05637	0.01705	4.03565	11.58740 *
United States	-0.00063	0.01264	0.03802	-0.03159	0.00619	3.37958	1.55654
OA							
Australia	-0.00092	0.01455	0.04883	-0.07539	-0.22142	5.56652	73.20119 *
Czech Republic	-0.00117	0.01501	0.08084	-0.05045	0.33865	6.34839	125.94310 *
Denmark	-0.00101	0.01246	0.03201	-0.04920	-0.14994	3.52620	3.95851
Hong Kong	-0.00093	0.02252	0.10184	-0.09051	-0.04890	5.13829	49.44583 *
Israel	-0.00025	0.01321	0.04334	-0.04400	-0.45717	4.07605	21.51759
Norway	-0.00100	0.01786	0.03999	-0.06872	-0.35500	3.32510	6.58057
Singapore	-0.00212	0.01831	0.06284	-0.07117	0.31973	4.57579	31.20980 *
South Korea	-0.00091	0.01515	0.05018	-0.04529	-0.00443	3.63627	4.36979
Sweden	-0.00121	0.01639	0.04085	-0.04351	0.12113	3.17062	0.94752
Switzerland	-0.00072	0.01349	0.04451	-0.050407	-0.05354	4.40114	21.30991 *
Taiwan	-0.00133	0.01712	0.05422	-0.06735	-0.25294	3.79113	9.51618 *
EM							
Argentina	-0.00081	0.01428	0.03900	-0.06477	-0.47403	4.71667	41.50219 *
Austra	-0.00109	0.01635	0.05359	-0.05345	-0.24909	3.44021	4.76956
Belgium	-0.00121	0.01510	0.06282	-0.05640	0.11842	4.46299	23.70316 *
Brazil	-0.00014	0.01963	0.06142	-0.06831	-0.20454	3.43791	3.87543
Chile	-0.00044	0.01318	0.05642	-0.05161	0.05675	5.36152	60.32186 *
China-Shanghai	-0.00370	0.02502	0.08889	-0.08045	-0.01138	4.27019	17.41657 *
-SZ	-0.00372	0.02700	0.08380	-0.08371	-0.30541	3.92586	13.27705 *
Colombia	-0.00024	0.01333	0.05065	-0.07960	-0.51122	9.50404	467.79560 *

Egypt	-0.00034	0.00723	0.03316	-0.02710	0.63170	5.92578	109.60400 *
Greece	-0.00104	0.01404	0.06295	-0.06335	-0.06028	5.46921	65.95385 *
Hungary	-0.00119	0.01385	0.03642	-0.04365	0.08155	3.42135	2.20297
India	-0.00039	0.02201	0.06409	-0.07696	-0.03458	3.79717	6.90953
Indonesia	-0.00099	0.01985	0.09106	-0.09043	-0.42842	6.17685	116.83610 *
Malaysia	-0.00078	0.01178	0.02801	-0.09979	-2.33725	21.64366	3986.84000 *
Mexico	-0.00059	0.01447	0.06165	-0.05497	0.05147	5.21079	52.85974 *
Pakistan	-0.00111	0.02041	0.09126	-0.07074	-0.05753	5.15831	50.41369 *
Poland	-0.00165	0.01394	0.04096	-0.05718	-0.03970	3.98152	10.46443 *
Russia	-0.00138	0.01869	0.05020	-0.07808	-0.94449	5.43273	102.37410 *
South Africa	-0.00034	0.01497	0.05149	-0.04721	0.08990	3.96831	10.46730 *
Saudi Arabia	0.00002	0.01705	0.05048	-0.10099	-1.17497	9.27978	485.16900 *
Thailand	-0.00089	0.01539	0.05111	-0.04087	0.39809	3.94693	16.51757 *
Turkey	-0.00120	0.02024	0.06484	-0.07752	0.01755	4.09852	13.03602 *
Venezuela	-0.00075	0.01258	0.04080	-0.04142	-0.25231	3.87991	11.10322 *

Post-Crisis							
	Mean	Std. Dev.	Max	Min	Skewness	Kurtosis	Jarque-Bera
G7							
Canada	-0.00040	0.02649	0.09370	-0.09788	-0.40540	4.79959	42.53055 *
France	-0.00102	0.02343	0.08649	-0.09944	-0.44364	5.01017	52.70635 *
Germany	-0.00071	0.02172	0.07939	-0.09694	-0.22626	4.89595	41.47657 *
Italy	-0.00005	0.02423	0.09870	-0.09680	0.05698	5.90339	92.16554 *
Japan	-0.00071	0.02675	0.13050	-0.11059	-0.19771	7.04774	180.56800 *
United Kingdom	-0.00018	0.02364	0.09384	-0.09266	-0.03597	6.30626	119.39020 *
United States	-0.00072	0.02644	0.10833	-0.08835	0.01919	5.49433	67.93605 *
OA							
Australia	-0.00050	0.01947	0.05360	0.00018	-0.51689	4.87576	50.07639 *
Czech Republic	-0.00050	0.03212	0.12364	0.00000	-0.40342	7.60354	238.45850 *
Denmark	-0.00079	0.02242	0.08201	0.00000	-0.24884	5.64597	79.13335 *
Hong Kong	0.00029	0.03108	0.13407	0.00014	0.16852	6.17961	111.60700 *
Israel	-0.00048	0.02607	0.05757	0.00008	-1.47264	9.99381	628.66830 *
Norway	-0.00063	0.03562	0.11016	0.00267	-0.39574	4.14454	21.13927 *
Singapore	-0.00020	0.03249	0.12579	-0.00194	0.35987	4.00630	16.70974 *
South Korea	0.00043	0.02491	0.11284	0.00165	-0.51198	7.14888	199.35690 *
Sweden	0.00028	0.02630	0.09865	0.00000	0.27380	4.53020	28.83486 *
Switzerland	-0.00057	0.02131	0.10788	0.00000	0.28800	6.82734	163.53540 *
Taiwan	0.00058	0.02030	0.06525	0.00123	-0.15747	4.06632	13.49550 *
EM							
Argentina	0.00061	0.03170	0.10432	-0.12952	-0.55551	5.30831	71.64246 *
Austra	-0.00104	0.03286	0.12021	-0.10253	-0.01639	4.16393	14.80090 *
Belgium	-0.00084	0.02302	0.09221	-0.08319	-0.18258	5.59096	74.73969 *
Brazil	0.00047	0.03244	0.13679	-0.12096	0.13053	6.09159	105.08500 *
Chile	0.00051	0.01670	0.11803	-0.06215	0.62239	13.58243	1239.45000 *
China-Shanghai	0.00144	0.02292	0.09033	-0.06986	-0.09638	4.59807	28.28497 *
-SZ	0.00228	0.02393	0.08508	-0.07450	-0.54329	4.37121	33.41432 *
Colombia	0.00038	0.01683	0.08795	-0.09085	-0.60052	9.91217	537.32410 *
Egypt	0.00002	0.00973	0.02695	-0.12743	-8.42704	113.99380	137590.10000 *
Greece	-0.00099	0.02793	0.10028	-0.09590	-0.03156	5.53759	70.33966 *
Hungary	0.00003	0.03148	0.13178	-0.12649	-0.09744	5.40743	63.68433 *
India	0.00062	0.02828	0.15990	-0.11604	0.35975	7.32976	210.30410 *
Indonesia	0.00103	0.02754	0.09802	-0.12629	-0.43465	7.02597	185.19130 *
Malaysia	0.00056	0.01089	0.04055	-0.03681	-0.01741	4.71840	32.24887 *
Mexico	0.00056	0.02454	0.10441	-0.07266	0.32397	5.22986	58.86374 *
Pakistan	0.00028	0.02345	0.05418	-0.09774	-0.63239	5.17346	69.03211 *
Poland	-0.00032	0.02223	0.06084	-0.08289	-0.27969	3.96085	13.49421 *
Russia	-0.00035	0.04527	0.20204	-0.21199	-0.18106	6.76344	156.04950 *
South Africa	0.00014	0.02287	0.06834	-0.07581	-0.00873	3.81984	7.34081 **
Saudi Arabia	-0.00107	0.02600	0.09087	-0.10329	-0.26461	6.36136	126.40210 *
Thailand	0.00035	0.02522	0.08917	-0.12564	-0.79875	7.38933	238.18160 *
Turkey	0.00082	0.02548	0.12127	-0.09014	0.09730	5.93160	94.23396 *
Venezuela	0.00013	0.02274	0.09782	-0.07342	-0.03858	4.49272	24.38954 *

Table 3 Descriptive Statistics. This table includes the descriptive statistics of daily return of three economics zone: Advanced Economies (G7), Other Advanced Economies (OA) and Other Economies (EM); and Gold before and after the financial crisis with the sample from 17 September 2007 to 17 September 2009. The first three variables are indices in average of stock markets under the specific economics zone, and the gold price is recorded in US dollars.

	<u>Pre-Crisis</u>				<u>Post-Crisis</u>			
	G7	OA	EM	GOLD	G7	OA	EM	GOLD
Mean	-0.00093	-0.00110	-0.00104	0.00027	-0.00056	-0.00020	0.00023	0.00126
Std. Dev.	0.01142	0.01123	0.00908	0.01430	0.01928	0.02007	0.01672	0.01883
Max	0.05857	0.03585	0.02848	0.03423	0.06093	0.06748	0.06682	0.07081
Min	-0.06703	-0.04540	-0.04873	-0.04901	-0.07123	-0.07240	-0.06677	-0.76624
Skewness	-0.42102	-0.12560	-0.57238	-0.71363	-0.33165	-0.37120	-0.39315	0.28598
Kurtosis	10.04554	3.82142	5.63340	4.11834	5.08123	4.98240	5.02308	5.30469
Jarque-Bera	543.3457*	7.962779*	89.01095*	35.48058*	52.08848*	48.91831*	51.43004*	61.32139*

*Note: * indicates statistical significance at the 1% critical value.*

Table 4 Correlation tests. This table shows the results of correlation tests for all the variables, including the daily return of three economics zone: Advanced Economies (G7), Other Advanced Economies (OA) and Other Economies (EM); and Gold before and after the financial crisis with the sample from 17 September 2007 to 17 September 2009.

	<u>Pre-Crisis</u>				<u>Post-Crisis</u>			
	G7	OA	EM	GOLD	G7	OA	EM	GOLD
G7	1	0.69468	0.74772	0.05975	1	0.89916	0.91243	0.05606
OA	0.69468	1	0.85943	0.10180	0.89916	1	0.91924	0.01097
EM	0.74772	0.85943	1	0.13415	0.91243	0.91924	1	0.04319
GOLD	0.05975	0.10180	0.13415	1	0.05606	0.01097	0.04319	1

Table 5 Pairwise Granger-Causality Results. This table reports the Granger-Causality among all the variables, including the daily return of three economics zone: Advanced Economies (G7), Other Advanced Economies (OA) and Other Economies (EM); and Gold before and after the financial crisis with the sample from 17 September 2007 to 17 September 2009.

Null Hypothesis:	Pre-Crisis			Post-Crisis		
	Obs	F-Statistic	Prob.	Obs	F-Statistic	Prob.
G7 does not Granger Cause GOLD	257	0.15430	0.85710	257	6.78295	0.0014*
GOLD does not Granger Cause G7		0.36451	0.69490		2.53059	0.08160
EM does not Granger Cause GOLD	257	0.43347	0.64870	257	3.61333	0.02840
GOLD does not Granger Cause EM		0.00596	0.99410		2.40330	0.10850
GOLD does not Granger Cause OA		0.06368	0.93830		2.23340	0.10920
EM does not Granger Cause G7	257	1.44615	0.23740	260	3.44487	0.03340
G7 does not Granger Cause EM		0.93484	0.39400		2.70974	0.06850
OA does not Granger Cause G7	257	0.28240	0.75420	260	3.21559	0.04180
G7 does not Granger Cause OA		11.35370	0.000020*		12.53840	0.0000*
OA does not Granger Cause EM	257	4.50086	0.01200	260	1.43785	0.23940
EM does not Granger Cause OA		8.79885	0.00020*		11.27200	0.0000*

Table 6 Unit Root Tests. This table indicates the results of unit root tests of daily return of three economics zone: Advanced Economies (G7), Other Advanced Economies (OA) and Other Economies (EM); and Gold before and after the financial crisis with the sample from 17 September 2007 to 17 September 2009.

Variable	<u>Pre-Crisis</u>		<u>Pre-Crisis</u>	
	Augumented Dickey-Fuller	Phliips-Perron	Augumented Dickey-Fuller	Phliips-Perron
GOLD	-3.313466 [-13.72701] *	-1.513988 [-28.36585] *	-3.134283 [-13.56539] *	-1.513980 [-28.26203] *
G7	-2.366344 [-16.90651] *	-1.270643 [-21.17442] *	-2.366117 [-16.93990] *	-1.270588 [-21.21547] *
OA	-3.382087 [-11.20481] *	-1.372545 [-23.69110] *	-3.382086 [-11.22747] *	-1.372397 [-23.73379] *
EM	-2.242241 [-16.00371] *	-1.325655 [-22.46822] *	-2.241784 [-16.03506] *	-1.325553 [-22.51050] *

*Note: * indicates statistical significance at the 1% critical value.*

Table 7 Cointegration tests results. This table reports the results of cointegration test for all the variables, including the daily return of three economics zone: Advanced Economies (G7), Other Advanced Economies (OA) and Other Economies (EM); and Gold before and after the financial crisis with the sample from 17 September 2007 to 17 September 2009.

Pre-Crisis

Hypothesized no. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.368889	116.909400	27.584340	0
At most 1 *	0.233653	67.594450	21.131620	0
At most 2 *	0.156004	43.080250	14.264600	0
At most 3 *	0.125780	34.143520	3.841466	0

Post-Crisis

Hypothesized no. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.255691	74.120060	27.584340	0
At most 1 *	0.215954	61.065230	21.131620	0
At most 2 *	0.135907	36.664850	14.264600	0
At most 3 *	0.116065	30.966260	3.841466	0

Max-eigenvalue test indicates 4 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Table 8 ARCH results. This table reports the Granger-Causality among all the variables, including the daily return of three economics zone: Advanced Economies (G7), Other Advanced Economies (OA) and Other Economies (EM); and Gold before and after the financial crisis with the sample from 17 September 2007 to 17 September 2009.

Pre-Crisis					
Variance equation		$\mu_t = \gamma_{G7,0} + \gamma_{G7,1} \varepsilon_{t-1}^2 + \sigma_1 \mu_{t-1}$			
Dependent Variable: G7	Coefficient	Std. Error	z-Statistic	Prob.	
$\gamma_{G7,0}$	0.0000	0.0000	2.2652	0.0235	
$\gamma_{G7,1}$	0.5496	0.1341	4.0986	0.0000	
σ_1	0.5356	0.1036	5.1690	0.0000	
Variance equation		$\mu_t = \gamma_{EM,0} + \gamma_{EM,1} \varepsilon_{t-1}^2 + \sigma_1 \mu_{t-1}$			
Dependent Variable: EM	Coefficient	Std. Error	z-Statistic	Prob.	
$\gamma_{EM,0}$	0.0000	0.0000	1.0770	0.2815	
$\gamma_{EM,1}$	0.0590	0.0367	1.6096	0.1075	
σ_1	0.8917	0.0747	11.9314	0.0000	
Variance equation		$\mu_t = \gamma_{OA,0} + \gamma_{OA,1} \varepsilon_{t-1}^2 + \sigma_1 \mu_{t-1}$			
Dependent Variable: OA	Coefficient	Std. Error	z-Statistic	Prob.	
$\gamma_{OA,0}$	0.0000	0.0000	0.6543	0.5129	
$\gamma_{OA,1}$	0.0341	0.0347	0.9837	0.3253	
σ_1	0.8935	0.1361	6.5658	0.0000	
Variance equation		$\mu_t = \gamma_{GOLD,0} + \gamma_{GOLD,1} \varepsilon_{t-1}^2 + \sigma_1 \mu_{t-1}$			
Dependent Variable: Gold	Coefficient	Std. Error	z-Statistic	Prob.	
$\gamma_{GOLD,0}$	0.0001	0.0001	0.8449	0.3982	
$\gamma_{GOLD,1}$	-0.0401	0.0267	-1.4985	0.1340	
σ_1	0.5296	0.6043	0.8764	0.3808	

Table 9 GARCH results. This table reports the GARCH(1,1) test among all the variables, including the daily return of three economics zone: Advanced Economies (G7), Other Advanced Economies (OA) and Other Economies (EM); and Gold before and after the financial crisis with the sample from 17 September 2007 to 17 September 2009.

<u>Post-Crisis</u>				
Variance equation		$\mu_t = \gamma_{G7,0} + \gamma_{G7,1}\varepsilon_{t-1}^2 + \sigma_1\mu_{t-1}$		
Dependent Variable: G7	Coefficient	Std. Error	z-Statistic	Prob.
$\gamma_{G7,0}$	0.0000	0.0000	0.6121	0.5405
$\gamma_{G7,1}$	0.0761	0.0302	2.5163	0.0119
σ_1	0.9151	0.0314	29.1568	0.0000
Variance equation		$\mu_t = \gamma_{EM,0} + \gamma_{EM,1} \varepsilon_{t-1}^2 + \sigma_1\mu_{t-1}$		
Dependent Variable: EM	Coefficient	Std. Error	z-Statistic	Prob.
$\gamma_{EM,0}$	0.0000	0.0000	1.0345	0.3009
$\gamma_{EM,1}$	-0.0357	0.0128	-2.7951	0.0052
σ_1	1.0252	0.0135	75.8868	0.0000
Variance equation		$\mu_t = \gamma_{OA,0} + \gamma_{OA,1} \varepsilon_{t-1}^2 + \sigma_1\mu_{t-1}$		
Dependent Variable: OA	Coefficient	Std. Error	z-Statistic	Prob.
$\gamma_{OA,0}$	0.0000	0.0000	0.9537	0.3402
$\gamma_{OA,1}$	-0.0330	0.0203	-1.6244	0.1043
σ_1	1.0215	0.0187	54.6977	0.0000
Variance equation		$\mu_t = \gamma_{GOLD,0} + \gamma_{GOLD,1} \varepsilon_{t-1}^2 + \sigma_1\mu_{t-1}$		
Dependent Variable: Gold	Coefficient	Std. Error	z-Statistic	Prob.
$\gamma_{GOLD,0}$	0.0000	0.0000	1.0900	0.2757
$\gamma_{GOLD,1}$	-0.0320	0.0106	-3.0104	0.0026
σ_1	1.0167	0.0100	101.4396	0.0000

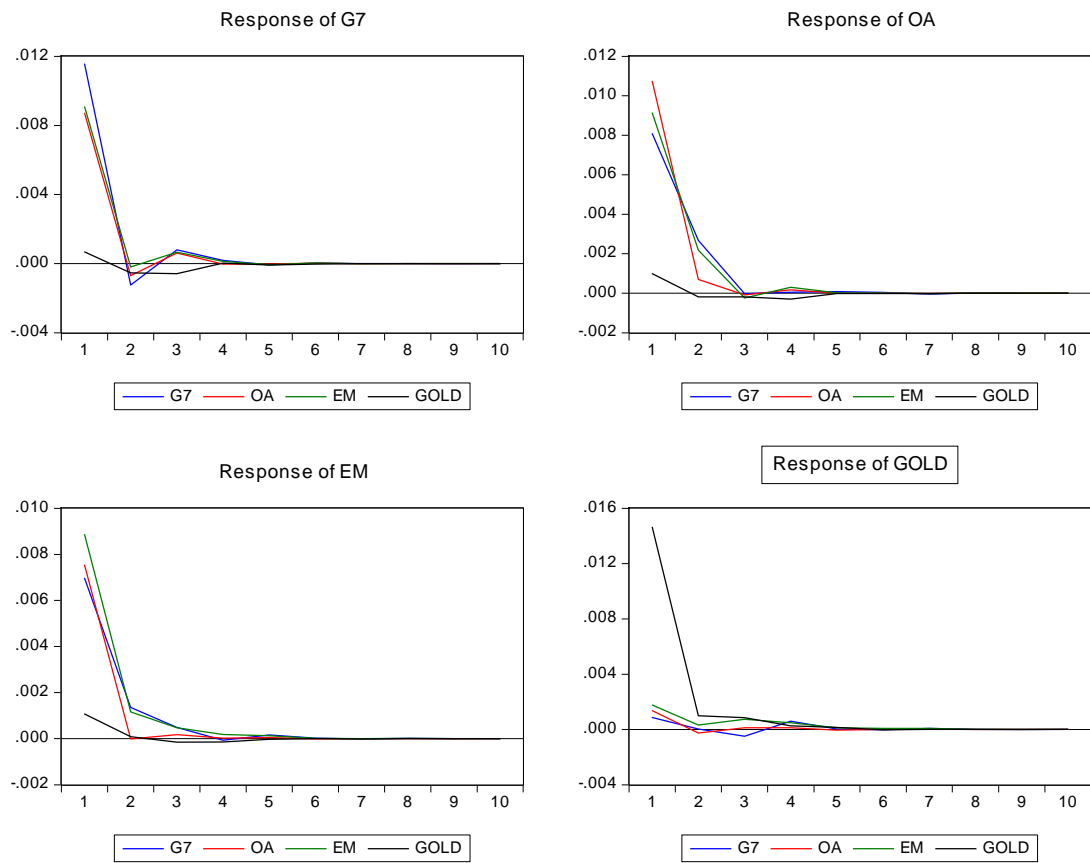
Table 10 VAR of G7, OA and EM. This table reports the Granger-Causality among all the variables, including the daily return of three economics zone: Advanced Economies (G7), Other Advanced Economies (OA) and Other Economies (EM); and Gold before and after the financial crisis with the sample from 17 September 2007 to 17 September 2009.

	<u>Pre-Crisis</u>				<u>Post-Crisis</u>			
	G7	EM	OA	GOLD	G7	EM	OA	GOLD
G7(-1)	-0.217428 (0.104890) [-2.07301]	0.189610 (0.080870) [2.34477]	0.327317 (0.098550) [3.32127]	-0.012050 (0.132070) [-0.09124]	0.225105 (0.159690) [1.40960]	0.202504 (0.139470) [1.45194]	0.404041 (0.161410) [2.50324]	0.357860 (0.162660) [2.20004]
G7(-2)	-0.019271 (0.104550) [-0.18432]	0.143952 (0.080610) [1.78586]	0.180831 (0.098240) [1.84077]	-0.186898 (0.131650) [-1.41969]	-0.631222 (0.161110) [-3.91796]	-0.354978 (0.140710) [-2.52281]	-0.470089 (0.162840) [-2.88684]	-0.233656 (0.164100) [-1.42384]
OA(-1)	-0.089431 (0.132640) [-0.67421]	-0.371521 (0.102270) [-3.63284]	-0.477230 (0.124640) [-3.82902]	-0.196333 (0.167020) [-1.17548]	-1.998400 (0.166470) [-1.20048]	-0.204874 (0.145390) [-1.40917]	-0.483439 (0.168250) [-2.87328]	0.084560 (0.169560) [0.49870]
OA(-2)	0.033754 (0.131440) [0.25680]	-0.123179 (0.101340) [-1.21551]	-0.030553 (0.123500) [-0.24738]	-0.095833 (0.165510) [-0.57902]	0.218731 (0.162960) [1.34222]	0.071739 (0.142320) [0.50405]	0.142350 (0.164710) [0.86424]	0.029398 (0.165990) [0.17711]
EM(-1)	0.306994 (0.170910) [1.79625]	0.332576 (0.131770) [2.52394]	0.412332 (0.160590) [2.56764]	0.232523 (0.215200) [1.08048]	0.259642 (0.205070) [1.26610]	0.265479 (0.179100) [1.48228]	0.471358 (0.207270) [2.27410]	-0.342228 (0.208880) [-1.63862]
EM(-2)	0.054275 (0.172070) [0.31543]	0.096314 (0.132660) [0.72600]	-0.098178 (0.161680) [-0.60724]	0.382395 (0.216670) [1.76490]	0.266962 (0.203940) [1.30903]	0.227146 (0.178110) [1.27530]	0.316569 (0.206130) [1.53580]	0.036886 (0.207730) [0.17757]
GOLD(-1)	-0.042463 (0.050320) [-0.84389]	-0.004286 (0.038790) [-0.11048]	-0.025084 (0.047280) [-0.53054]	0.063261 (0.063360) [0.99846]	0.041095 (0.062030) [0.66256]	0.092975 (0.054170) [1.71634]	0.055327 (0.062690) [0.88253]	-0.012430 (0.063180) [-0.19674]
GOLD(-2)	-0.037749 (0.050390) [-0.74914]	0.002670 (0.038850) [0.06871]	0.015131 (0.047350) [0.31958]	0.033105 (0.063450) [0.52175]	0.135778 (0.061740) [2.19907]	0.096164 (0.053920) [1.78332]	0.128159 (0.062410) [2.05365]	0.035065 (0.062890) [0.55755]
C	-0.000931 (0.000720) [-1.29518]	-0.000903 (0.000550) [-1.63040]	-0.000856 (0.000680) [-1.26830]	0.000350 (0.000900) [0.38729]	-0.001000 (0.001150) [-0.86718]	-0.000126 (0.001010) [-0.12547]	-0.000550 (0.001170) [-0.47159]	0.001188 (0.001170) [1.01097]
R-squared	0.031842	0.083167	0.111699	0.032466	0.140123	0.118957	0.177770	0.063227
Adj. R-squared	0.000611	0.053592	0.083044	0.001255	0.112385	0.090536	0.151246	0.033009
Sum sq. resids	0.032046	0.019049	0.028292	0.050809	0.082234	0.062724	0.084008	0.085317

S.E. equation	0.011367	0.008764	0.010681	0.014313	0.018210	0.015903	0.018405	0.018548
F-statistic	1.019575	2.812059	3.898082	1.040218	5.051678	4.185552	6.702332	2.092338
Log likelihood	790.5059	857.3473	806.5131	731.2777	669.4066	704.2061	666.6641	664.6762
Akaike AIC	-6.081758	-6.601924	-6.206327	-5.620838	-5.139351	-5.410164	-5.118009	-5.102539
Schwarz SC	-5.957471	-6.477638	-6.082041	-5.496552	-5.015065	-5.285878	-4.993722	-4.978252
Mean dependent	-0.001046	-0.001158	-0.001157	0.000235	-0.000388	0.000342	-0.000031	0.001100
S.D. dependent	0.011371	0.009009	0.011154	0.014322	0.019328	0.016676	0.019978	0.018862

Graph 1 Impulse Response Tests. The graphs show the impulse response for all the variables, including the daily return of three economics zone: Advanced Economies (G7), Other Advanced Economies (OA) and Other Economies (EM); and Gold before and after the financial crisis with the sample from 17 September 2007 to 17 September 2009.

Pre-Crisis



Post-Crisis

