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An investigation of the Causality Relation between Gold Futures and Spot Price Volatilities in Iran

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ABSTRACT

Financial markets have determinant role in the countries' economy, and also greatly influence prosperity and recession of their economy. One of the most important financial markets, are the futures markets which are in connection with spot markets. The reason for their close relationship is the fast information transmission between two markets which, volatility in one markets cause the leading changes in another. In similar vein, this study aims to investigate causality between gold futures and spot price volatilities in Iran.
Thus far, in localized perspective, although, similar endeavors have been undertaken to scrutinize this significant issue, the volatilities between Gold Futures and Spot Price remained as an unnoticed issue. Building this oversight, this study is a first attempt which investigates causality relation between gold spot and futures price volatilities through "Granjer causality" econometrics method as a main pattern of the research and also GARCH method as a subsidiary one. The data pertain to gold spot and daily prices of futures time-series in the time limit of August 2011 that encompasses 341 data. The results obtained from Granjer causality confirmed the meaningful volatility spillover in 99%confidence level form spot to futures market. In other words, the gold spot market is the causality futures market and the volatilities transfer from gold spot market to futures. Hence, one can use the volatilitis of gold spot market to predict the futures volatilities. Moreover, at the time of volatilities in the spot market one can use these volatilities to specify futures volatilities behavior as well.
KEY WORDS: Gold Futures; Volatility; Granjer Causality; GARCH

1. INTRODUCTION

Financial markets have special importance among other markets for their share and value in the economy their effects on the rate of business transactions. The significance of these markets is not just for their high volume of transactions; their value lies in the fact that these markets supply the required finance through different resources such as financial institutes by the financial tools for the financial managers. Finance derivatives are a kind of financial tools, allocating a large number of financial transactions in the markets to themselves. Futures contract is one of finance derivatives. Several decades have passed since the appearance of the markets in which these tools are transacted. Futures market can be good examples. Based on futures contract, the seller is committed to sell the buyer some cargos based on the current price on due time; Futures contract is an agreement based on purchasing and selling assets in a specific time in the future with a clear price [14].

Today, the futures market is for the products such as petroleum, gold, mineral, industrial, and agricultural goods. Among the mentioned products, gold has a special position in the financial markets. Generally, the gold market has a significant and unique role in financial markets as a safe haven that is also used for hedging and diversification. While there is no theoretical basis for why gold is referred to as a safe haven asset, historical evidences suggest that investments on the gold market are affected during the times of turmoil in other financial markets. One explanation could be that it is one of the oldest forms of money, traditionally used as an inflation hedge. Moreover, gold is often uncorrelated or even negatively correlated with other types of assets [21].

Giving the important role of gold in economy and its various usages in industry, jewelry, and investment, investigating variability and effective factors in price volatility can provide worthwhile results for the investors and planners. Various researches and studies have been implemented in the field of futures markets and their role in the capital markets across the world. Besides studying matters such as price discovery, market stability and efficiency from financial aspects, there is another feature with a significant importance that is how to relate spot markets to futures markets [11]. Another important issue which is highly regarded is the relationship between price volatility of spot and futures markets. In other words, does the futures price volatility lead to the volatility of spot prices? (To put

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it another way, does the volatility of the futures market prices lead to the increase or decrease of gold prices in the spot market?); does the variability of spot market prices lead to the volatility in futures prices? And is there a bilateral correlation between them or no correlation at all? The derived data from causality studies between variability of spot and futures markets can be useful for the markets' activists, investors and brokers; because, if volatility occurs in one market and the results confirm the causality correlation, it will consequently transfer to the other markets; then, with regard to the specified relations, an appropriate position can be selected.

This research concerns with the volatility correlation of spot and futures markets of gold prices in Iran. In other words, the correlation between the variability of futures and spot markets and the cause of these effects is the main enquiry of this research. Statistical population of this research was gold spot and futures markets 'daily prices at the time range of 2011 August and September 2012, yielding 341 data. Gold futures contract's prices were taken from Iran Mercantile Exchange Co. website and gold spot prices were extracted from Gold, Jewelry and Coin Union. The studies on the internal and external articles showed that there are several ways to investigate this correlation. Hence, regarding the main enquiry of this research, the econometrics causality of Granjer was used as the main method and the GARCH method as a subsidiary method of the research.

2. LITERATURE REVIEW

The volatility in futures and spot prices of gold and their correlation has formed the main part of the finance studies. This section will discuss the most important internal and external literature in this field:

Ahmadpoor and Nikzad (2011) studied the relationship between spot and futures prices of gold at Iranian Stock Exchange, using two-variable GARCH method and Johansson Test. They confirmed a long-term correlation between the prices of spot and futures markets of gold in Iran. Also, they showed that the futures market conducts the spot market [2]. Delavari and Rahmati (2011) investigated the volatility of gold prices using ARCH models. Their study showed that regarding the mentioned sample, the volatility of gold prices is asymmetric. To put it another way, it was concluded that good news (positive shocks), lead to more volatility in prices and returns compared with bad news (negative shocks) [7].

The rest of domestic studies on gold have mainly examined the subjects such as checking effective factors on gold price volatility in Iran or predicting futures prices [19],[1].

In the foreign studies, Melvin and Sulttan (1990) used monthly data of gold futures prices COMEX from 1975 to 1988 and GARCH model to assess the conditional variance of gold prices. They realized that South Africa's political riots and oil price volatility are determining factors in conditional variance of momentary gold price predictions [18].

Cai, Cheung, and Wong (2001) investigated daily price volatility of gold in COMEX futures' contracts from 1994- 1997, using ARCH model. Among 23 macro-economic variables, employment, customer price index, GDP, and personal income were introduced as the effective factors on gold price. The gained results showed that volatility has long- term history and this is a suitable guide for pricing options of the gold in long term [6].

Tully and Lucey (2007) used APGARCH model to check gold futures and spot monthly prices of COMEX from 1983- 2003. They surveyed the impact of the variables such as dollar and pound prices, FTSE index (futures and spot), Brent oil price, S&P 500 index, customer price index (CPI), unemployment rate, industrial production index and interest rate in America and England on futures and spot prices of gold, using self-regression technique. The conclusion of their study confirmed the role of the dollar in gold; but few other macro-economic variables had such an impact [22].

Other studies were pertained to checking the relations between prices and futures/spot volatility of the commodities rather than gold, enjoying similar methods with the current article. Among them, the most important studies belong to Feng et al. (2003) in one article, investigated the Malaysian palm oil futures and cash markets with univariate time series model. The conclusions of their study showed that evidence of spillover effect between both markets. The two markets were efficient in incorporating previous information to each other. Variance spillovers, however, were transmitted in both directions but the role of the price leader is not identifiable [10]; Kawaller et al. (1987) on checking the correlation of spot market and futures contracts of S&P500 [16]; Asche and Guttormsen (2002) on the correlation between spot and futures prices of gasoline [4]; Flores and Vegas (2007) on the relationship between both spot and futures markets of stock indexes [11]; Liu et al. (2011) on the correlation between two markets of spot and petroleum [17]; Jackline and Doe(2011) on the relation between spot and futures markets of lean hogs and pork bellies [15]; Hernandes and Torero (2009) on the correlation between spot and futures prices and variability of spot and futures prices for agricultural commodities [13].

After surveying the above studies, to check the correlation between price variability, Granjer Causality econometric was used as the main model of the research and GARCH method was concerned as the subsidiary method.

3. METHODOLOGY

3-1 GARCH Model

Volatility in finance markets indicates variance dissonance in one time series. In order to describe it, Engle (1982) developed the standard ARCH model. When the lag of ARCH models became too large, Bollerslev (1986) proposed adopting the generalized ARCH, known as the GARCH model. Simple and general transactions of GARCH are as follows:

$$P_t = P_0 + \sum_{i=1}^{p} \alpha_i R_{t-i} + \sum_{j=1}^{q} \beta_j \varepsilon_{t-j} + \varepsilon_t \qquad (1)$$

Where $\varepsilon_t | \Omega_{t-1} \sim D(0, h_t)$

$$h_t = v + \gamma_1 h_{t-1} + \gamma_2 \varepsilon_{t-1}^2 \qquad (2)$$

In this model, P_t represents the price at time *t;* ε_t is residual at time *t;* $\varepsilon_t | \Omega_{t-1} \sim D(0, h_t)$ denotes residual ε_t at time *t* given information set Ω at *t-1*, which follows the distribution *D(0, ht); ht* denotes the conditional variance and α_i , β_j and γ_i are parameters

This model has two equations; the first equation is a criterion for specifying conditional mean and determining error levels. Second equation defines the conditional variance. In checking the relationship between stock return and volatility, the first equation reflects stock returns and the second equation indicates stock volatility.[3]

3-2. Standard Test of Granjer Causality

Granger (1969) proposed a time-series data based approach in order to determine causality. In the Granger-sense X_t is a cause of Y_t if it is useful in forecasting y In this framework"useful" means that X_t is able to increase the ccuracy of the prediction of Y_t with respect to a forecast, considering only past values of Y_t.

The empirical results presented in this paper are calculated within a simple Granger-causality test in order to test whether futures prices" Granger cause" spot prices and vice versa. The following two equations can be specified for Granjer causality:

$$S_t = \propto_0 + \sum_{i=1}^{m} \alpha_1 S_{t-i} + \sum_{j=1}^{n} \propto_2 F_{t-j} + \varepsilon_{1t} \qquad (3)$$

$$F_t = \propto_3 + \sum_{i=1}^{m} \alpha_4 F_{t-i} + \sum_{j=1}^{n} \propto_5 S_{t-j} + \varepsilon_{2t} \qquad (4)$$

Based on the estimated OLS coefficients for the equations (3) and (4) four different hypotheses about the relationship between spot price (S_t) to futures price (F_t) can be formulated:

1- Unidirectional Granger-causality from spot price to futures price. In this case spot price increases the prediction of the futures price but not vice versa. Thus $\sum_{j=1}^{n} \propto_5 \neq 0$ and $\sum_{j=1}^{n} \propto_2 = 0$

2- Unidirectional Granger-causality from futures price to spot price. In this case futures price increases the prediction of the spot price but not vice versa. Thus $\sum_{j=1}^{n} \propto_5 = 0$ and $\sum_{j=1}^{n} \propto_2 \neq 0$

3- Bidirectional (or feedback) causality. In this case the spot price increases the prediction of the futures price and vice versa. Thus $\sum_{j=1}^{n} \propto_5 \neq 0$ and $\sum_{j=1}^{n} \propto_2 \neq 0$

4- Independence between futures price and spot price. In this case there is no Granger causality in any direction, thus $\sum_{j=1}^{n} \propto_5 = 0$ and $\sum_{j=1}^{n} \propto_2 = 0$

Hence by obtaining one of these results it seems possible to detect the causality relationship between futures price and spot price [12].

4. Data analysis

The descriptive statistics of futures and spot prices of gold are presented in Table (1) According to the results, the means of the futures prices are significantly higher than those of spot markets. In other words, the prices in gold futures market are higher than spot prices. The standard deviation shows that price volatility in the futures markets

are higher than spot markets. To test distribution normality, skewness and kurtosis statistics have the values of 0 and 3, respectively. According to Table (1), the kurtosis of both spot and futures markets are less than 3, confirming the normality of the distribution in spot and futures market prices.

Table (1) - Descriptive statistics for gold spot and futures prices

Output	Average	Standard Deviation	Skewness	Kurtosis
Spot	6580000	1134274	- 0.158038	2.590182
Futures	7573830	1318735	- 0.239817	2.150945

Sources: research findings

The results of pattern variable stability with augmented Dickey-Fuller method are shown in table (2).
The available variables in table are defined as following:
F :gold futures price
S :gold spot price
d(F) : subtraction of the first degree of gold futures price
d(S) : subtraction of the first degree of gold spot price
The results of table (2) shows that gold spot price and gold futures price in the possible level 99 percent are instability so they need to be subtracted. After subtracting, the results showed that the statistics were more than critical values, there for the above variables were stable degree one.

Table (2) – Result of variables stability test at the level of 99 percent

variables	Statistic	p-value	critical values	Result
F	-2.09	0.24	-3.44	-
d(F)	-7.94	0.00	-3.44	I(1)
S	-1.23	0.66	-3.44	-
d(S)	-17.57	0.00	-3.44	I(1)

Sources: research findings

To use GARCH's sub- models, an ARCH-LM test was implemented. Statistics of the so-called test for prices in spot and futures markets of gold were 41.92 (0.00) and 5.7 (0.01), respectively, confirming conditional dissonance in the residues. With regard to AIC measure that should be minimum for the prices in spot markets, AR (2) - GARCH (0,1) and for futures market the process of ARMA (1, 1)-GARCH (1, 0) were selected whose results are reported in Tables (3) and (4).

Table (3)- GARCH model for prices in spot market- AR(2)-GARCH(0,1)

Parameter	Coefficient	Standard deviation	Statistics Z
Average equation			
C	- 189.0514	4540.635	- .041635(0.9668)
AR(2)	- 0.360611	0.030866	- 11.68308(0.000)
Variance equation			
C	100.2895	6.38	15.70726(0.000)
$\propto_1$	0.887659	0.102312	8.67599(0.000)

AIC: 26.50418, Log likelihood: - 4461.95

Table (4)- GARCH model for prices in futures markets- ARMA(1,1)-GARCH(1,0)

Parameter	Coefficient	Standard deviation	Statistics Z
Average equation			
C	11270.45	10941.08	1.030104(0.3030)
AR(1)	- 0.978172	0.013665	- 71.58107(0.000)
MA(1)	0.840641	0.030604	27.46541(0.000)
Variance equation			
C	896	373	2.405648(0.0161)
β_1	0.976251	0.012796	76.29140(0.000)

AIC: 27.05261, Log likelihood: - 4566.861

After modeling the volatility of spot and futures prices of gold and extracting volatility series for spot and futures markets, one can determine causality relationship of volatility. Results of causality relationship are shown in Table (5). The first row shows causality relationship from futures to spot; in that way, the null hypothesis implies that gold spot market is not the casualty of futures; its opposite hypothesis (main hypothesis) suggests its contrary

idea. The resulted statistic is 111.616 and significant at 99% confidence level. In other words, gold spot market is the causality of gold futures market and volatility from gold spot market transfer to futures. So, the main hypothesis is confirmed. The second row shows the causality relation of spot to futures. Null hypothesis suggests that the futures market is not the causality of spot market; but, the main hypothesis represents that gold futures market is the causality of the gold spot market. The resulted statistic is 0.53574 and insignificant at 99% confidence level, confirming null hypothesis. In other words, gold futures markets are not the causality of gold spot market and the volatility does not transfer from futures to spot.

Table (5) -Volatility spillover effect between gold futures and spot markets

Overflow impact	F statistic
F ↛ S	111.616 (0.000) ***
S ↛ F	0.53574 (0.464) NS

***: ***: Significant at of 99 % NS: insignificant
Resource: research findings

5.CONCLUSION

The findings of this study are summarized as follows:
The means of futures price are higher than the spot price; in other words, the price in gold futures market in Iran is higher than its spot.

The higher standard deviation in futures markets in comparison to spot markets indicates that price volatility in the futures markets is more than gold spot markets; while the normal distribution of the prices is confirmed in both futures and spot markets.

The results confirmed the existence of conditional dissonance. Hence, price volatility is modeled and the process of AR(2)-GARCH(0,1) was selected for spot markets and the process of ARMA(1,1)-GARCH(1,0) was chosen for futures markets.

The results of Granjer Causality Test indicated that gold spot market is the causality of futures markets and volatility from gold spot market transfers to the futures. In other words, at the confidence level of 99%, a significant overflow occurs from spot market to futures; therefore, one can make use of volatility price of gold spot market to foresee price volatility of the futures markets. Given these results, shocks in the spot market impact futures market; so, they can be used for identifying futures behavior patterns in the market.

Results of Granjer Causality Test also indicate that gold futures market is not the causality of gold spot markets and volatility from futures don't transfer to spot markets; consequently, from futures volatility one cannot predict spot market's volatility.

REFERENCES

1. Ahmadi, A., M. Ahmadloo, 2012. Prospect of gold future contract prices using Arima model in Iran Mercantile Exchange. National Knowledge of Analyzing Stock, No. 9.

2. Ahmadpoor, A., M. Nikzad, 2011. Investigating correlation between futures and spot prices of gold in Iran Mercantile Exchange. J. Stock., 13: 175-190.

3. Andres, V, 2007. Econometrics of time lags by practical function. Translated by Sadeghi, M.and Shavalpoor, S, Imam Sadeq University, Part 1, 1st Ed.

4. Asche, F., Alte G. Guttormsen., 2002. Lead- lag relationship between futures and spot prices. institute for research in economics and business administration, Bergen, issn 0803-4028.

5. Bollerslev, T., 1986. Generalized autoregressive conditional heteroskedasticity. J. Econometrics., 31: 307–327.

6. Cai, J., Y, L. Cheung., C.S.Wong, M, 2001. What moves the gold market? J. Futures Market. 21(3): 257-278.

7. Delavari, A., Z. rahmati, 2011. investigating variability of gold prices' volatilities in Iran using ARCH models. Development and knowledge magazine, Seventh year, NO. 30.

8. Engle, R.F., 1982. Autoregressive conditional heteroskedasticity with estimates of the variance of United Kingdom inflation. Econometrica., 50: 987–1007.

9. Executive process of stock transactions (futures transactions), Iran Mercantile Exchange, Nov.2007.

10. Feng, S.X.B., Lin, S.X.W & Ho, Daniel, 2003. Spillover Effects in the Malaysian Palm Oil Futures and Cash Markets. Malaysian Journal of Economic Studies Vol. XXXX Nos. 1 & 2.

11. Floros, Christos., D. Vougas, 2007. Lead-lag relationship between futures and spot markets in Greece:1999- 2001. Intl. J. Finance and Economics., 7: 168-174.

12. Gujarati, D, 2006. Basis of econometrics. Translated by Abrishami, H., Tehran University, fourth publications.

13. Hernandes,M. A., T. Maximo, 2009. Examining the dynamic relation between spot and futures price of agricultural commodities. J. Commodity market review, 47-86.

14. Hull, J, 2005. Principles of finance management andrisk management. Translated by SajadSayah, S. and SalehAbadi, A., Software Group, 1st Ed.

15. Jackline, S., M. Deo, 2011. Lead - lag relationship between the futures and spot Prices. J. Economics and International Finance., 3(7): 424-427.

16. Kawaller, I. G. P. D. Koch, and T. W. Koch, 1987. The temporal price relationship between SandP500 futures and the S&P 500 Index. J. Finance., 51(5): 1309-1329.

17. Liu, L., J. Wan, 2011. A study of correlations between crude oil spot and futures markets: A rolling sample test. Physica A 390: 3754–3766.

18. Melvin, M., J. Suttan, 1990. South African Political unrest, oil prices, and the time varying risk premium in the gold futures market. J. Futures Market.,10(2): 103–111.

19. Sarfaraz, L., A. Afsar, 2006. The analysis of effective factors on gold price and forecasting model using fuzzy neural network. J. Economic Research., 149-165.

20. Taklif, A., 2011. Studying futures transaction behavior of crude oil NYMEX stock (1986-2010) regarding level changes and volatility of crude oil. J. Economic Research., No.47: 31-52.

21. Trück, S., K. Liang, 2012. Modeling and forecasting volatility in the gold market. Intl. J. Banking and Finance., Vol 9, Iss 1, Article 3: 48-80.

22. Tully,E., B,M. Lucey, 2007. A power GARCH examination of the gold market. Intl. J. business and finance., 21(2): 316-325.