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Financial Crisis and Dynamic the Dependency between Six International Currencies Volatility with Sectors Volatility: Evidence from Six Australian Sectors

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This paper investigates the influence of volatility of foreign exchange rate of the U.S., the U.K., Netherlands, Japan, China and Singapore to the volatility of the six Australian sectors within the investigated period controlling for the time periods global financial crisis 2007-2008.The volatility in this study was estimated using GARCH(1,1) models. Daily data is collected for a period of 2002 to 2014. The dataset is divided into three sub periods: before GFC (July 2002 to July 2007), during GFC (July 2007 to July 2009) and after GFC (July 2009 to July 2014). The estimated results find strong relationship between exchange rates for the six countries with six Australian sectors volatility, except health care sectors during GFC. The same relationship is evident before GFC, except banks sector. The statistically significant impact of these foreign exchange on the six Australian sectors continues after GFC, except materials sector is weakly significantly. This result is important for the investors and other market participants to understand the risk factors related to the sectors of the Australian stock market.

Key Words: Australian sector, Global crisis, Volatility, Stock Returns, Exchange Rate.

1. Introduction

During the two decades, Australian country has experienced several crises, the Asian currency crisis in July 1997, the Mexican currency crisis in 1994 and the subprime crisis of 2007 and 2008. According to Australian trade commission, the stock of foreign direct investment crash during these crises, also the Australian exchange rate crash during the Asian crisis in 1997 and U.S subprime crisis 2007. Theoretically, exchange rate is the relative value of a foreign country's currency in terms of the home country's currency, and the exchange rate will affect the domestic economy greatly especially investment denominated in foreign currency. Stock market can reflect a country's economic development, and the stock market prices (indices) can reflect the whole stock market which can be regarded as the barometer of country's economic situation and shareholder wealth.

According to Kim (2003) the growing degree of the world trade capital movement has made the exchange rate as on the main determinants of business profitability and equity prices. It's important to note that when studying the dynamic behaviour of shareholder wealth, the effect of the exchange rate market can't be neglected.
According to economic theory, the exchange rate changes and the stock market volatility have a strong relationship, (e.g..Dornbusch and Fisher, 1980; Frankel, 1983;

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Smith, 1992; kanas, 2000; Kontonikas, 2012; Baur, 2012; Chan et al., 2011; Kenourgios and Padhi, 2012; Dimitriou et al., 2013, Hussain M.and Bashir U. (2013) Besides, the Mexico Financial crisis 1994, the Asian financial crisis in 1997 and global financial crisis all showed the coupling effect of the foreign exchange market and stock market. These strong relationships between the exchange rate volatility and financial market volatility will also affect the shareholder wealth.

Thus, this study aims into model the volatility of Australian sectors return and factors affecting the volatility of the six Australian industry stock return. However, very few empirical studies have been done to investigate their relationship in the context proposed in this study, which six countries of foreign exchange rate volatility influence on the six Australian sectors return. One of the important defects of the previous research is that every study focuses on a specific issue. To put it differently, there is a lack of investigation from a more comprehensive and multi-perspectives, because of the significance of linking the six countries with Australian economy. second of the important defects of the previous research is that every research wasn't find out the relationship through three samples period during the global financial crisis.

Specifically, this study suggests investigating the being of volatility in the six Australian sectors returns (banks, health care (HCARE), information technology (IT), materials, telecom and utility) due to variation in exchange rates of six countries, namely US, UK, Netherland, Japan, China, and Singapore. This research considers the six countries and the six Australian sectors, because these countries are the highest stock of FDI in Australia. Previous researches have mainly focused on a single currency, and group of micro/macro-economic variables (Liow, Ibrahim, & Huang, 2006; Kontonikas, 2012; Baur, 2012; Chan et al., 2011; Guo et al., 2011; Kenourgios and Padhi, 2012; Dimitriou et al., 2013). In this research, the advance econometric technique used in this study, the GARCH (1, 1) model is applied for it. Various researchers have employed GARCH (1.1) suck as (Joseph and Vezos 2006; Adjasi 2009; Tai 2010; Brooks et al 2010). Second, the top-performing sectors locally in 2014 were healthcare, telecommunications and materials. Also the recent Financial System Inquiry (FSI) has put the banks sector in focus, with the final report recommending higher capital ratios for the banks, because this sector is among the largest on ASX.

In addition, this research will help investors know trends stock markets, and how it affected by exchange rates, and therefore to invest accordingly, and foreign investors can invalidate the exchange rate risk.

On the other hand, this paper contribution to the existing literature in a number of ways, first we consider the six sectors return volatility in Australian market with the foreign exchange rate volatility located in US, UK, Netherland Japan, China, and Singapore. Highest stock of foreign direct investment countries have not been examined broad empirical analysis yet, in other words. Our interest is focused on highest stock of FDI countries. Second, the sample data considered in our research includes the period of global financial crisis 2007-2008, which significantly affected in performance of financial market, foreign direct investment and exchange rate.

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The rest of this research is provided as follows. Section 2 contains brief review of the related literature. The methodology is presented in section 3. The empirical result is described in section 4.

2. Literature Review

In early stage, studies were mostly conducted in U.S and European countries, after the financial crisis in 2008 the focus has shifted to financial market of world's countries, furthermore, studies on the volatility of exchange rate and stock market volatility are widely conducted in both developed and developing countries because of the increasing degree of the integration of the world financial market. The asset market approach to determine the exchange rate, are supposed to be run causality from stock prices to exchange rate changes as expectations regarding the movements of financial asset prices affect the dynamics of exchange rates (Mundell, 1963, 1964; Dornbusch and Fisher, 1980, Branson, 1983; Frankel, 1983).

The impact of foreign exchange rate volatility on stock market volatility from US, UK, European countries have huge literature. In this case, Kanas (2000), investigates the dependency between the volatility of stock return and exchange rate volatility for six countries, namely U.S, the UK, Japan, Germany, France and Canada. According to his results, he finds significant evidence in all the countries except Germany. El-Masry (2007) examines the linkage among the exchange rate exposures on stock return in UK industries, the empirical findings provide evidence of exchange rate exposure effect on the UK stock. Mun (2007) examine the volatility and the correlation between the stock markets and the exchange rate volatility. He finds the positively correlation between the exchange rate volatility with local market but negative relationship for U.S. market. In other word, higher exchange rate volatility decrease the correlation among the local market and U.S. Aydemir and Demirhan (2009) investigate the relationship between the exchange rate and Turkish equity market. They find association among the exchange rate and stock market indices. Yang and Doong (2004) investigate the dependency among stock price and foreign exchange markets for the G-7 countries. They find evidence from stock returns to exchange rate changes for France, Italy, Japan and the US.

According to Kutty (2010) investigate the association between foreign exchange rates with Mexico stock market for 17 years period. His empirical results show that there is significant relationship in short period and the opposite not true. Diamandis and Drakos (2011) Study the linkage between the exchange rate and share price in Latin America countries. According to their empirical finding, there is relationship between the Latin America countries stock market with the foreign exchange rate, but the financial and currency crisis (2007-2008) are affected on the stability of that relationship. Joseph and Vezos (2006) on their study on the understanding of stock returns to exchange rates in US banks and found strong deviation in foreign exchange rate sensitivity by financial division of banks. According to results found, coefficients of foreign exchange rate sensitivity were characteristically positive for both OLS and EGARCH. The impact of foreign exchange rates was not prominent regardless of employing high frequency data.

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The previous empirical research shows that there are number of article investigate the effect of Volatility of exchange rate on Asian stock market. Zhao (2010) analyses the dynamic relationship between the real effective exchange rate and the Chinese stock price, using a VAR with a multivariate GARCH model. The results show that there is no stable long run symmetry relationship between the two financial markets. Furthermore, the paper reveals that bidirectional causality exists between volatility on the two markets. Using a copula based approach. Lee et al. (2011) examine the interaction between stock prices and exchange rates of several Asia-Pacific countries by dynamic correlations. Their empirical results indicate that the correlation between stock and foreign exchange markets becomes higher when stock market volatility increases. For the same region, negative correlation between these two markets are revealed by Yang et al. (2014).Yau and Nieh (2009) find the long-term balance and causal association between unequal stock prices and exchange rate in two Asian countries namely Taiwan and Japan. Liu and Shrestha (2008) investigate the relationship between the Chinese market and macroeconomic variables. He finds negative relationship among the stock price and the exchange rate. Also find s Chinese market has a negative association with US and other developed countries.
Despite extensive work to investigate the relationship between volatility of financial market with foreign exchange rate volatility in European countries and U.S. Hardly to find a few studies examine the relationship among foreign exchange rate volatility with Australian sectors volatility. Shamsuddin and Kim (2003) examine the dependency between foreign exchange rate volatility with Australian stock return volatility during the Asian crisis and stock markets. The result shows that there are significant relationships between the two variables. Ryan & Worthington (2004) assess the impact of market, interest rate and foreign exchange rate risks on the sensitivity of Australian bank Stock Returns. Dark et al (2005) investigate effects among the USD/AUD and the Australian ordinaries index. He finds the volatile effects from Australian exchange rate to Australian Ordinaries index. Wang & Yang (2009) consider asymmetric GARCH models for measuring the volatility for the AUD/USD, GBP/USD and JPY/USD exchange rates.

Lastly, considering the complex relationship explained above, the analysis of the dynamic interaction between volatility of foreign exchange rate and volatility of asset market are not easy but crucial, not only for investment and risk management issues, but also for the economic and financial stability.

3. The Methodology and Model

3.1 The Data

This research used daily data covering the period from July 2002 to July 2014, extracted from data stream and external trade statistics from Australian central bank and Australian trade commission. This study attempt to investigate the influence of volatility of foreign exchange rate located on United States of America, England, Netherlands, Japan, China and Singapore to volatility of the six Australian sectors within the investigated period controlling for the time periods global financial crisis 2007-2008 . The researcher divided the covering period to three sub periods, first is from July 2002 to July 2007 second, during the global financial crisis, which is from

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July 2007 to July 2009. Third after the global financial crisis period, that is from July2009 to July 2014. The reason to dividing the sample into three samples is to provide greater insight into the nature of estimation of foreign exchange rate risk in Australian industry sectors market before and after the crisis.

On the other hand, we expect the Australian sectors to be more exposed to exchange rate fluctuations in both the pre and post-GFC periods. In the post-GFC period, due to increased market uncertainty arising from the crisis, we expect that more sectors will be highly exposed to exchange rate volatility. The Australian sectors return is expressed as a percentage computed by multiplying the first difference of the logarithm of Australian industry sectors value by 100.

$$ASR_i = \text{Ln}\ (P_t/P_{t-1})$$

3.2 Development of ARCH and GARCH model:

GARCH was used investigated the existence of stock return volatility in global stock market. This model allows the researcher to conditional volatility estimation by modelling the stock return and exchange rate together by Joseph and Vezos (2006). According to Engle (1982), the GARCH (1, 1) is the most simplest of the volatility models. The model is modifiable. A GARCH model is a generalized form of GARCH (1, 1) with added lag terms, used for longer spans of data (daily or hourly). Various researchers have employed GARCH and its modifications in modelling financial time series data exhibiting time varying volatility, particularly on stock returns and various micro and macro-economic variables such as (Joseph and Vezos 2006; Adjasi 2009; Tai 2010; Brooks et al 2010; Aloui et al. 2013).

The model of this research contents of two equations (i) the main equation (ii) the variance equation, it consists of two terms (i) the ARCH term (lag of squared residuals) and (ii) the GARCH term (previous period's volatility). Both ARCH and GARCH coefficients must be positive. However, if coefficients are negative they indicate presence of leverage effects. The sum of the ARCH and GARCH coefficients determine the extent of perseverance in shocks to volatility. Persistence holds if the sum is less than or equal to unity.

(i) The mean equation

$$r_{i,t} = c + \delta_1 r_{m,t} + \delta_3 r_{audusd} + \gamma \ln(h_{it}^2) + \varepsilon_{it} \qquad (1)$$

Where $r_{i,t}$ is the six Australian sectors return i at time t, C is constant, $\delta_1 r_{m,t}$ is the market return r_{audusd} is return of Australian Dollar giants U.S Dollar, ε_{it} is the error term or residual.

ii) Variance equation

Residual derived from mean equation1.1 is used in making variance equation 1.2

$$h_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta h_{t-1}^2 + \rho\sigma_{fx,t}^2 + \varepsilon_{t-1}^2 \qquad (1.2)$$

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Here, h_t^2 is variance of the residual derived from equation 1.1, it's also known as current day's variance or volatility of six Australian sectors (ASR), h_{t-1}^2 is previous days residual variance its known as GARCH term, ε_{t-1}^2 is Previous period's squared residual derived from equation (1.1) it's also known as previous day's sector return information about volatility. $\sigma_{fx,t}^2$ is Australian Dollar giants six currencies namely U.S., the U.K., Netherlands, Japan, China and Singapore.

$EUAUDR, GBAUDR, AUDSGR, AUDJPY$ and $AUDCY$ are also known as variance regressors as they can also contribute in the volatility of the six Australian sectors return Ht in equation1.2.

4. The Findings

4.1 Descriptive Statistics

The descriptive statistics of the six Australian sectors returns and foreign exchange rate data of six countries namely the US, the UK, Europe, Singapore, China, Japan for period of July 2002 to June 2014 are presented in table 1.

During the overall sample period, mean Australian sectors return of the six series are positive and range 0.00149 (telecom sector) to 0.012087 (Hcare sector) In addition, regarding volatility as measured by standard deviation, materials sector has a higher standard deviation than other sectors and exchange rate return. Also, average returns of all variables are smaller than its standard deviation, which means the return series is not normally distributed. Based on the skewness, most of the variables return series indicate negative skewness. Only EURAUD, GBPAUD, banks, IT sector return series are negatively skewed. For kurtosis, the value of kurtosis is greater than 3.0 for the six Australian sectors returns and six exchange rates. This designates the typical leptokurtic distribution. Additionally, these non-normal distributions of the data are confirmed by the skewness, kurtosis, standard deviation and the Jarque-Bera statistics. The previous findings show that, ARCH and GARCH family are appropriate in this research.

4.2 Unit Root test

Unit Root Statistics is to determine whether all data are stationary. In order to make strong conclusions about the time series properties of the time series data, this study uses the unit root tests of the ADF, the PP and the KPSS. These were introduced by Dickey-Fuller (1979) and Phillips and Perron (1988). This research measures unit root of the six currency and the six Australian sectors return in level and in first difference.

The results in Table 2 suggest the null hypothesis of the series being a unit root process is rejected for the first differences of the series at 1% significance level for all markets for ADF and PP test. The ADF and PP test result suggest that all variables are stationary for first different. In case of KPSS test, most of the variables are stationary for first difference. This does mean, we accept the null hypothesis of the

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series. In summary, the previous findings show that, ARCH and GARCH family are, suitable in this research.

4.3 Volatility Model

The Volatility Model (GARCH1, 1) uses in this study to examine the six Australian sectors returns and foreign exchange rate data of six countries namely the US, the UK, Europe, Singapore, China, Japan for period of July 2002 to June 2014 are presented in table 3.

For banks sector, the result shows that, there are no association between the six currencies with banks sector in the pre-GFC period. There is a strong positive significant between the banks sector with market index. While during GFC periods, there are negatively significant between the three Asian countries with bank sector, and a weak positively significant with the UK. It means that a one percentage point increase of the market (ASX200) level would increase price level by 98% a percentage point in bank sector. The findings of post GFC period show that, Singapore, Europe and Japan are strongly negatively significant with bank sector except Europe is positively significant. GBPAUD is a weak positive relationship with banks sector. ARCH and GARCH are statistically significant in the three sub samples. The sum of these coefficients is .98 which specified that shocks to fickleness have a permanent effect. The positive value of GARCH (-1) shows that volatility in lag1 affects volatility for current lag in such a way that if volatility is more in lag it gets increased for current lag.

Based on pre-GFC period indicates that only U.S , Singapore and Japan currencies return are a strong negative with significant predictor of health care sector. The results also show the association between the AUDUSD with health care sector is negative with significant during GFC period. We find positively significant relation between the AUDJPY and GBPAUD with health care sector in post-GFC period. Based on table 3, there are strongly negatively relationships the U.S, Singapore and China currencies with health care sector in same period. ARCH and GARCH are statistically significant in the three sub samples. The sum of these coefficients is .98 which specified that shocks to fickleness have a permanent effect. The positive value of GARCH (1,1) shows that volatility in lag1 affects volatility for current lag in such a way that if volatility is more in lag it gets increased for current lag.

In terms of IT sector, the finding of pre-GFC period show that, the coefficient of AUDSGD (0.006658), AUDUSD (0.164169), EURAUD (0.002088) and AUDCY (0.003602) are strong significant with positive relationship with IT sector. Also negative with significant dependency linkage Japan and the UK with IT sector return. There are negatively significant between the U.S, China, Singapore and Japan currencies with IT sector and positively significant with the UK, Europe and ASX200 and during GFC period. The outcomes of post-GFC period show that, the three Asian countries are strong significant with negative relationship with IT sector, the US. is strongly and positively significant with it sectors . ARCH and GARCH are statistically significant in the three sub samples. The sum of these coefficients is 1.03 which specified that shocks to fickleness have a permanent effect during GFC period. While the sum of

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these coefficients is 0.17 which denoted that shocks to fickleness have no continual effect in post-GFC and pre-GFC periods.

Based on table 3, the AUDUSD and market (ASX200) are strongly positively significant with materials sector return in the three sub periods. It means that a one percentage point increase of the AUDUSD level would increase price level by 12% percentage points in materials sector return during GFC. The dependency between EURAUD with materials sector return is positive with significant pre GFC period, but negatively in post GFC period. ARCH and GARCH are statistically significant in the three sub samples. The sum of these coefficients is .95 which specified that shocks to fickleness have a permanent effect. The positive value of GARCH (-1) shows that volatility in lag1 affects volatility for current lag in such a way that if volatility is more in lag it gets increased for current lag.

For telecom sector, there are negative impacts of the three Asian countries on telecom sectors return in pre-GFC period and post GFC period. The coefficient of EURUSD (0.000564), are significant with a negative relationship with telecom sector in pre-GFC period. AUDUSD has a negative with significant with telecom sector during-GFC period and post-GFC perio, but Europe has a positive during GFC period. The coefficient of GBPUSD (0.000666) is significant with a positive relationship with telecom sectors return in post-GFC period. ARCH and GARCH are statistically significant in the three sub samples. The sum of these coefficients is .95 which specified that shocks to fickleness have a permanent effect. The positive value of GARCH (-1) shows that volatility in lag1 affects volatility for current lag in such a way that if volatility is more in lag it gets increased for current lag.

In terms of utility sector, the outcomes show that, Singapore and Japan currencies both have negative impacts on utility sector return in the three sub-periods. The table 3 also shows that, the AUDUSD has negative with significant linkage with utility sector volatility during GFC and post-GFC periods. Also, the EURAUD has weak positive influences on utility sector return during GFC and post-GFC periods. The coefficient of GBPUSD (.0003617) is significant with a negative relationship with utility sector return during GFC period , but a weak positive in post-GFC period.
ARCH and GARCH are statistically significant. The sum of these coefficients is 1 which specified that shocks to fickleness have a permanent effect. The positive value of GARCH (-1) shows that volatility in lag1 affects volatility for current lag in such a way that if volatility is more in lag it gets increased for current lag.

5. Summary and Conclusions

The main objective of this research was the development of a procedure to model volatility based on GARCH (1,1) approach. This approach was used to test the volatility between the six international currencies with six Australian sectors return. The dataset is divided into three sub periods: before GFC (July 2002 to July 2007), during GFC (July 2007 to July 2009) and after GFC (July 2009 to July 2014). Empirical analysis shows the importance of the influences that affect Australian sectors such as AUDUSD, AUDSGD, EURAUD, AUDJPY, AUDCY, and GBPAUD.

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The findings of this study demonstrate that relationship between exchange rates for the six countries with six Australian sectors volatility pre-GFC period except banks sector. The same relationship is strong evident during GFC. The six foreign exchange rates have strong impacts on the six Australian sectors volatility in post-GFC period. This research is important for the investors and other market participants to understand the risk factors related to the sectors of the Australian stock market.

For future studies, researchers can use spill-over, based on MGARCH and VAR approaches. The final suggestion is for future studies to add technical indicators like price momentum, moving average convergence-divergence (MACD), and relative strength index (RSI).

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Table 1: The descriptive statistics of daily six sectors return and six currencies return

The table report summary statistics of the return of six sectors and six currencies return: banks sector, health care (HCARE), information technology (IT), materials, telecom, utility , market (ASX200) and six foreign exchange rates located to USD , UK, Europe, Japan , China and Singapore.

	AUDUSD	AUDSGD	EURAUD	AUDJPY	AUDCY	GBPAUD	ASX200	BANKS	HCARE	IT	MATERIALS	TELECOM	UTILITY
Mean	0.007179	0.002324	-0.00252	0.004908	0.003076	-0.00562	0.007148	0.007599	0.012087	0.008593	0.01091	0.00149	0.008914
Median	0.021655	0.011955	-0.0127	0.027142	0.019431	-0.00977	0.013088	0.0000	0.0000	0.0000	0.012449	0.0000	0.00112
Maximum	2.091866	1.658463	1.845138	2.673679	2.064026	1.781214	2.32787	4.208286	2.062143	5.902475	4.051158	3.118786	2.254609
Minimum	-1.93366	-1.80559	-1.63683	-3.04275	-1.9109	-1.46628	-3.71478	-3.69835	-3.25973	-5.28169	-5.5333	-4.71175	-3.47148
Std. Dev.	0.250721	0.199227	0.203833	0.313379	0.246389	0.206465	0.438254	0.581035	0.439089	0.688306	0.704872	0.507206	0.428697
Skewness	-0.49953	-0.72797	0.700116	-0.77501	-0.48989	0.724781	-0.55179	0.155332	-0.27406	0.342782	-0.41546	-0.71345	-0.32458
Kurtosis	11.44495	14.00412	10.72851	16.11777	11.8458	9.945769	9.34569	9.0645	5.785878	9.485662	8.268292	9.090369	7.578376
Jarque-Bera	9425.097	16058.43	8040.33	22740.36	10323.46	6561.623	5406.963	4805.999	1050.69	5543.573	3707.374	5099.764	2786.908
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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Table 2: The unit roots analysis of the six currencies and Australian sectors return of daily data.

The series of first difference is represented by ∆. Also, two specification of with intercept (C) and intercept and trend (C & T) are considered. Here, ***, **, and * represent significance at the .01, .05, and .10 levels respectively.

	ADF		PP		KPSS	
	C	C & T	C	C & T	C	C & T
lnAUDUSD	-1.995229	-2.389600	-1.949934	-2.354715	5.353123***	0.246192***
∆lnAUDUSD	-24.85155***	-24.84754***	-203.1990***	-203.1321***	0.015220	0.014747
lnAUDSGD	-2.871127	-2.646566	-2.757303	-2.541185	0.918406***	0.324098***
∆lnAUDSG	-26.67335***	-26.69982***	-30.20205***	-30.18320***	0.169183	0.054185
lnEURAUD	-1.562614	-2.019167	-1.585181	-2.122225	4.128922***	0.542235***
∆lnEURAU	-27.99747***	-27.99430***	-28.31454***	-28.30645***	0.074597	0.071717
lnAUDJP	-2.530460	-2.623867	-2.394742	-2.482604	1.056849***	0.500815***
∆lnAUDJP	-26.59919***	-26.59647***	-28.07463***	-28.06608***	0.058427	0.052279
lnAUDCY	-2.701767	-2.481114	-2.651246	-2.439220	1.070675***	0.333016***
∆lnAUDCY	-26.02637***	-26.05048***	-30.66882***	-30.59667***	0.153697	0.053965
lnGBPAUD	-1.480001	-1.808124	-1.415790	-1.822171	6.432256***	0.527044***
∆lnGBPAU	-26.59468***	-26.60349***	-29.68751***	-29.66265***	0.138736	0.102862
LnASX200	-1.643411	-1.701821	-1.589189	-1.634190	2.030961***	0.893295***
∆lnASX200	-56.70972***	-56.70366***	-56.76310***	-56.75770***	0.129897	0.098023
lnBANKS	-1.096770	-1.939201	-0.964270	-1.814540	2.636158***	0.506658***
∆lnBANKS	-54.54231***	-54.53834***	-54.72304***	-54.72399***	0.087289	0.061599
lnHCARE	-0.614084	-1.612020	-0.473075	-1.485646	4.277996***	0.745968***
∆lnHCAR	-59.11295***	-59.10359***	-59.34548***	-59.33567***	0.102618	0.104252
lnIT	-1.132915	-2.929253	-1.033629	-2.810457	5.200446***	0.637978***
∆lnIT	-58.13400***	-58.12579***	-58.13400***	-58.12579***	0.073192	0.077318
lnMATER	-1.997969	-1.764446	-1.924863	-1.627859	3.440921***	1.265374***
∆lnMATER	-56.43486***	-56.45672***	-56.80289***	-56.86791***	0.302755	0.043616
lnTELEC	-1.503010	-1.200676	-1.423703	-1.095371	1.996564***	0.845697***
∆lnTELEC	-41.16065***	-41.17617***	-54.99237***	-55.01755***	0.213003	0.100232
lnUTILI	-1.638170	-1.560444	-1.533011	-1.432356	1.101169***	0.904766***
∆lnUTILI	-21.89811***	-21.89457***	-853.6940***	-853.2242***	0.037772	032422

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3: Sectoral return and conditional variance equation: GARCH (1, 1) estimates using daily data 1-7-2002 to 1-7- 2014.

The dependent variable is the daily return of the six Australian sectors. Here, banks, healthcare, information technology, materials, telecom and utility. The independent variables are market return, AUDUSD, AUDSGD, EURAUD, AUDJPY, AUDCY and GBPAUD.

	ASX200	AUDUSD	AUDSGD	EURAUD	AUDJPY	AUDCY	GBPAUD	Resid(-1)^2	GARCH-1	R-squared
BEFORE GFC										
BANKS	0.87436***2	0.001374	-3.14E-05	8.87E-05	-0.000130	-0.000141*	-8.07E-05	0.148148***	0.672221***	0.562408
HCARE	0.842961***	-0.150819***	-0.000509**	0.000355	-0.000431**	-5.38E-05	-0.000373	0.085227***	0.665004***	0.381591
IT	0.138201**	0.164169**	0.006658***	0.002088**	-0.000797**	0.003602***	-0.000838**	0.146356***	0.331745***	0.008826
MATERIALS	1.542700***	0.107158***	2.00E-05	-0.000246**	-5.40E-06	-2.92E-05	1.87E-05	0.044945***	0.906507***	0.710099
TELECOM	0.603183***	0.003006	-0.000543***	-0.000564***	-0.000361**	-0.000481***	0.000128	0.030401***	0.944573***	0.170222
UTILITI	0.490312***	-0.026976	-0.000241***	-1.35E-05	-0.000117	-0.000216***	0.000131	0.022077***	0.958353***	0.196867
DURNING GFC										
BANKS	0.984054***	-0.094010	-0.000833***	7.95E-05	-0.000470***	-0.000595***	0.000564*	0.046606***	0.950850***	0.623624
HCARE	0.530873***	-0.238100***	-0.000354	5.09E-05	-9.92E-05	-0.000257	0.000181	0.039540***	0.951803***	0.424680
IT	0.550793***	-0.219875**	-0.003179***	0.004289***	-0.002231***	-0.003572***	0.005572***	0.026111***	1.011072***	0.130405
MATERIALS	1.378928***	0.127825**	2.23E-05	-0.000357	-0.000130	-9.62E-06	0.000366	0.071762***	0.926079***	0.739831
TELECOM	0.484651***	-0.170646***	0.000364	0.002545***	4.56E-05	0.000676	0.000203	0.123385***	0.859040***	0.220271
UTILITI	0.637013***	-0.201139***	-0.000554***	0.000472*	2.39E-05	-0.000304***	-0.000361**	0.013620***	1.006245***	0.450406
AFTER GFC										
BANKS	1.076228***	-0.018224	-0.000216***	7.68E-05***	-0.000120***	-0.000150	8.93E-05*	0.058342***	0.930075***	0.762303
HCARE	0.619859***	-0.171408***	-0.000700***	0.000165	-0.000482***	-0.000623***	0.002843***	0.022271***	0.934887***	0.321030
IT	0.248920***	0.530859***	-0.002201***	-0.000601	-0.001484***	-0.001841***	0.000701	0.091917***	0.066962***	0.084082
MATERIALS	1.314128***	0.060114**	-3.10E-05	0.000180**	1.20E-05	-4.62E-05	8.09E-05	0.065157***	0.908186***	0.788949
TELECOM	0.508668***	-0.120256***	-0.000654***	4.93E-05	-0.000547***	-0.000656***	0.000666***	0.099495***	0.867748***	0.172403
UTILITI	0.606632***	-0.110403***	-0.000262***	0.000140*	-9.22E-05	-0.000126*	0.000130*	0.015182***	0.973008***	0.399684

Notes *,**, *** denote significance levels at 10%, 5%, and 1% respectively