EVIDENCE ON HEDGE RATIOS CHANGES AROUND THE SUBPRIME MORTGAGE CRISIS

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ABSTRACT

During the subprime mortgage crisis period, the New Century Financial Corporation was the biggest subprime mortgage lender in the United States and declared bankruptcy on April 2, 2007. This paper compared two types of hedge ratios--the hedge ratio before April 2, 2007 and the hedge ratio after April 2, 2007. We applied the hedge ratios of American, British, Canadian, German, Hong Kong and Japanese stock futures markets to examine the hypothesis. It is shown that the serious subprime mortgage crisis has led to a greater average hedge ratio in all six markets and the average hedge ratio has had a more obvious change in America, Britain, and Hong Kong. In other words, the results show that when the investors are in the asymmetry return of the financial assets they are inclined to weigh adverse evidence more heavily. The results are consistent with the findings of Lien (2005). These findings are helpful to risk managers dealing with stock index futures in the above markets.

JEL: G01, G15

KEYWORDS: Hedge ratios, Subprime mortgage crisis, DCC-GARCH

INTRODUCTION

The aim of hedging is to use futures markets to reduce a particular risk. The risk might relate to a foreign exchange rate, the level of the stock market, or some other variable. Generally, hedging may be divided into three types. First, a perfect hedge is one that completely eliminates the risk. Perfect hedges are rare. Secondly, a short hedge is a hedge that involves a short position in futures contracts. A short hedge is appropriate when the hedger already owns an asset and expects to sell it at some time in the future. Thirdly, hedges that involve taking a long position in a futures contract are known as long hedges. A long hedge is appropriate when an investor knows it will have to purchase a certain asset in the future and wants to lock in the price now. According to the situation of the market an investor can adopt any one hedging ploy to reduce the risk of the investment. In other words, hedging employs long-short strategies to reduce the variance of risk at the same time. One example is when an investor holds stocks he can adopt a short position on futures to offset risk. Hence, the measure of adopting a long-short position is defined as the hedge ratio, which represents the investor's attitude for future risk. Generally speaking, when the market trend is stable, the hedge ratio will become smaller, whereas if a big fluctuation of the market takes place it will get bigger.

Formerly, research about hedge ratios has overemphasized looking for the best value or comparing the models of the hedge ratio. For example, Park and Switzer (1995) estimated the risk-minimizing futures hedge ratio for three types of stock index futures: (i) S&P 500 index futures, (ii) major market index (MMI) futures, (iii) Toronto 35 index futures and the results reveal that the hedge ratio which is estimated by Bivariate cointegration GARCH is superior to the conventional ordinary least square (OLS) and OLS with cointegration (OLS-CI). Lien et al. (2002) compared OLS and constant-correlation vector generalized autoregressive conditional heteroscedasticity (VGARCH) and claimed that the OLS hedge ratio performs better than the VGARCH one. Floros and Vougas (2006) measured the hedging effectiveness of the Greek stock index futures using four different methods: (i) OLS, (ii) error correction model (ECM), (iii) vector error correction model (VECM), and (iv) Bivariate cointegration GARCH (B-GARCH) and found that the hedge ratio from the B-GARCH model provides greater variance reduction. This result is in accordance with Park and Switzer (1995). Hsu Ku et al. (2007) applied the dynamic conditional correlation (DCC)-GARCH model of Engle (2002) with error correction terms to investigate the optimal hedge ratios of British and Japanese currency futures markets and compare the DCC-GARCH and OLS model. Results show that the dynamic conditional correlation model yields the best hedging performance. The foregoing research overemphasizes looking for the best value or comparing the models of the hedge ratio. Research on how the positive and negative news affects the hedge ratio has seldom been researched, especially when the market meets strong fluctuations.

Table1: Descriptive Statistics and Unit-root Test

Market	Category	Mean	SD	Skewness	Kurtosis	Jarque -Bera	Q(2)	Q^2 (2)	Augmented Dickey-Fuller Unit Root Test	
									Price	Return
America	Spot	0.000041	0.0096	-0.2423	5.2592	115.9035 **	8.8535 *	15.6760 **	-1.5644	-25.9329 **
	Futures	0.000030	0.0095	-0.2124	5.3785	126.7308 **	4.3194	13.8280 **	-1.7501	-24.8900 **
Britain	Spot	-0.000086	0.0112	-0.2580	5.8395	180.8098 **	15.5060 **	32.3260 **	-1.9687	-26.8371 **
	Futures	-0.000086	0.0108	-0.2734	5.3642	127.8267 **	12.9080 **	25.5730 **	-1.9049	-26.3142 **
Canada	Spot	0.000265	0.0100	-0.5118	4.8567	97.5868 **	8.3023 *	34.2770 **	-1.5938	-25.1164 **
	Futures	0.000260	0.0102	-0.5301	4.7182	88.4830 **	7.8158 *	29.3090 **	-1.6152	-25.3746 **
Germany	Spot	0.000174	0.0114	0.6507	8.2092	625.8034 **	8.1869 *	30.9430 **	-1.2718	-24.6086 **
	Futures	0.000181	0.0114	-0.6155	8.1254	603.1713 **	9.7988 **	29.2370 **	-1.2626	-14.6658 **
Hong-Kong	Spot	0.000707	0.0168	-0.1191	8.3687	626.9226 **	5.6126 *	124.32 **	-1.4610	-24.6050 **
	Futures	0.000688	0.0174	0.1230	7.7406	489.1661 **	6.9011 **	80.3670 **	-1.4880	-25.2210 **
Japan	Spot	-0.000593	0.0133	-0.5652	5.0375	117.8574 **	0.8705	20.5310 **	-0.6898	-23.5518 **
	Futures	-0.000594	0.0136	-0.5110	4.9084	101.7331 **	1.7100	22.9480 **	-0.7269	-23.3021 **

*Notes: ** and* represent significance at the 1% and 5% levels, respectively. Q (2) and Q (2) are the LB tests for the 2nd-order serial correlations of standardized residuals and standardized squared residuals, respectively.*

The main reason why financial assets generate asymmetric fluctuation is the investors' stronger reaction to negative news than to positive news. Recent research about the asymmetric fluctuation of financial assets has been too numerous to enumerate (Blasco et al., 2002; Yang and You, 2003; Balaban and Bayar, 2005; Kian and Kuan, 2006; Liau and Yang, 2008). Moreover, the hedge ratio also generates variability following the asymmetric fluctuation of the financial assets. Brooks et al. employed the FTSE100 stock index to consider the impact of asymmetry on time-varying hedges and claimed that the asymmetric model gives superior hedging performance. Lien and Yang (2007) researched ten commodity futures contracts and estimated the dynamic minimum variance hedge ratios (MVHRs) using the Bivariate GARCH model that incorporates the basis spread effect of the asymmetric fluctuation. The results show that the positive basis spread has greater impact than the negative basis spread on the variance and covariance structure and they reported the importance of the asymmetric effect when estimating hedging strategies. Lee (2008) investigated the effects of asymmetries and regime switching on the futures hedging effectiveness of the Nikkei 225 stock index futures by using an asymmetric Markov regime switching BEKK GARCH (ARSBEKK) model. The results show that when the model takes the asymmetric effect into consideration, the hedging effectiveness is improved in estimating the hedge ratio, so the hedge ratio is in connection with the asymmetric fluctuation of the financial assets. Moreover, Lien (2005) incorporates asymmetric responses to positive and negative news within a stochastic volatility framework and the result shows that asymmetry leads to a greater average optimal hedge ratio. In another words, the hedge ratio increases with the increasing degree of asymmetry.

During the U.S. subprime mortgage crisis, large financial institutions have collapsed or been bought out. Especially, after the New Century Financial Corporation bankruptcy on April 2, 2007, which was the largest U.S. independent provider of home loans, many problems in subprime lending have emerged and the global financial markets have since felt its effects continuously (CNN Money.com). With the current unstable financial state, the returns of financial markets fluctuate widely and thus the hedging effectiveness in various markets are worthy of analysis, hence this paper investigates two types of hedge ratios--the hedge ratio before 2007 April 02 and the hedge ratio after 2007 April 02 in America (S&P 500 index), Britain (FTSE 100 index), Canada (Toronto 60 index), Germany (Frankfurt-Commerzbk index), Japan (NK-225 index[Tokyo]), Hong Kong (Hang-Seng index) We want to investigate whether the U.S. subprime mortgage crisis has led to a greater average optimal hedge ratio in these six futures markets. The empirical results show that the serious subprime mortgage crisis has led to a greater average hedge ratio in all six markets and the average hedge ratio has had a more obvious change in America, Britain and Hong-Kong. In another words, investors are inclined to weigh adverse evidence more heavily when financial fluctuation increases. The result is consistent with the empirical result for Lien (2005).

This article is organized as follows. Section II provides the DCC-GARCH model and its specification for our empirical studies. Section III reports the time series data and some descriptive statistics. Section IV includes model estimations and the results of hedging effectiveness for the markets of America, Britain, Canada, Germany, Japan and Hong Kong. Finally, Section V concludes with a discussion on the findings.

METHODOLOGY

Data and Descriptive Statistics

The data employed in this paper are obtained from Datastream and the study period is from 3 April 2006 to 31 March 2008. The index price is defined as daily spot closing and futures settlement data for each market respectively. The index returns are defined as the natural logarithms difference of the index. Table 1 lists the descriptive statistics and unit-root test for the daily index returns of each market. The mean returns are positive in America, Canada, Germany and Hong Kong and they are negative in Britain and Japan. And the skewness statistics show that all return series are negatively skewed except the spot market in Germany and the Futures market in Hong Kong. The kurtosis statistics show a departure from normality and all series are highly leptokurtic.

The Jargue-Bera (JB) statistics reject the normality for each return series. All these characters imply non-normal distributions with fatter tails. The Ljung-Box (LB) for the standardized squared residuals shows serial correlations of second moments for both the spot and futures in all the markets and serial correlations of first moments for both the spot and futures in all the markets except the sport market in Japan and the futures market in America and Japan. Therefore, it is appropriate to apply a GARCH model. Secondly, the results of the augmented Dickey-Fuller (ADF) test for the existence of a unit root are strongly rejected for log differences of both spot and futures prices, but cannot be rejected for the log level.

Model Specifications

Several studies have probed the optimal hedge ratio for stock market portfolios using stock index futures. While restricting the hedge ratio to be constant over time Engle (1982) and Bollersley (1986) estimated the optimal hedge ratio by modeling the distribution of stock index and futures changes within the generalized autoregressive conditional heteroscedastic (GARCH). Park and Switzer (1995) claim that if the joint distribution of stock index and futures prices is changing over time, estimating a constant hedge ratio may not be appropriate. Higgs and Worthington (2004) capture the time-varying second moments of the joint distribution and use an error correction model (ECM) when co-integration occurs between financial variables. Floros and Vougas (2006) claim the M-GARCH model provides greater variance reduction. In another words, more recent papers use a variety of advanced econometric methods (i.e., ECM, VECM or M-GARCH) with or without error correction terms to estimate the optimal hedge ratios. Especially, Hsu Ku et al. (2007) conclude that the inclusion of dynamic conditional correlations (DCC) in the GARCH model can better capture the frequent fluctuations in futures markets. In this study, we incorporate a bivariate DCC-GARCH model to estimate the hedge ratios.

In this article, we use the Engle's DCC-GARCH to estimate hedge ratios. Given the dynamic conditional correlation (DCC) model, the GARCH specification requires modeling the first two conditional moments of the bivariate distributions of s_t and f_t . In order to capture the time-varying variance and covariance, the second moment can be parameterized with a bivariate constant correlation GARCH (1,1) model. The bivariate distributions of spot and futures are assumed as follows:

$$s_t = \alpha_{0s} + \sum_{i=1}^{k} \alpha_{1is} S_{t-i} + \sum_{i=1}^{k} \alpha_{1if} F_{t-i} + \varepsilon_{st} \quad (1)$$

$$f_t = \alpha_{0f} + \sum_{i=1}^{k} \alpha_{2is} S_{t-i} + \sum_{i=1}^{k} \alpha_{2if} F_{t-i} + \varepsilon_{ft} \quad (2)$$

$$\begin{bmatrix} \varepsilon_{st} \\ \varepsilon_{ft} \end{bmatrix} \Big/ \Psi_{t-1} \sim N(0, H_t) \quad (3)$$

$$H_t = \begin{bmatrix} h_{s,t} & h_{sf,t} \\ h_{sf,t} & h_{f,t} \end{bmatrix} \quad (4)$$

$$h_{s,t} = v_{0s} + v_{1s} \varepsilon_{s,t-1}^2 + v_{2s} h_{s,t-1} \quad (5)$$

$$h_{f,t} = v_{0f} + v_{1f} \varepsilon_{f,t-1}^2 + v_{2f} h_{f,t-1} \quad (6)$$

$$h_{sf,t} = \rho_{sf,t} \sqrt{h_{s,t}} \sqrt{h_{f,t}} \quad (7)$$

$$\rho_{sf,t} = \frac{q_{sf,t}}{\sqrt{q_{ss,t} q_{ff,t}}} \quad (8)$$

$$q_{sf,t} = \bar{\rho}_{sf} + v(z_{s,t-1} z_{f,t-1} - \bar{\rho}_{sf}) + \delta(q_{sf,t-1} - \bar{\rho}_{sf}) \quad (9)$$

we define s_t and f_t as the change in the price of the spot and futures between time t and t+1, respectively; S_{t-1} and F_{t-1} are the log prices of the foreign currency in US dollars for immediate and future deliveries, respectively; Ψ_{t-1} is the information set at time t-1; the parameter $\rho_{sf,t}$ in equations (7) and (8) is the dynamic conditional correlations between the spot and futures returns and must be estimated; H_t in equation (4) is the conditional variance matrix at time t; the term ε_{st} and ε_{ft} in equations (1) and (2) are the error terms which are dependent on the information set Ψ_{t-1}; h_{st} and h_{ft} are conditional variance of spot and futures returns, respectively. Eventually, the conditional correlation $q_{sf,t}$ which was specified by Engle (2002) is employed in equation (9) where $\bar{\rho}_{sf}$, $z_{s,t} = \varepsilon_{st} / \sqrt{h_{s,t}}$ and $z_{f,t} = \varepsilon_{ft} / \sqrt{h_{f,t}}$ are the constant unconditional correlation between spot and futures markets and the standardized residuals of the spot returns and of futures returns, respectively (for details see Hsu Ku et al. (2007)). In order to estimate the DCC-GARCH framework, we can use the maximum likelihood method

(MLE). By way of MLE, we can obtain the estimates of $\rho_{sf,t}$, $\sqrt{h_{s,t}}$ and $\sqrt{h_{f,t}}$, thereby obtaining the optimal hedge ratio $b_t^* = h_{sf,t} / h_{f,t} = \rho_{sf,t}\sqrt{h_{s,t}} / \sqrt{h_{f,t}}$. In this paper, all the above methods of estimating the hedge ratios are applied and their effectiveness is compared in this paper.

MODEL ESTIMATION AND COMPARISON AMONG HEDGING MARKETS

The DCC-GARCH model developed by Engle (2002) is employed to capture dynamic conditional correlations as well as the long-run shared trends between spot and futures exchange returns. Table 2 summaries the results of the DCC-GARCH estimated for all spot and futures markets. According to Table 2, regarding the conditional variance, it is shown that estimations of all parameters are statistically significant except the v_{0s} in Germany and v_{2s} and v_{2f} in Japan. Estimations of the parameters δ in the conditional correlations are statistically significant in Canada and Germany under significance at the 10% level and statistically significant in Hong Kong under significance at the 5% level.

It is shown that the persistence of the conditional correlations is significant between the spot and futures in Canada, Germany and Hong Kong. And estimations of the parameters γ in the conditional correlations are statistically significant in Hong Kong under significance at the 10% level and statistically significant in America, Britain, Germany and Japan at the 5% level except for Canada which is not significant at the 10% level. It is shown that the persistence of the conditional correlations in the standardized residuals is all statistically significant except for in Canada.

The results of the LB(2) and $LB(2)^2$ statistics show that all LB(2) and $LB(2)^2$ statistics for the standardized residuals and standardized squared residuals show no serial correlations between the spot and futures in America, Britain, Canada, Germany, Hong Kong and Japan under significance at the 5% level. It is shown that the design of the DCC-GARCH model has dealt with the condition of the non-normal distributions with fatter tails.

Thus, the results in Table 2 suggest that the DCC-GARCH model is appropriate. We employ $b_t^* = \rho_{sf,t}\sqrt{h_{s,t}} / \sqrt{h_{f,t}}$ to obtain optimal hedge ratios for the DCC-GARCH models, respectively, and then calculate the average of the hedge ratios in every market.

Table 3 presents the number, average, variance and t-value of the optimal hedge ratio in America, Canada, Britain, Germany, Hong Kong and Japan. In each market, we divided the full period April 2006 to March 2008 into two sub-periods in accordance with the serious subprime mortgage crisis which began when the New Century Financial Corporation collapsed. One sub-period is from April 2006 to March 2007, the other is from April 2007 to March 2008. In every market, for the sub-period April 2006 to March 2007 we observed 259 samples to calculate the hedge ratios and for the sub-period (April 2007 to March 2008) 261 observed samples are used to calculate the hedge ratios.

For the full period (April 2006 to March 2008) the average hedge ratio of 1.0164 for Britain was the highest hedge ratio in all the markets and the only market whose average hedge ratio was more than one. And the average hedge ratios of 0.9924 for Germany, 0.9735 for America, 0.9593 for Canada, and 0.9511 for Japan are the second, third, fourth and fifth highest, respectively. The average hedge ratio of 0.9204 for Hong Kong is the lowest. In sum, Britain and Germany in the Europe markets belong to the higher hedge ratio category. Hong Kong and Japan in the Asian markets belong to the lower hedge ratio category.

Table 2: The Hedge Ratio Results of Six Markets-MLE of DCC-GARCH Model

$$s_t = \alpha_{0s} + \sum_{i=1}^{k} \alpha_{1is} S_{t-i} + \sum_{i=1}^{k} \alpha_{1if} F_{t-i} + \varepsilon_{st} \qquad f_t = \alpha_{0f} + \sum_{i=1}^{k} \alpha_{2is} S_{t-i} + \sum_{i=1}^{k} \alpha_{2if} F_{t-i} + \varepsilon_{ft}$$

$$h_{s,t} = v_{0s} + v_{1s} \varepsilon_{s,t-1}^{2} + v_{2s} h_{s,t-1} \qquad h_{f,t} = v_{0f} + v_{1f} \varepsilon_{f,t-1}^{2} + v_{2f} h_{f,t-1}$$

$$q_{sf,t} = \bar{\rho}_{sf} + v(z_{s,t-1} z_{f,t-1} - \bar{\rho}_{sf}) + \delta(q_{sf,t-1} - \bar{\rho}_{sf}) \qquad h_{sf,t} = \rho_{sf,t} \sqrt{h_{s,t}} \sqrt{h_{f,t}}$$

$$H_t = \begin{bmatrix} h_{s,t} & h_{sf,t} \\ h_{sf,t} & h_{f,t} \end{bmatrix} \qquad \begin{bmatrix} \varepsilon_{st} \\ \varepsilon_{ft} \end{bmatrix} \Big/ \Psi_{t-1} \sim N(0, H_t)$$

Parameter Garch (*,*)	America Garch (1,1)	Britain Garch (1,1)	Canada Garch (1,1)	Germany Garch (1,1)	Hong Kong Garch (1,1)	Japan Garch (1,1)
Conditional Variance						
v_{0s}	0.0000043 (4.409) **	0.0000050 (3.896) **	0.0000100 (3.935) **	0.0000042 (1.732)	0.0000018 (2.137) **	0.0001230 (8.772) **
v_{1s}	0.0940000 (4.792) **	0.1830000 (6.484) **	0.0870000 (4.493) **	0.1790000 (0.594) **	0.0440000 (4.584) **	0.2540000 (4.111) **
v_{2s}	0.8600000 (33.130) **	0.7920000 (27.830) **	0.8090000 (20.821) **	0.8050000 (28.595) **	0.9510000 (77.725) **	0.0280000 (0.447)
v_{0f}	0.0000064 (5.362) **	0.0000047 (3.969) **	0.0000123 (3.467) **	0.0000036 (2.013) **	0.0000022 (2.421) **	0.0001510 (8.267) **
v_{1f}	0.1180000 (5.189) **	0.1780000 (0.471) **	0.0870000 (4.186) **	0.1680000 (6.583) **	0.0440000 (5.093) **	0.2380000 (4.071) **
v_{2f}	0.8150000 (26.601) **	0.7950000 (28.081) **	0.7910000 (16.073) **	0.8180000 (32.065) **	0.9500000 (90.613) **	-0.0620000 (-0.836)
Conditional correlation						
γ	0.1000000 (2.922) **	0.1770000 (4.571) **	0.0260000 (1.088)	0.3990000 (8.914) **	0.0600000 (1.784) *	0.1930000 (4.577) **
δ	0.1230000 (0.511)	0.0890000 (0.582)	0.6340000 (2.020) *	0.1650000 (2.023) *	0.1470000 (0.534) **	0.0330000 (0.138)
LB Tests For 2th-Order Serial Correlation of Standardized Residuals and Standardized Squared Residuals						
Spot Q(2)	0.727	0.185	0.516	0.175	0.227	0.743
Spot Q^2 (2)	1.651	0.875	0.106	0.130	3.944	3.088
Futures Q(2)	1.031	0.355	0.621	2.990	0.033	0.956
Futures Q^2 (2)	0.655	1.242	0.024	0.176	4.922	3.254

*Notes:**and* represent significance at the 1% and 5% levels, respectively. Q (2) and Q^2 (2) are the LB tests for the 2 nd-order serial correlation of standardized residuals and standardized squared residuals, respectively. The parameters of γ and δ are the coefficients included in Equation 9. The regression DCC-GARCH model contains all Equations 1-9.*

The remaining markets such as the American and Canadian ones in the North American market are in the middle hedge ratio category. With regard to the variance of the hedge ratio, for the full period (April 2006 to March 2008), the variance of the hedge ratio was higher in America and Germany and lower in Canada and Hong Kong. Moreover, the variance of the hedge ratio in both Britain and Japan were in the middle. Since this paper examines whether the hedge ratios have changed after the serious subprime mortgage crisis, Table 3 illustrates the hedge ratios comparison for the two sub-periods. In each market the hedge ratios after April 2, 2007 are bigger than the hedge ratios before April 2, 2007.

Especially, the t values are significant at the 5% levels in the American, British and Hong-Kong markets. The results show that investors were more risk-averse during the serious subprime mortgage crisis. Moreover, this result is consistent with the empirical findings of Lien (2005). In other words, it is shown that when the investors are in the asymmetry return of the financial assets, especially as they were in the U.S. "subprime mortgage crisis", the decision makers not only generate strong reflections but also are inclined to weigh adverse evidence more heavily.

Figures 1- 6 display the time-varying hedge ratio for each market over the two sub-periods (i.e. the period before and after the serious subprime mortgage crisis began). Though the hedge ratio of Germany has a slight dropping tendency after November 2007, the hedge ratio has a rising tendency in all six markets when the serious subprime mortgage crisis began. The condition is consistent with the results in Table 3.

Table 3: The Number, Average and Variance and T-Value of Optimal Hedge Ratios in America, Britain, Canada, Germany, Hong-Kong, and Japan

Market	Number of hedge ratio 2006/04~2007/03	Number of hedge ratio 2007/04~2008/03	Average of hedge ratio 2006/04~2008/03	Average of hedge ratio 2006/04~2007/03	Average of hedge ratio 2007/04~2008/03	Variance of hedge ratio 2006/04~2008/03	Variance of hedge ratio 2006/04~2007/03	Variance of hedge ratio 2007/04~2008/03	$H_0: \mu_1 = \mu_2$ $H1: \mu_1 \neq \mu_2$ t-value
American	259	261	0.9735	0.9585	0.9884	0.0026	0.0015	0.0032	7.0707 **
British	256	261	1.0164	1.0081	1.0246	0.0018	0.0015	0.0020	4.5102 **
Canadian	259	261	0.9593	0.9575	0.9610	0.0009	0.0008	0.0010	1.3217
German	259	261	0.9924	0.9891	0.9957	0.0029	0.0027	0.0030	1.4187
Hong-Kong	259	261	0.9204	0.9163	0.9245	0.0005	0.0019	0.0012	2.6927 **
Japanese	259	261	0.9511	0.9491	0.9531	0.0015	0.0010	0.0020	1.1800

*Notes: **and* represent significance at the 1% and 5% levels, respectively. μ_1 is the average hedge ratio from April 2006 to March 2008 and μ_2 is the average hedge ratio from April 2006 to March 2008.*

Figure 1: Time-Varying Hedge Ratio in DCC-GARCH Estimations for America

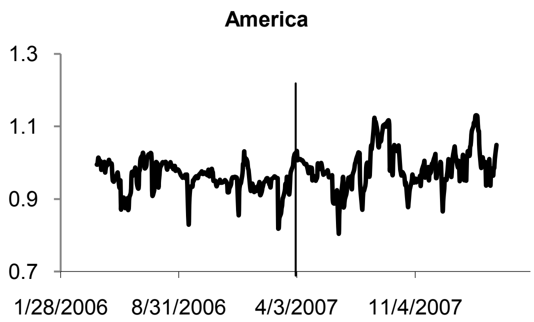


Figure 2: Time-Varying Hedge Ratio in DCC-GARCH Estimations for Britain

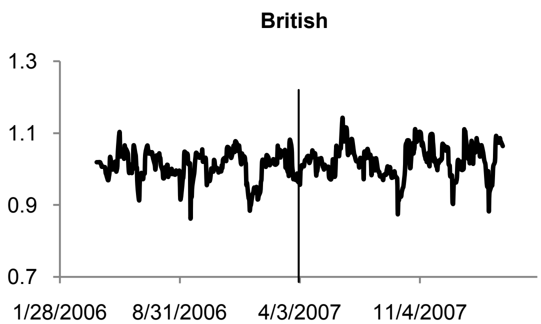


Figure 3: Time-Varying Hedge Ratio in DCC-GARCH Estimations for Canada

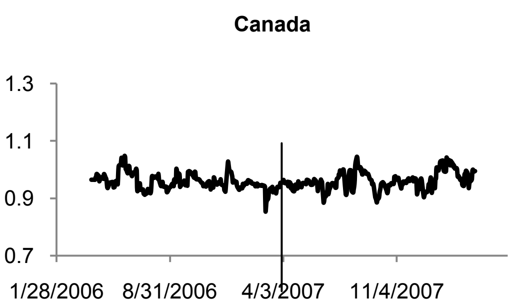


Figure 4: Time-Varying Hedge Ratio in DCC-GARCH Estimations for Germany

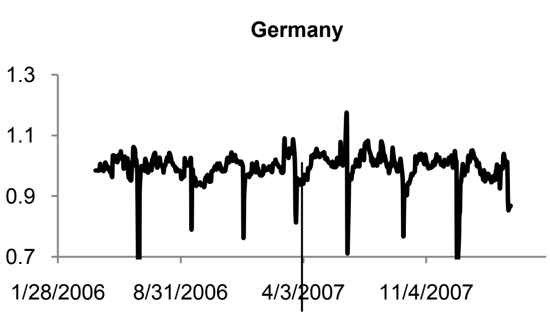


Figure 5: Time-Varying Hedge Ratio in DCC-GARCH Estimations for Hong-Kong

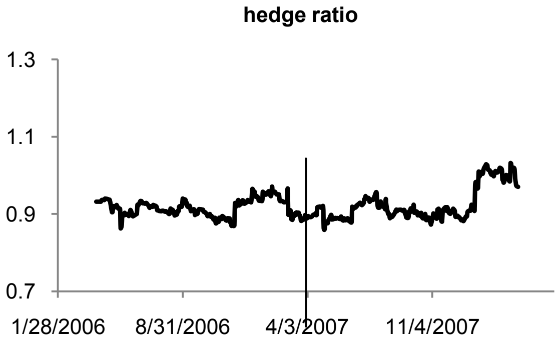
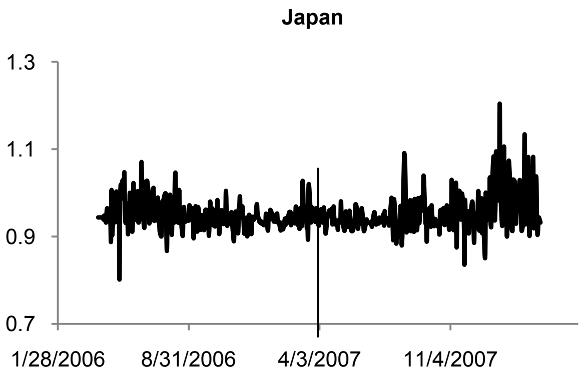


Figure 6: Time-Varying Hedge Ratio in DCC-GARCH Estimations for Japan



More specifically, our results present at least four important implications for financial market investors who want to reduce portfolio risk using futures contracts. First, it is shown that when the investment market is in the asymmetry return of the financial assets, especially as when in the U.S. "subprime mortgage crisis", the decision makers not only generate strong reflections but also are inclined to weigh adverse evidence more heavily. Secondly, the hedges ratio is in accordance with asymmetric volatility of the risk, so the hedge ratio has an impact on investment decision makers. Thirdly, with regard to the risk arbitrage, the main goal for hedging is to minimize the variability of return on investment. When a financial crisis happens the hedge ratios are expected, in general, to get bigger. The investors can employ hedge ratios (the measure of adopting a long-short position) to reduce the variance of risk and to make profits. Fourthly, our article also shows how the hedging methodologies can be evaluated in a modern risk management background, using a technique based on the estimation of value at risk.

CONCLUSIONS

During the U.S. subprime mortgage crisis, large financial institutions have collapsed or been bought out. Especially, after the New Century Financial Corporation bankruptcy on April 2, 2007, many problems in subprime lending have emerged and the global financial markets have since felt its effects continuously. This paper investigates the hedge ratio changes in America, Britain, Canada, Germany, Hong Kong and Japan. We used the DCC-GARCH of Engel (2002) to estimate the hedge ratio for the period from 3 April 2006 to 31 March 2008. The data employed in this paper imply non-normal distributions and serial correlations for both the spot and futures in all the markets, so the DCC-GARCH model is applied.

It is shown that the serious subprime mortgage crisis led to a greater average hedge ratio. The empirical results show that investors were more conservative during the time the serious subprime mortgage crisis began. In other words, it is shown that when the investors are in the asymmetry return of the financial assets, especially as in the U.S. "subprime mortgage crisis", the decision makers not only generate strong reflections but also are inclined to weigh adverse evidence more heavily. This result is consistent with the empirical findings of Lien (2005).

While the major purposes of this paper have been fulfilled, further research problems remain unsolved. For instance, this study has only used the daily data for the period from 3 April 2006 to 31 March 2008. It could incorporate the intra-day data or a wider event period to get a more exact conclusion. Besides, future research could also use different markets, frameworks or ordinances or fit different models to explore the changing hedge ratios.

REFERENCE

Balaban, Ercan and Bayar, Alsi, (2005), Stock return and volatility：empirical evidence from fourteen countries, Applied Economics Letters, 12, 603-611.

Blasco, N., Corredor, P. and Santamaria, R., (2002), Is bad news cause of asymmetric volatility response? A note, Applied Economics, 34, 1227-1231.

Brooks, Chris, Henry, Olan T. and Persand, Gita, (2002), The effect of asymmetries on optimal hedge ratios, Journal of Business, 75 (2).

CNN Money.com, (2007), New Century files for Chapter 11 bankruptcy, CNN Money.com, Retrieved April 2, 2007.
(http://money.cnn.com/2007/04/02/news/companies/new_century_bankruptcy/)

Engle, Robert F., (1982), Autoregressive conditional heteroskedasticity with estimates of the variance of United Kingdom inflation, Econometrica, 50, 987-1007.

Engle, Robert F., (2002), Dynamic conditional correlation: a simple class of multivariate generalized autoregressive conditional heteroskedasticity models, Journal of Business and Economic Statistics, 20(3), 339-350.

Engle, R. F. and Granger, C. W. J., (1987), Co-integration and error correction: representation, estimation and testing, Econometrica, 55(2), March, 251-276.

Engle, Robert F. and Kroner, Kenneth F., (1995), Multivariate simultaneous generalized ARCH, Econometric Theory, 11(1), Mar, 122-150.

Floros, Christos and Vougas, Dimitrios V., (2006), Hedging effectiveness in Greek Stock Index Futures Market, 1999-2001, International Research Journal of Finance and Economics, 5, 1450-2887.

Higgs, Helen and Worthington, Andrew C., (2004), Transmission of returns and volatility in art markets: a multivariate GARCH analysis, Applied Economics Letters, 11(4), 217-222.

Hsu Ku, Yuan-Hung, Chen, Ho-Chyuan and Chen, K. H., (2007), On the application of the dynamic conditional correlation model in estimating optimal time-varying hedge ratios, Applied Economics Letters, 14, 503-509.

Kian, Teng Kwek and Kuan, Nee Koay, (2006), Exchange rate volatility and volatility asymmetries：an application to finding a natural dollar currency, Applied Economics, 38, 307-23.

Lee, Hsiang-Tai, (2008), The effects of asymmetries and regime switching on optimal futures hedging, Applied Financial Economics Letters, 4, 133-136.

Liau, Yung-Shi and Yang, Jack J. W., (2008), The mean/volatility asymmetry in Asian stock markets, Applied Financial Economics, 18(5), 411-419.

Lien, Donald and Li Yang, (2007), Asymmetric effect of basis on dynamic futures hedging: empirical evidence from commodity markets, Journal of Banking & Finance, 32, 187-198.

Line, Donald, Tse, Y. K. and Tsui, Albert K. C., (2002), Evaluating the hedging performance of the constant-correlation GARCH model, Applied Financial Economics, 12, 791-798.

Line, Donald, (2005), A note on asymmetric stochastic volatility and futures hedging, The Journal of Futures Markets, 25(6), 607-612.

Park, Tea H. and Switzer, Lorne N., (1995), Time-varying distributions and the optimal hedge ratios for stock index futures, Applied Financial Economics, 5, 131-137.

Yang, Jack J. W. and You, Shwu-Jen, (2003), Asymmetric volatility：pre and post financial crisis, Journal of Management, 20, 797-819.

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