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The Relationship between the Commodity Theoretical Prices and the Commodity Settlement Price for the Future Contracts in the Iran Mercantile Exchange

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ABSTRACT

Volatility of prices and inefficiency of commodity money markets are the main obstacles to economic growth and development. According to theoretical reasoning and evidence from empirical findings, in solving market issues and problems such as lack of transparency, price vibrations risk, high transaction costs and so on, market-based instruments-such as derivatives instruments- are known as more successful solutions than their alternative approaches around the world and are used by many countries. One of these instruments is future and one of the most important issue of this instrument market is relationship between theoretical prices and settlement prices on the other hand, we know that in IME the unique goods can be traded in the from of future is gold coin. Therefore, we tested above relationship in this market. For this, I tested data normality at first, and then the relationship between theoretical price and settlement price were analyzed with pearson correlation analysis and mean comparision test. Results showed significant and positive relationship between these prices in the future market of Iran gold coin.

KEYWORDS: futures, futures theoretical price, settlement price, spot price, mercantile exchange.

1. INTRODUCTION

Today we observe the increasing spread of financial instruments in financial markets around the world. So the transformation of the global economy in recent decades and economic development has been caused to create or develope various financial instruments. In additions to the traditional trading spread of physical and financial assets, derivatives trading including futures, swaps contracts, option contracts have increasing growth. In the current business conditions, fluctuations in markets are very severe which these fluctuations are the source of many types of risks. Therefore, innovation and discovering various risk coveraging instrument is important. New various financial instruments can be considered as a result of feeling the need to have a special tool for coveraging risk. Therefore, future markets and stock option in the financial and investment environment of current world found increasingly important and these markets have reached to a level of financial innovation that it is necessary all professionals in finance be aware of how these markets act, how to use them and also the pricing mechanism in these markets. On the other hand, exchanges play an important role as financial institutions in the development and expansion the use of new financial instruments and making the bed to active presence of investors in these markets. One of the instruments that are widely is traded in stock exchanges and OTC is futures. Active people in the futures market can be speculators, arbitragors and risk coverage that each of them does a particular activity. In recent years, many studies and researches taken place on the futures market and its role in capital market around the world. In addition to examining factors such as price discovery, market stability and market efficiency, another issue which is more important from financial point of view is: how is the relationship between theoretical prices and the settlement prices of the futures.

Anyone with any motivation that enters to future market is seeking to determine the futures price and make decision based on it. In the present study, the focus of researcher is on this issue that whether the information which is collected and analyzed about futures confirms the existence of significant correlation between the theoretical price and settlement price in gold futures. In this regard, the following research question is: whether investors and the present people in market compare theoretical price and settlement price, when trading futures of gold coin?

In other words, whether investors determine commodity futures prices based on its theoretical price?

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2. LITERATURE REVIEW

Price discovery in future and cash markets and the relationship type between these two markets in most theoretical issues is interesting topics of traders, financial analysts and economists. Although the cash and future market react to the same information, according to theoretical relationships, the main question is which of them show earlier response. accordingly, Gilbert (1985) in an article stated that always the theoretical prices led to future market transaction. On the other hand, Brooks *et al.* (2001) for testing the relationship between cash and futures market of FTSE 100 index using Engel and Granger methods, concluded that there is a strong relationship between the future and theoretical price and changes of index price in the cash market depend on the changes of future and theoretical price of index. But Asche and Guttormsen (2002) in his study which investigated the relationship between future prices of gasoline and their theoretical and cash prices using a model of Johansson, claimed that at least one long-term relationship between the variables of future price and cash and theoretical price is established. So theoretical prices is a guidance for future market prices. On the other hand Gee (2005), which investigated the relationship between cash and future market prices in Malaysian stock index by using the error correction model, shows that future market is guidance of cash market and price changes in future market in comparison of cash market relatively is more efficient. Before he, Fabozzi (2001) also states that market participants can use from theoretical prices as a computational index to predict settlement prices of futures. About futures market efficiency Lean *et al.* (2010) in his study entitled "Market efficiency of cash and futures contracts of oil" came to this conclusion that the future transactions market of oil contracts is efficient and there is significant long-term relationship between the prices of futures, spot and theoretical of oil transactions, so between the current spot prices of commodity and the futures prices of commodity and expected spot prices of that commodity always is an equilibrium relationship. He also claimed that theoretical and settlement prices of futures in each contract daily will be a basis for traders to determine the futures price for the next days. In another study, Kolb and Overdahl (2009) in a study on different markets of commodity futures, states that basically there is two views in relation to formation of future prices of commodities. First, the relationship between the future and spot price about the commodities which can store that is considered as the storage cost in pricing. And second view that separate prices into two parts including expenditure of expected risk and prediction of future spot price. He after presentation several theoretical relationships for various futures and investigation of two above perspectives concluded that for using each of theories there should be a long-term lasting relationship between spot and futures prices in the form of theoretical relationships. In this regard, Kaur and Rao (2009), in their study titled "The effect of pricing of futures prices of agricultural products traded in agricultural mercantile exchange on the spot prices of those commodities" concluded that there is positive and increasing relationship between the spot and theoretical prices with futures prices of agricultural products in most of his discussed contract (21 Contracts of 27 discussed contract).He also according to the results of means comparison test suggests that there is a significant relationship between theoretical average prices of agricultural products and average prices of agricultural products futures in two of the four discussed products and concluded that there is not a fair price for these two products. He has concluded in his research that arbitrage opportunities exist in the onset of futures or in the middle of the trading of these contracts but at the end of those contracts period are never observed these opportunities.

In Iran, Chaleshtary Hosseini (1997), in his study entitled "Feasibility of futures design in the Islamic financial system. "That performed with the aim of identifying potential facilities of future financial markets and introducing efficient instrument for these markets and identification of Islamic markets and its financial system, it was concluded that the issuance and completion futures and buy and sell (transfer) of futures in Islamic financial system is prohibited. And in terms of Islamic specific contracts can be issued to the futures. In support of this view, Botshekan (1998) in his study titled "Futures markets and the right of option and the feasibility of their set-up in Iran", which performed with the aim of investigation the types of futures and options contracts and detailed investigation of necessary facilities to set-up this type of markets in exchange and concluded that, by removing legal obstacles in the financial markets of country exist the context of creating this type of markets.

3. RESEARCH METHODOLOGY

3.1. Research Hypotheses

Given to the introduction and background of research, we stated research hypotheses as follows:

There is a significant relationship between theoretical prices of commodity futures and settlement prices of futures of that commodity (for futures of gold coins).

3.2. Research Variables

According to the research hypothesis, research variables include: A) the theoretical price of futures (FU) B) settlement price of futures (settlement price (ΔSmp) daily futures).

3.2.1. The theoretical price of futures (FU)

In Iran Mercantile Exchange, futures contract is a contract that based on it the seller is committed to sell a certain amount of the specific commodity in a certain maturity with determined price. in turn, the other side of contract is obligated to purchase that product with above determined specifications and to prevent rejection of both sides from doing contract, both sides committed in format stipulation that deposit an amount as a guarantee fee to cambium room. cambium room can adjust guarantee fee based on futures price changes and also it can with drawels some part of guarantee fee of each side to give to another side, and he will have right to use it until liquidate with each other in maturity date. As a result, the theoretical price of commodity futures is a price that financial market of that commodity expects to obtain in the specified future date (with respect to the factors influencing that market). Theoretical prices of futures obtain from the following equation with helping EXCEL software:

$$\mathbf{FU = p+pt(c- r)}$$

Where:
FU= Theoretical price of coins futures for delivery at time t.
P= Coin spot price at time t.
R= Interest rate of traded assets (rate of annual return). We find this rate from the following command:
r= Asset sale price - Asset purchase price / Asset purchase price
c= Financing cost rate which will determine it as the interest rate of public banks loans.
T= Time of futures delivery in term of year (Fabozzi, 2001). (365 ÷ the number of days remaining to maturity=t)

3.2.2. Settlement price (ΔSmp)

Settlement price of futures is the price that futures is trading based on it or the price that an investor with short position and another investor with long position agree on it. In this study we consider the futures settlement price as current amount of futures transactions, which will be announced daily by the mercantile exchange of Iran.

3.3. Statistical Population and Sample

Because of transacting only gold coin futures in Iran commodity futures market, this study used from the settlement prices of gold futures in the mercantile exchange of Iran between 2008-2010 and have following conditions.

1. Due to the nature of the futures, a contract will be investigated if its maturity is clear and confirm by Iran Mercantile Exchange.
2. From total of 11 gold coin futures that is registered in Iran mercantile exchange (624 daily data) because the volume of conducted transactions in futures for delivery in November 2008 was low (only 18 days) this contract has been removed from the statistical population.
3. Because transactions of any futures start from a certain time and complete at a certain date, therefore it is possible that in a working day will flow several futures. Thus the number of statistical data will increase and there will be different data for each of contract, therefore in this study we examine each of these contracts separately.

In this study, after definition of population and determining the criteria of its delimitation, we pay to collecting information and determination its members. In this context can be seen that during the days of doing contract from December 2008 to August 2010 obtained data is in the form of 606 working days. On the other hand, due to the emerging future transactions in our country, the sampling methodology in this research is available sampling. So, all performed future transactions in the Iran Mercantile Exchange from December 2008 until the end of August 2010 will be examined on a daily basis. Therefore, we consider all members of statistical population as statistical sample due to the nature of the futures.

3.4. Methods of Data Analysis

In this study, data is analyzed based on the correlation analysis and because it can be applied in the process of using information, therefore this research is applied research. Therefore according to the research issue and mentioned hypothesis, first we investigate data normality using Kolmogorov-Smirnov test, then, using the Pearson correlation coefficient we will investigate the amount and direction of correlation between each of the study variables in 95% confidence level. Finally, for investigating the variations between these two prices we will use means comparison test.

4. RESEARCH FINDINGS

4.1. Kolmogorov-Smirnov Test

According to the Table (1), Kolmogorov-Smirnov test performed for investigating the data normality in each of the ten futures (606-day period), respectively, from futures with the maturity of February 2008 to maturity of August 2010. according to table, the significance level obtained for all dependent and independent variables is more than

desired significance level that is α =0.05. Therefore we can say with 95% confidence that the hypothesis H_1 is rejected and hypothesis H_0 is accepted. That is, independent variables (theoretical prices of futures) and dependent variable (settlement prices of futures) of research hypothesis are normal. So we can use from Pearson correlation test to test the research hypothesis.

Table 1: Normality test of data from futures of February 2008 to futures of April 2010

The name of contract	Variables	Kolmogorov-Smirnov Test		
		Test statistic	degrees of freedom	Significant level
Maturity February 2008	FU	0.207	43	0.056
	ΔSmp	0.161	43	0.228
Maturity April 2009	FU	0.978	49	0.295
	ΔSmp	0.772	49	0.591
Maturity June 2009	FU	0.117	62	0.365
	ΔSmp	0.172	62	0.152
Maturity August 2009	FU	0.583	52	0.054
	ΔSmp	0.542	52	0.940
Maturity October 2009	FU	0.175	52	0.095
	ΔSmp	0.208	52	0.056
Maturity December 2009	FU	0.183	50	0.093
	ΔSmp	0.171	50	0.120
Maturity February 2009	FU	0.099	50	0.708
	ΔSmp	0.075	50	0.939
Maturity April 2010	FU	0.937	64	0.319
	ΔSmp	0.911	64	0.073
Maturity June 2010	FU	0.801	54	0.543
	ΔSmp	0.956	54	0.320
Maturity August 2010	FU	0.896	94	0.398
	ΔSmp	0.978	94	0.294

4.2. Pearson Correlation Coefficient Test

Because of data normality we can examine the amount of correlation of each variable in each of the ten futures (606-day period), with Pearson correlation coefficient. The result of data related to the futures with maturity of February 2008 to maturity of August 2010 is according to the following table:

Table 2: significant test of correlation coefficient of research hypothesis variables from futures of February 2008 to August 2010

Maturity of contract	Variables	Pearson correlation coefficient	Significant level
February 2008	FU ΔSmp	0.93	0.000
April 2009	FU ΔSmp	0.85	0.000
June 2009	FU ΔSmp	0.92	0.000
August 2009	FU ΔSmp	0.83	0.000
October 2009	FU ΔSmp	0.83	0.000
December 2009	FU ΔSmp	0.72	0.000
February 2009	FU ΔSmp	0.84	0.000
April 2010	FU ΔSmp	0.83	0.000
June 2010	FU ΔSmp	0.95	0.000
August 2010	FU ΔSmp	0.85	0.000

According to the above table it can be seen that the obtained Pearson correlation coefficient in all discussed futures fluctuate between two numbers of 0.72 and 0.95, also the obtained significance level (p-value) in all contracts is less than 0/05. Therefore the hypothesis H_0 is rejected and the null hypothesis will be accepted. With 95% confidence we can conclude that there is increasing (direct) and significant relationship between theoretical price and settlement price of futures in all gold coin futures.

4.3. Means Comparison Test

According to the following descriptive statistics table we can observe some differences between the mean of theoretical and the settlement prices. As a result, for determining whether presented differences are significant or not, researcher used means comparison test and the reason for means comparison test in addition to doing correlation test was its selection by previous investigators. So for each of the discussed futures, first the summary of descriptive statistics tables include amounts related to the standard deviation, the mean of research variables and the difference between them are expressed and described.

Table 3: Description of data in research hypothesis variables from futures of February 2008 to August 2010

Name of futures	The number of statistical universe days	The mean of theoretical price	The mean of settlement price	Standard deviation of theoretical price	standard deviation of settlement price	Price difference of settlement price and theoretical price
Delivery February 2008	42	2078533	2077434	56777.37	55539.40	-7901
April 2009	49	2150483	2144905	32664.40	33513.37	-6396
Delivery June 2009	62	2151528	2147473	37218.57	38991.79	-5685
Delivery August 2009	67	2239930	2224345	35969.18	36309.20	6898
Delivery October 2009	72	2379923	2386468	130270.7	144370.9	7025
Delivery December 2009	46	2715766	2723596	19922.45	180135.9	7830
Delivery February 2009	67	2698413	2703111	83427.74	91671.65	6698
Delivery April 2010	51	2759258	2768178	38505.16	39138.18	8920
Delivery June 2010	54	2998744	3028597	119909.1	122577.3	19853
August 2010	96	3011284	3090513	12283.01	12484.14	28229

As the above table shows, from total of ten futures concluded by the mercantile exchange, in three futures delivery of February 2008, delivery of April 2009 and delivery of June (153 data from 606 of the total daily data) the mean of settlement price is less than the mean of theoretical price (because the amount of price difference is negative). But in the seven contracts of this year (453 of the total 606 daily data), the mean of settlement price is more than the mean of theoretical price (Because the amount of price difference is positive). That is, in the 25% of all working days of these contracts (606 ÷ 153) settlement price is less than theoretical price and in 75% of working days of this year (606 ÷ 453) settlement price is more than theoretical price. The difference between these two prices in futures for delivery of June and August 2010 is more than other contracts. Moreover, as it is shown in this table, the process of increase the difference between the theoretical and the settlement prices of the contract for delivery in June 2010 to delivery in August 2010 have ascendant way which this issue is according to the severe fluctuations of gold price in the world which is started from early June 2010 and continue up to now (November 2010) and also influence of these fluctuations to traders seems obvious. (Which measure the effects of fluctuations in world gold and currency markets on the different markets of country will require to further research) also in the above table expresses separately the amount of standard deviation of variable for each contract, the mean of variables and differences between these variables, for example, in the futures with maturity of February 2009, the mean of settlement prices is lower than the mean of theoretical prices to the size of £ 6,396. Also, due to the fact that any gold coins futures in country include ten complete coins, for most futures from the above table is concluded that the mean difference of observed prices in each of these contracts for ten gold coins do not seem to be much, therefore, to investigate whether the difference between the mean of settlement prices and the mean of theoretical price in discussed futures is significant or not, use from mean comparison test (T test) and suggest two hypotheses H_0 and H_1 as follows:

H_0: There is no significant difference between the mean of theoretical prices and settlement prices of gold coins futures. (H_0:μ_1=μ_2)
H_1: There is significant difference between the mean of theoretical prices and settlement prices of gold coins futures. (H_0:μ_1#μ_2)
The results of T test for each of gold coin futures of country separately is described in the following table:

Table 4: Means comparison test between research hypothesis variables from futures of February 2008 to August 2010

Maturity of the contract	Variables	Number	The amount of T-test	Degrees of freedom	Significant level
February 2008	Theoretical prices and settlement prices	42	-1.444	41	0.15
April 2009	Theoretical prices and settlement prices	49	-1.521	48	0.12
June 2009	Theoretical prices and settlement prices	62	-1.431	61	0.13
August 2009	Theoretical prices and settlement prices	67	1.468	66	0.16
October 2009	Theoretical prices and settlement prices	72	1.462	72	0.14
December 2009	Theoretical prices and settlement prices	46	1.704	45	0.13
February 2009	Theoretical prices and settlement prices	67	1.738	66	0.16
delivery April 2010	Theoretical prices and settlement prices	51	1.681	50	0.136
June 2010	Theoretical prices and settlement prices	54	8.383	53	0.000
August 2010	Theoretical prices and settlement prices	96	12.080	95	0.000

Given to the calculated mean difference between the theoretical prices and settlement prices in eight futures from maturity of February 2008 to maturity of April 2010, and also the T-test values and obtained significance level in each of these contracts, concluded that there is no significant difference between the mean of theoretical prices and settlement prices of these eight contracts (from the maturity date of February 2008 to the maturity date of April 2010).Thus, hypothesis $H_1$is rejected and H_0 with utmost confidence of 95% is accepted. That is, there is no significant difference at 5% error level between theoretical price and settlement price of the futures. But on the other hand, given to the calculated mean difference between the theoretical price and the settlement price of two other contracts of this research that is, from contracts with maturity of June and August 2010 and also the T-test value and its obtained significance level is concluded that there is significant difference between the mean of theoretical prices and the mean of settlement prices in these two contracts. Therefore, H_1 is confirmed and H_0 with utmost confidence 9.99% is rejected.

Then given to the obtained results of the means comparison test, from futures of February 2008 to first semester futures of 2010 is concluded that from total ten discussed contracts (the number of 606 daily data) in 8 contracts (i.e.80% of contracts) there is not a significant difference between the means changes in the theoretical prices and settlement prices which is high percentage of the total discussed contracts and data.

5. CONCLUSION

In this study investigated the relationship between theoretical prices of future market of gold coins in Iran Mercantile Exchange with settlement prices of these contracts. Consistent with theories of financial engineering, theoretical logic and investigations of most foreign researchers, we expected that in all conducted futures contracts exist a significant positive relationship between these prices and also, there is no significant difference between these prices.

Also in this study Pearson correlation and means comparison test (and according to possibly shadow of other effective variables on the dependent variable, such as foreign currency and prices of oil in the future market) which results indicate that investors in the mercantile exchange of Iran when doing futures transactions of gold coins, the theoretical prices of these contracts are considered in their daily transactions. That is, investors determined futures price of commodity based on theatrical prices of that commodity because in all discussed futures the relationship between research variables is positive in terms of direction and in terms of value is close to one number, so we can conclude by having daily theoretical prices of futures (or its changes) can pay to forecasting the settlement price of

that contract. On the other hand, according to the results of means comparison test, in eight of the ten discussed futures do not observed significant difference between the mean of theoretical prices and the mean of settlement prices, so investors of futures by having theoretical prices changes can predict the settlement prices changes daily.

In other words, in future transactions of mercantile exchange of Iran, "settlement prices" is influenced by the action of participant in market and investors to theatrical prices and its related variables. Accordingly, the results of this study are in agreement with most of the above mentioned external research, including (Kaur and Rao, 2009).

But in the two contracts of delivery June and August 2010 observed significant difference between means of research variables in means comparison test (although this difference in order to confirm the hypothesis of the study is based on existence of a significant relationship between the variables). In interpreting this lack of compliance with the eight other contracts in this study can refer to the factors affecting the gold market in the country that including the following points;

- Severe and immediate changes in gold prices and fluctuations in the global economy (including changes in foreign exchanges rates such as dollar and euro, changes in oil prices, the U.S. and Europe economy fluctuations) which increase from the beginning of June and increasingly in July and August 2010 raise and also continue up to now (November 2010 the defense date of this thesis), caused to creating excitement in the gold market in these two contracts, so even in the last days of June and August 2010 futures contracts, this atmosphere has been established. Which are due to increase the volume of conducted futures and recorded prices by the traders of these two contracts.
- Unfamiliarity of some investors with financial problems and lack of financial analysts and specialists and agents who predict future performance of market on the basis of scientific methods to cause these investors based on confidential information, heard, rumors, and other recommendations and in general, based on information obtained from informal sources start to invest. Changes in the settlement prices relative to theoretical prices could be considered based on this behavior of investors.
- The impact of government policies and the central bank in the cash markets of gold coin, the lack of strong and independent cash market, changing the regulations and in general economic sufficient instability at the macro level that cause investors and market participants of gold coin futures in the calculations of theoretical prices and adopt a buy or sell positions in these contracts stricken confusion and computational errors, that as a result will cause to overall loss for them in these contracts which in the long-term caused investors exit from the futures market of mercantile exchange of Iran.

Finally, with regard to the matters referred in this analysis, we can strongly reject hypothesis H_0 of this research. In other words, we can say that the Pearson correlation coefficient and also means comparison tests confirm existence of significant relationship between the settlement price and the theoretical price of the futures for gold coins for all contracts listed in Iran Mercantile Exchange, from maturity of February 2010 until maturity of August 2008. Therefore, it can be said that the theoretical price play strategic role in order to determining the prices for future market participants for these commodities.

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