Volatility Dynamics in Dubai Gold Futures Market

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Abstract

This study explores the volatility dynamics of gold futures traded on the Dubai Gold and Commodities Exchange. We test the effect of margin trading reform implemented by the Emirates Securities and Commodities Authority on the dynamic relationship between the daily gold futures volatility and volume, open interest, and futures returns. We find that volatility dynamics with respect to volume and return are consistent with other futures markets patterns but not with the open interest, especially after the reform. Moreover, the reform has decreased trading volume and open interest and increased gold futures volatility.

Keywords: Volatility; Dubai gold futures; Margin trading

JEL classification: C30; G10

I. Introduction

The Dubai Gold and Commodities Exchange (DGCX) was established in 2005 and is the first international online derivatives market in the Middle East. An electronic trading platform allows members around the world to direct market assess. DGCX is jointly owned by the Dubai government's Dubai Multi Commodities Center (DMCC), Financial Technologies (India) Limited, and the Multi Commodity Exchange of India Limited (MCX). DGCX trades futures contracts on gold, silver, fuel oil, steel, freight rates, cotton and three major currencies. Futures options contracts are traded for gold only.

Dubai, the "City of Gold", has historically been a major trading centre for spot gold, with the Dubai Multi Commodities Center (DMCC) estimating that in 2006, Dubai's import and export of gold amounted to 489 and 274 tonnes, respectively. The gold futures contract began trading on November 22, 2005, and the gold options on futures were introduced on April 30, 2007. The trading volume of the contract has been rising steadily with a total of 71,316 contracts (representing USD 1.5 billion in value) traded in March of 2010 (representing an average of around 4,000 contracts a day). The contracts are traded on the DGCX's electronic platform and continuously from Monday through Friday between 8:30 am and 11:30 pm Dubai time, corresponding to 12.30 am to 4:30 pm New York time, 4:30 am to 7:30 pm London time and 12:30 pm to 3:30 am Singapore time. Hence the operating hours of the market in Dubai overlap exchanges in other major global centres. The size of the futures contract is 32 troy ounces (1 kg) of 0.995 purity according to the Dubai Good Delivery Standard. Delivery is made with Dubai Gold Receipt. The contract matures in bi-monthly intervals, i.e., February, April, June, August, October and December, and the prices are quoted in USD (per troy ounce).

DGCX is regulated by the Emirates Securities and Commodities Authority (ESCA) which is the regulatory authority for both the Dubai Financial Market and the Abu Dhabi Securities Market. ESCA has implemented several regulatory reforms that have impacted the operations of DGCX. These have been aimed at improving the efficiency of the market, to protect investors from unfair and incorrect practices and to provide regularity and stability for market trading with a view to ensuring smooth and prompt liquidation of positions. Such reforms will be taken into consideration to test their effects on the volatility dynamics of the Dubai gold futures market.

In the literature little attention has been paid to emerging markets with most attention paid to the effects of general regulations in the US market (see for example Ma et al., 1993, and Yang et al., 2001). An exception to this is a study by Chan et al. (2004) which has addressed the futures markets in China. There is a large body of literature that has looked at the determinants of the volatility of futures prices (see for example Najand and Yung, 1991, Foster, 1995, and Fung and Patterson, 2001). One area of this research focuses on the volatility of commodity futures. An early study by Garcia et al. (1986) investigated the impact of lagged volume in five commodity futures contracts on volatility and found significant positive relationships. Bessembinder and Seguin (1993) examined the link between volatility, volume and open interest of contracts. Their results suggested that trading volume had a significant positive effect on volatility, while open interest had a significant negative effect. The study by Chan et al. (2004) examined the daily volatility of four futures contracts on Chinese futures exchanges and found different patterns of volatility under different government regulatory reforms. Their results for volume and open interest effects are consistent with the literature, with positive and negative relationships respectively. Regulation is also shown to amplify the effects of these factors. The study also reports that both positive and negative returns are positively related to volatility, with negative returns associated with a more significant impact.

In this paper, we examine the volatility dynamics of Dubai gold futures with respect to changes in variables such as volume, open interest, and futures returns. The study also seeks to shed light on the impact of margin trading reform implemented by ESCA on the volatility dynamics of Dubai gold futures. The study will be of practical benefit for the evolving finance industry in the United Arab Emirates (UAE) and the region generally. Relatively, little analysis of financial markets in the Gulf region has been undertaken to date and no study has been conducted of Dubai futures markets. It is expected that this investigation will provide a platform for further on-going research in other derivatives markets which have been recently established in the UAE. Moreover, the relevance of this study stems from the importance policymakers and regulators place on improving the effciency of financial markets and from the need for market participants to improve their understanding of emerging future markets.

The rest of the paper proceeds as follows. Section 2 presents the framework within which we conduct our empirical estimation. Section 3 describes our data and presents our results and Section 4 checks the robustness and consistency of our results. We conclude in Section 5.

II. Methodology

To investigate the dynamics of Dubai gold futures volatility, we first measure the daily volatility of futures prices using two approaches of extreme-value method such as Parkinson (1980) and Rogers and Satchell (1991). The Parkinson measure uses daily high and low futures prices and Rogers-Satchell measure incorporates daily opening and closing futures prices in addition to Parkinson's instruments. Respectively, they go as follows:

$$V_t = \frac{1}{4\log 2}\left[\log(\frac{High_t}{Low_t})\right]^2, \tag{1}$$

$$V_t = \left[\log(\frac{High_t}{Open_t})\log(\frac{High_t}{Close_t})\right] + \left[\log(\frac{Low_t}{Open_t})\log(\frac{Low_t}{Close_t})\right] \tag{2}$$

Next, we examine how gold futures volatility relates to volume, open interest, and positive and negative returns. We envisage using lagged volume as an indicator of flow of information, to avoid simultaneity relationships with volatility, and open interest as an indicator of market depth. Chan et al. (2004) use open interest as level of hedging activities that could mitigate futures volatility. In addition, to test whether there is evidence of asymmetric effects of returns on volatility, we include the positive and negative returns in the volatility specification. The regression specification is as follows:

$$V_t = \alpha_0 + \alpha_1 X_{1t-1} + \sum_{i=2}^{4} \alpha_{it} X_{it} + e_t, \tag{3}$$

where X1t−1 is the log trading volume of the futures contract at time t − 1, X2t is the log open interest, X3t is the positive future returns at time t equivalent to max[0, Rt]; and X4t is the negative future returns at time t equivalent to min[0, Rt], with Rt being the daily futures returns measured as the logarithmic difference between two consecutive futures prices.

Specification (3) tests a number of hypotheses. First, we can see whether the effect of volume on volatility is positive, α1 > 0. Second, we test the market depth effect on volatility, α2 < 0. Finally, we test whether good news and bad news have effects on volatility by checking respectively the coeffcient signs as α3 > 0and α4 < 0.

We also directly addresses the regulatory reform concerning margin trading undertaken by the Emirates Securities and Commodities Authority during the study period, since the inception of the futures contract. We conduct our analysis over the entire sample period as well as over two sub-periods that are pre and post reform. The reform concerns changes in the regulations on margin trading that took effect in June 2008. Among many other decisions, ESCA has set an initial margin of not less than 50% of the market value of the securities traded on margin, as well as a maintenance margin of not less than 25% of the same traded market securities. In addition, DGCX imposes an extra margin call on all open positions when volatility is high.

Our proposition is that the margin trading reform reduces the trading volume and open interest and has an impact on gold futures price volatility as through changes in market liquidity and depth. We expect that the volatility dynamics represented by Eq.(3) will display different results before and after the reform. Such proposition has been highlighted by Tesler (1981) who showed that an increase in cost of trading may lower the volume and open interest and hence liquidity, which may, in turn, increases future price volatility.

The regression technique adopted for the analysis is the generalized method of moments (GMM) of Hansen (1982). This approach has been widely used in the literature to study the determinants of futures volatility. For a recent example, see Holmes and Tomsett (2004). This technique addresses the issue of time-varying conditional heteroskedasticity as well as the presence of any unconditional distributional properties. It also handles contemporaneous relationships between the variables of interest and provides autocorrelation consistent estimates. In considering both heteroskedasticity and autocorrelation, the Newey-West (1987) method for selecting the bandwidth is employed. We also take instruments from the independent variables and test whether specification (3) is exact using the J-statistic to test for over-identifying restrictions. Finally, both volatility measures are used to check the robustness of the results.

III. Data and Results

The data consists of daily data of gold futures contracts traded on the Dubai Gold and Commodities Exchange. These contracts are the most active ones in Dubai. The sample period covers the contracts traded from May 2007 till June 2010. The data is collected from the DGCX and includes daily high future price, daily low price, opening price, closing price, trading volume and opening interest.

Table 1 provides descriptive statistics for the full sample and the two sub-periods. A preliminary investigation of the raw data reveals that the average daily return is positive as seen by the difference between the mean of positive returns and the absolute mean of negative returns. Post-reform trading volume and open interest have decreased comparing to pre-reform figures. The volatility, measured by both Parkinson and Rogers and Satchell, has increased in magnitude (around 0.01%) after the margin trading reform. This finding goes in line with Tesler's (1981) argument that an increase in margin requirements may serve to increase futures price volatility if market liquidity is reduced.

Table 2 displays the GMM estimation results using both Parkinson (Panel A) and Rogers-Satchell (Panel B) volatility measures. Over the full period of the study the results indicate a negative relation between negative futures returns and volatility and a positive relation between positive returns and volatility. This is in line with the findings in the literature. There is an asymmetric effect observed, however, when considering the significance of the coefficients of positive and negative returns. The absolute magnitude of positive returns is higher than the negative returns, which does not conform to the evidence from developed markets, but is similar to the results found for the Chinese market by Chan et al. (2004). Unexpectedly, the opening interest coeffcient is significant with a positive sign but this effect may be due to influences due to the selection of the full period, masking sub-period effects. Finally, and in line with the expected results from the literature, the volume of trades is positively related to gold futures volatility. These results are similar for both measures of volatility. Nevertheless, the adjusted R^2 is higher using the Parkinson volatility measure which provides support for this approach in modelling the daily volatility of gold futures in this study. Moreover, the J-statistic is low enough to reject the hypothesis of over-identifying restrictions imposed in the regression.

In looking at the two sub-periods, the asymmetric effect of returns is again seen to be significant with respect to volatility. As observed for the full period, the magnitude in absolute terms is higher for the positive returns than for the negative returns. It seems that market participants react more to good news than bad news. The effect of volume on volatility, although positive, becomes insignificant after the reform. This is most likely due to the fact that the flow of information was improved and that speculation by day traders had lost momentum.

Open interest is seen to be negatively related to volatility pre-reform, as expected, but exhibits a positive relationship post-reform. It would appear that the level of hedging activity mitigated the volatility during the earlier period, but that the regulation on margin trading in 2008 resulted in the positive relationship between open interest and gold futures price volatility. This signal of a decrease in the market depth is also equivalent to a decrease in liquidity and consequently has increased price volatility. Given that DGCX imposes an extra margin call on all open positions in time of high volatility, the resultant increase in cost seems to make hedgers not hold their positions for long, with the result that their investments become speculative positions rather than hedge positions. This in turn could not contribute to stabilizing Dubai gold futures prices.

Overall, it appears that gold futures volatility has increased significantly due to the implementation of the margin trading regulatory reform. Market dynamics with respect to volume and return are consistent with other futures markets patterns but not with the open interest, especially after the reform took effect. This can be a feature of an emerging future market such as the one of Dubai.

IV. Additional Robustness Checks

Having used unconditional volatility estimates, we could think of presenting the results with conditional volatility such as the GARCH-type to see how the basic investigation of the analysis could be altered. We first assume that the returns follow a martingale with drift and GARCH(1,1) volatility specification, then we extract the conditional GARCH-type volatility and run a regression on the variables of interest. The following model highlights this specification:

$$R_t = \mu + u_t, \text{ and } u_t \mapsto iid(0, \sigma_t^2) \quad (4)$$
$$\sigma_t^2 = a + b\sigma_{t-1}^2 + cu_{t-1}^2.$$

The assumption of i.i.d. innovations is almost certain to be violated but may not limit the purposes of the analysis. Nevertheless, and being aware of the non-normality of the innovations, we assume Student-t distribution of the return innovations. Table 3, Panel A, displays the estimation results and shows significant ARCH and GARCH effects. This tells that there is volatility persistence in the Gold Furures returns indicating that large volatility increases do last at least the following day. Panel B of Table 3 shows the results of the estimation of Eq. (3) using the conditional volatility extracted from specification (4). The results confirm the inferences obtained from the analysis conducted with the unconditional volatilities with one exception that is the significant negative relationship between the lagged trading volume and the volatility.

Furthermore, we undertake an additional robustness check by separating out specific gold futures contracts traded within the study period to highlight the effect of margin trading switching regime. To make sure accounting for the margin trading reform effect, we choose the contracts that are maturing in August 2008 and August 2009. The starting trading dates of these contracts are, respectively, August 8, 2007, and August 8, 2009. In the DGCX, the last trading day is the business day six days prior to delivery; therefore the last trading days for the contracts are respectively, July 31, 2008, and July 31, 2009.

Table 5 displays the GMM estimation results using only Parkinson measure of volatility. In every future contract, we find that the asymmetries in the return effect on volatility are statistically significant. We also find no effect of open interest on the volatility dynamics in August 2009 contract, similar to previous post-reform results. In addition, and consistent with the previous results, the patterns found in the volatility with respect to volume, open interest, and returns are similar to the ones found using the complete time series.

V. Conclusion

This paper investigates factors influencing the volatility of the gold futures contracts traded on the Dubai Gold and Commodities Exchange (DGCX). The study looks at the period May 2007 to June 2010. The effect on market volatility of the margin trading reform introduced in June 2008 is also considered.

In line with expectations, the volume of trading, which can be considered a proxy for speculative market activity, is observed to be positively linked to volatility. The effect of open interest, a measure of market depth or hedging activity, is shown to vary over the two sub-periods considered. Pre-reform, the results indicate a negative relationship with volatility in line with expected findings. However, a positive relationship is evident in sub-period after the reform. The results also suggest that the regulation of margin trading has the effect of raising market volatility.

Overall, the study also found, in line with the literature, that there was an asymmetric effect of returns on volatility. Negative returns were associated with lower volatility while positive returns were positively related to volatility. However, an unexpected result was that positive returns appear to have a greater impact on volatility than negative returns. There appears to be more reaction to good news than bad.

Future research avenues can be addressed such as testing the predictive power and information content of gold future volatility relative to other measures such as option implied volatility in explaining the future realized volatility.

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Table 1: Descriptive Statistics of Dubai gold futures contracts

	Full period		Pre-reform		Post-reform		
Variable	Mean	S.D.	Mean	S.D.	Mean	S.D.	T-stat
Daily return (%)	0.0372	1.7837	0.0542	1.6850	0.0280	1.8357	0.3341
Daily positive return (%)	0.5940	0.9700	0.5336	0.8263	0.6267	1.0397	−3.37986*
Daily negative return (%)	-0.5570	1.2565	-0.4790	1.2839	-0.5990	1.2400	3.2405*
Volume	1262.74	1340.63	1471.64	1560.71	1151.66	1249.28	4.146*
Open interest	1037.08	962.54	1560.71	1247.36	956.41	118.48	12.9525*
Parkinson volatility (%)	0.0171	0.0314	0.0107	0.0136	0.0205	0.0372	−8.6331*
Rogers-Satchell volatility (%)	0.0157	0.0281	0.0098	0.0109	0.0188	0.0336	−8.7634*
Observations	1494		525		969		

Notes: The full period covers the contracts traded from May 2007 till June 2010. Daily positive future returns are measured as max$[0, R_t]$, and daily negative future returns are measured as min$[0, R_t]$, with R_t being the daily futures returns measured as the logarithmic difference between two consecutive futures prices. Parkinson volatility is measured as $V_t = \frac{1}{4\log 2}\left[\log\left(\frac{\text{High}_t}{\text{Low}_t}\right)\right]^2$, and Rogers-Satchell volatility as $V_t = \left[\log\left(\frac{\text{High}_t}{\text{Open}_t}\right)\log\left(\frac{\text{High}_t}{\text{Close}_t}\right)\right] + \left[\log\left(\frac{\text{Low}_t}{\text{Open}_t}\right)\log\left(\frac{\text{Low}_t}{\text{Close}_t}\right)\right]$. S.D. stands for standard deviation. The T-stat assesses the statistical significance of the difference in means between the period before reform and the period after reform. * denotes 1% significance level, ** denotes 5% significance level, and *** denotes 10% significance level.

Table 2: GMM Estimation for Gold Futures Volatility

Panel A: Parkinson volatility measure (%)

	Full period		Pre-reform		Post-reform	
Coefficient	Value	t-stat	Value	t-stat	Value	t-stat
α_0	-0.0024	−3.9497*	-0.0079	−2.3913**	-0.0350	−3.8855*
α_1	0.0027	2.9910*	0.0049	6.2698*	0.0015	1.2031
α_2	0.0015	1.8875***	-0.0024	−2.8830*	0.0042	4.0162*
α_3	2.5110	4.6761*	0.4349	2.8552*	1.9503	5.5794*
α_4	-0.9670	−3.3574*	-0.3729	−1.7011***	-1.2743	−3.4854*
Adjusted R^2	0.2594		0.0542		0.3350	
J-statistic	9.30E-29		1.33E-27		6.16E-30	
Observations	1494		525		969	

Panel B: Rogers-Satchell volatility measure (%)

	Full period		Pre-reform		Post-reform	
Coefficient	Value	t-stat	Value	t-stat	Value	t-stat
α_0	-0.0115	−3.6648*	-0.0020	-0.6328	-0.0186	−2.6100**
α_1	0.0024	3.7412*	0.0054	6.5869*	0.0004	0.3229
α_2	0.0010	1.7846***	-0.0034	−3.1968*	0.0044	3.7086*
α_3	0.9769	4.4988*	0.2405	1.7725***	0.7452	4.1948*
α_4	-0.3937	−2.8307*	-0.1273	-1.4194	-0.5016	−2.5514**
Adjusted R^2	0.0583		0.0451		0.0862	
J-statistic	3.39E-30		5.91E-29		3.39E-29	
Observations	1494		525		969	

Notes: α_1 is the coefficient of log trading volume of the futures contract at time $t-1$, α_2 is the coefficient of log open interest, α_3 is the coefficient of positive future returns at time t equivalent to $\max[0, R_t]$; and α_4 is the coefficient of negative future returns at time t equivalent to $\min[0, R_t]$, with R_t being the daily futures returns measured as the logarithmic difference between two consecutive futures prices. * denotes 1% significance level, ** denotes 5% significance level, and *** denotes 10% significance level.

Table 3: Estimation for Gold Futures GARCH Volatility

Panel A: GARCH(1,1) Estimation

Coefficient	Value	t-stat
μ	0.0011	3.718*
a	1.12E-06	1.755***
b	0.0187	4.326*
c	0.9772	188.166*

Panel B: Estimation using GARCH Volatility

	Full period		Pre-reform		Post-reform	
Coefficient	Value	t-stat	Value	t-stat	Value	t-stat
α_0	0.0188	34.1178*	0.0162	16.4761*	0.0204	30.5047*
α_1	-0.0010	−9.0358*	-0.0005	−2.3564**	-0.0015	−11.5113*
α_2	0.0005	4.3542*	0.0003	1.4133	0.0009	6.0287*
α_3	0.1127	8.4435*	0.1003	3.6913*	0.1092	7.3992*
α_4	-0.0568	−5.4625*	-0.0183	-1.0213	-0.0731	−5.8942*
Adjusted R^2	0.1133		0.0359		0.1983	
Observations	1494		525		969	

Notes: Coefficients a and b are respectively for the ARCH and GARCH effects. α_1 is the coefficient of log trading volume of the futures contract at time $t-1$, α_2 is the coefficient of log open interest, α_3 is the coefficient of positive future returns at time t equivalent to max[0, R_t]; and α_4 is the coefficient of negative future returns at time t equivalent to min[0, R_t], with R_t being the daily futures returns measured as the logarithmic difference between two consecutive futures prices. * denotes 1% significance level, ** denotes 5% significance level, and *** denotes 10% significance level.

Table 4: GMM Estimation for Gold Futures Volatility of Some Futures Contracts

Parkinson volatility measure (%)				
	August 2008		August 2009	
Coefficient	Value	t-stat	Value	t-stat
α_0	-0.0155	-2.5378^{**}	-0.0185	-1.8596^{***}
α_1	0.0014	2.4396^{**}	0.0021	1.2390
α_2	-0.0016	-1.6859^{***}	0.0010	2.0713^{**}
α_3	1.8590	8.5329^{*}	1.3621	5.7375^{*}
α_4	-1.1811	-9.5863^{*}	-0.8702	-5.0278^{*}
Adjusted R^2	0.5796		0.5782	
J-statistic	3.87E-31		1.83E-29	
Observations	87		63	

Notes: α_1 is the coefficient of log trading volume of the futures contract at time $t-1$, α_2 is the coefficient of log open interest, α_3 is the coefficient of positive future returns at time t equivalent to max[0, R_t]; and α_4 is the coefficient of negative future returns at time t equivalent to min[0, R_t], with R_t being the daily futures returns measured as the logarithmic difference between two consecutive futures prices. * denotes 1% significance level, ** denotes 5% significance level, and *** denotes 10% significance level.