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GOLD SPOT AND DERIVATIVES MARKETS INTERACTION IN TURKISH FINANCIAL MARKETS

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ABSTRACT

This study explores the impact of gold derivatives market on the market efficiency of the Turkish financial markets over 2011-2018 period. The study uses price series of USD/Ons spot and futures contracts traded in Borsa Istanbul and US Commodity Exchange as reference indicators and employs the Vector Error Correction Model. The study results reveal that there is a significant unilateral relationship between the gold spot and derivatives markets, the spot market prices leading the derivative market both in the long and short run. The findings also show that there is a persistent influence of volatility in the gold market.

Keywords: Gold Futures, Hedging, Price discovery

JEL classification: G10, G13, L61

TÜRKİYE'DE ALTIN SPOT VE VADELİ PİYASALARIN ETKİLEŞİMİ

ÖZ

Bu çalışma, Borsa İstanbul ve ABD Ticaret Borsası'nda işlem gören USD/Ons vadeli işlem sözleşmelerini referans gösterge alarak altın spot ve türev piyasasının Türk sermaye piyasalarına katkısını 2011-2018 yılları arasındaki dönem için araştırmaktadır. Bu kapsamda çalışmada, Hata Düzeltme Modeli kullanılarak altın vadeli işlem piyasasının devreye alınmasının piyasa verimliliğini ne yönde etkilediği ele alınmaktadır. Elde edilen sonuçlar, Borsa İstanbul'da işlem gören altın spot fiyatları ile vadeli işlem fiyatları arasında hem uzun hem de kısa vadede tek taraflı ve anlamlı bir ilişki olduğunu, spot piyasanın vadeli işlemler piyasasına önderlik ettiğini ortaya koymaktadır. Ayrıca bulgular, altın piyasasında volatilitenin kalıcı bir etkisi olduğunu da göstermektedir.

Anahtar kelimeler: Altın Vadeli İşlemler, Riskten korunma, Fiyat keşfi

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1. Introduction

Commodity derivative markets perform a vital role in price discovery and risk management for market participants who use them in modeling their hedging and speculation strategies. In this frame, derivative and spot (cash) markets jointly contribute to price formation via altering available information since derivatives market bring more participants as speculators, hedgers and arbitrageurs to the market. Furthermore, market professionals generally claim that price discovery in commodity derivative markets is more efficient than spot market. One should also note that derivatives markets have lower cost than spot markets due to leverage. Speculators in derivatives markets may hedge their exposure by taking an offsetting position with a low cost compared to the one incurred by accepting physical settlement and selling the commodity in the cash market (Cox, 1976).

In the global market, most of the liquidity is provided by the over the counter (OTC) gold market. Table 1 shows global gold market volume by daily averages for 2018 and 2019. As to the gold futures, COMEX, which is one of the largest and the most liquid precious metal markets in the Chicago Mercantile Exchange (CME) Group, dominates other exchanges with US$ 48 billion, over US$ 65 billion trading volume in 2019.

Table 1: Global Gold Market Liquidity (Trading Volume In US$, Billion**)**

	2018	**2019**
OTC	**61.91**	**78.56**
Exchanges	**50.96**	**65.37**
- COMEX	41.09	48.47
- Shanghai Futures Exchange	2.78	8.82
- LME	0.29	0.35
- All other exchanges	1.46	7.73
Gold ETFs	**1.34**	**1.78**
Global Gold Market Liquidity	**114.21**	**145.71**

Source: World Gold Council web site accessed on June 30, 2020; https://www.gold.org/goldhub/data/trading-volumes

As shown in Figure 1, the liquidity level has shown a steady state from 2010 to 2015. However, starting from 2016, it has followed an upward trend parallel to the price upturn.

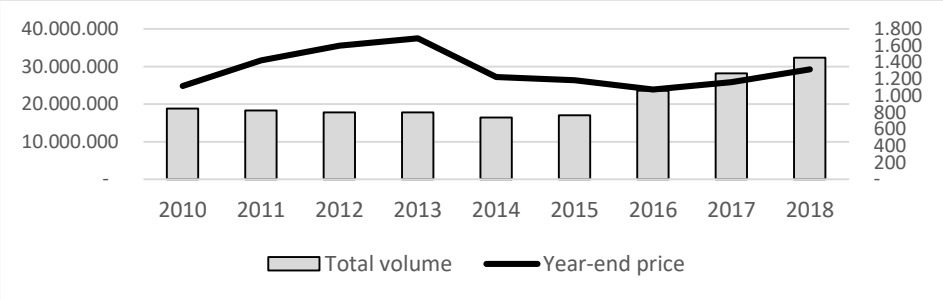

Figure 1: COMEX gold futures data
Source: Bloomberg (volume, left axis; price, right axis)

For centuries, households have used physical gold in the form of gold coin or jewelry as an investment instrument in Turkey, and the demand is highly influenced by socio-cultural factors. To increase financial inclusion of gold investment by bringing idle gold into the economy, organized gold spot market was launched in 1995 in Istanbul Gold Exchange. In 2013, Istanbul Gold Exchange, Istanbul Stock Exchange and Izmir Futures and Options Exchange were merged under the name of Borsa Istanbul.

Table 2 shows the volume of gold spot market from 2013 to 2018 in Borsa Istanbul (BIST). Although the trading system enables USD, EUR and TRY denominated transactions to take place, USD/Ons trades has a share in between 85% to 96% of the volume throughout the years.

Table 2: Borsa Istanbul Gold Spot Market Volume (USD, million)

	USD/Ons	TRY/Kg	Total Volume	USD/Ons Share in Total Volume
2013	17,194	1,056	18,250	94%
2014	8,834	731	9,565	92%
2015	9,171	370	9,541	96%
2016	8,836	719	9,555	92%
2017	16,085	2,297	18,382	88%
2018	8,956	1,523	10,479	85%

Source: Borsa Istanbul web site accessed on April 14, 2019;
https://www.borsaistanbul.com/veriler/verileralt/kmtp

As to derivatives trades, gold has both OTC and organized derivatives market in Turkey. Gold derivatives contracts are traded in the Borsa Istanbul relevant market where both banks and brokerage companies may execute transactions. Parallel to the international practices, the liquidity is higher in the OTC market. Table 3 shows the trading volume in the OTC and organized gold derivatives markets. Although gold futures trading volume in commodity markets has been recently increasing, it has a very small share in the OTC trades (6.6%) and organized derivatives markets (1.6%). In terms of liquidity, OTC

outperforms the organized market with USD 52 billion to USD 4 billion in 2018. The Capital Market Board of Turkey (CMB) reduced the OTC leverage to 10:1 by the beginning of 2017, which was 100 to 1 from 2011 to 2017. This new regulation dried the trading volume in gold and other contracts in the OTC market because of the lower leverage, as depicted in Table 3.

Table 3: OTC Gold And Borsa Istanbul Gold Futures Arkets' Volume (USD, million)

	Gold OTC	OTC (All Contracts)	Gold Share in OTC	BIST Gold Futures	BIST Futures (All Contracts)	Share of Gold Futures in the BIST
2013	230.789	1.386.194	16,6%	829	71.707	1,2%
2014	320.074	1.963.756	16,3%	849	198.541	0,4%
2015	279.755	3.361.530	8,3%	546	208.893	0,3%
2016	369.065	3.375.594	10,9%	1.740	192.077	0,9%
2017	150.959	1.226.074	12,3%	2.862	226.719	1,3%
2018	51.824	782.577	6,6%	4.278	270.764	1,6%

Source: Takasbank and Borsa Istanbul web sites accessed on April 14, 2019
https://www.borsaistanbul.com/veriler/verileralt/vadeli-islem-ve-opsiyon-piyasasi
https://www.takasbank.com.tr/tr/istatistikler/kaldiracli-alim-satim-islemleri-kasi

This study aims to analyze the post futures era of the Turkish financial markets where gold future contracts have launched by employing VECM (Vector Error Correction Model) over the period of 2011-2018. US COMEX, one of the world's major and the most liquid precious metal markets, is also included into the analysis in order to have a clear picture of the Turkish market positioning in the global gold market. To the best of our knowledge, this is the first study examining the interaction of gold derivatives traded in the organized market with the cash market in Turkey.

In this study, second section reviews the literature. The data and methodology are provided in the third section. Forth section evaluates the empirical results and the last section presents overall evaluation of the study.

2. Literature Review

There are numerous studies in examining price formation and the interaction of gold cash and derivatives markets prices and most of them looks at the direction of price change (Milunovich and Joyeux, 2007), rather than volatility spillover (Lkhamazhapov, 2013). The followings are the literature on the subject.

Liyuan (2009) analyzed the correlation of the gold future market index prices between the NY Commodity Exchange and the Shanghai Futures Exchange (SHFE) by using a "co-integration test" and found that the gold futures prices in the NY Commodities Exchange guides gold futures in the SHFE. Xu, Norden and Hagströmer (2010) examined SHFE gold futures trading and the effectiveness of the futures contracts by using the daily prices, volume, open interest, turnover, and the number of trades via bivariate GARCH models

from January 9, 2008 to February 12, 2010. They found that the new gold futures market in China is attractive in hedging for domestic gold market players (e.g. producers, consumers and investors). Arık and Mutlu (2014) investigated Chinese commodity market price relationship in the steel cash and futures markets. They found that gold cash market continues to maintain its eminence during the post-futures era.

Reichsfeld and Roache (2011) assessed the projection performance of cash prices in 10 commodity future contracts at the London Metal Exchange, Intercontinental Exchange, Chicago Mercantile Exchange and NY Mercantile Exchange from January 1990 to June 2011. They analyzed whether the performance were affected by market conditions by employing various models including random walk, univariate ARIMA (1,1,1) and ARMA (1,1) with and without drift and identified that the forecast from the future market surpasses the cash market and the performance of futures' forecasting did not vary according to whether prices are in an upturn or downturn.

Srinivasan (2012) examined both the price discovery process and volatility spillovers in the Indian spot and futures commodity markets. The study utilized Johansen cointegration, VECM and the bivariate EGARCH models. Johansen cointegration test shows the presence of long-term relationships between the markets. According to the VECM test results, a leading role as an effective price discovery instrument is played by the spot market.

Nicolau, Palomba and Traini (2013) worked out to identify the direction of causal relationship between cash and futures markets by estimating a set of recursive bivariate VAR models over a sample of daily market prices from January 1997 to September 2013 for crude oil, natural gas and gold markets. Their results showed that interactions between spot and futures prices is mainly derived by market type and maturity of contracts. Kumar and Sulphey (2015) examined the price formation for the Indian gold derivatives market over the period of 2009-2014 by employing co-integration and VECM and confirmed that there is a feedback relationship between the markets and both spot and derivatives markets are efficient.

Ahmad and Fun (2016) examined the efficiency of the gold derivatives market in Malaysia and the causal relationship with the spot gold market by using Restricted Least Square and Toda-Yamamoto Granger Causality methods from March 2014 to January 2015. Their result showed that Malaysian derivatives market is not efficient. The cash and derivative markets are not integrated and spot gold prices effect gold futures prices in Malaysia. Jin *et al*. (2018) analyzed price discovery and the relationship between the spot and derivatives market prices in the Chinese gold market by applying the VECM and found that price discovery happens primarily in the derivative market.

Kumar, Gupta and Taneja (2018) analyzed the price discovery between the gold cash and derivatives markets at the India Multi Commodity Exchange (MCX) by using VECM and

found that there is long term and bilateral relationship in the spot and future markets. Samna and Sadar (2018), on the other hand, examined the relationship between Chicago Mercantile Exchange (CME) and the MCX gold futures prices and trading volume in by using co-integration methodology and found that CME gold futures contracts' prices lead the Indian market.

Gupta and Bhardwaj (2018) analyzed the interaction of future and spot markets by using average daily spot and future prices of gold and silver from 2006 to 2012 in Indian Commodity Markets. They employ co-integration and VEC Granger causality tests and found that there is a two-way relationship between markets although he price discovery function is performed by the futures market.

Özdemir (2020) analyzed cointegration and causality relationship between gold spot and futures markets in Turkey via VECM, based on daily gold data for the 02.01.2009 - 31.05.2018 period acquired from Central Bank of Turkey web site. The result showed that there is a two-way relationship between the gold spot market and the gold futures market and markets are integrated with each other and mutual information flow is provided.

3. Data and Methodology

In our analysis, we use the daily return series of gold cash and derivatives markets in the Turkish capital markets from December 22, 2010 to December 31, 2018 (2093 observations). We obtain the price series of the gold futures contracts (XLT1) in the Borsa Istanbul Derivatives Markets from Bloomberg data vender. We also included Bloomberg gold spot market prices (XAUUSD) in the Borsa Istanbul Precious Metal Markets to the data set. We also obtain the gold index series of COMEX from Bloomberg. Figure 2 shows our data set for the BIST gold cash and derivatives markets and COMEX gold futures prices. Figure 2 clearly illustrates that the price series exhibit a tight co-movement for the sample period.

Figure 2: Gold spot (XAUUSD) and futures prices (COMEX and BIST gold futures-XLT1)

Table 4 gives the contract specifications of the BIST and CME COMEX futures contracts. We get the return series via taking logarithmic difference of price series.

Table 4: Gold futures contract specifications

	Borsa Istanbul Gold Futures	**CME COMEX Gold Futures**
Trading Venue	BISTECH electronic trading platform	Electronic trading; 24 hours / 6 days a week
Contract Size	1 ounce	100 ounces
Currency	USD	USD
Min. Price Tick	$0.05	$0.10
Trading Hours	Week days, Continuous trading from 9.30 a.m. to 6.15 p.m.	Sunday - Friday 5:00 p.m. – 4:00 p.m. (a 60-minute break each day at 4:00 p.m.)
Contract Months	February, April, June, August, October and December • Contracts with 3 different months nearest to the current month shall be traded concurrently	Monthly: • Current calendar month + next 2 calendar months • Within 23-month period: Any February, April, August and October contracts • Within 72-month period: Any June & December contracts
Settlement Period	Cash	Physical

Source: Borsa Istanbul, CME.

The relationship between the cash and future commodity markets' prices is determined by 3 factors: interest rate, convenience yield and storage cost (Kaldor, 1939; Narayan *et al.*, 2013). It is expected that arbitrage in the markets may lead futures and spot market prices to converge.

In this study, Johansen co-integration method and VECM are used to determine relationship between gold spot and future market. Similar to the study of Arık and Mutlu (2014) on steel market, our model consists of the error correction terms and the lagged differences of the series. The response to deviation in the long-run equilibrium is measured by error correction term. The short-term impact of previous periods' price change to the present period's price change is measured by the lagged differences.

On the first hand, we checked price series' stationarity and tested whether there is co-integration between the cash and derivatives markets prices by the Johansen test.

We estimate the following models:

$$\Delta S_t = \gamma_s + \alpha_s(S_{t-1} - a - \beta f_{t-1}) + \sum_{i=1}^{n} \propto_{s1} (i)\, \Delta S_{t-i} + \sum_{i=1}^{n} \propto_{s2} (i)\, \Delta f_{t-i} + \epsilon_{s,t} \quad \textbf{(1)}$$

$$\Delta f_t = \gamma_f + \alpha_f(S_{t-1} - a - \beta f_{t-1}) + \sum_{i=1}^{n} \propto_{f1} (i)\, \Delta S_{t-i} + \sum_{i=1}^{n} \propto_{f2} (i)\, \Delta f_{t-i} + \epsilon_{f,t} \quad \textbf{(2)}$$

where s is the cash (spot) market price, f is the futures price, i is the lag length, and $\in_{s,t}$, $\in_{f,t}$ are the disturbance terms.

$\propto_{s1}(i), \propto_{s2}(i)$,$\propto_{f1}(i), and \ \propto_{f2}(i)$ are individual lag differences coefficients which indicate short run relationship, $\propto_{s2}(i)$ and $\propto_{f1}(i)$ measure the impact of lagged price changes of the cash and derivatives markets on the price movements of the other market. One way causation from futures [cash] market to cash [futures] market requires $\propto_{s2}(i)$, $[\propto_{f1}(i)]$ to be significant, $\propto_{f1}(i)[\propto_{s2}(i)]$ to be insignificant and αs [αf] to be significant.

The error correction terms, $\alpha_s(S_{t-1} - a - \beta f_{t-1})$, $\alpha_f(S_{t-1} - a - \beta f_{t-1})$ represent the long-run equilibrium relationship between variables: αs and αf are called speed of adjustment parameters, they are the long run response of both market to the deviations. To get response to the divergences in the long run, speed of adjustment parameters must be significant (Lafuente, 2002).

To forecast and analyze global effects on the volatility of gold prices, COMEX daily return prices are integrated to the mean equation of GARCH model and the followings are estimated:

The mean equation : $spotreturn_t = \beta_0 + \beta_1 return_{comex(t)} + \varepsilon_t$ **(3)**

The variance equation : $\varepsilon_t | \ I_{t-1} \sim N(0, h_t) h_t = \omega + \gamma \varepsilon_{t-1}^2 + \varphi h_{t-1}$ **(4)**

where

β_0 : intercept
β_1 : Coefficients of the exogenous variables in the mean equation.
h_t : Conditional variance
ω : Constant term
$\gamma \varepsilon_{t-1}^2$: Previous period volatility, ARCH term
φh_{t-1} : Last period forecasted variance, GARCH term.

4. Empirical Findings

The summary of descriptive statistics is depicted in Table 5. The statistics show that the median values for all price series are close to the mean values, implying that the data are distributed around the mean. With the excess kurtosis, the series have fat tails (e.g. COMEX with a kurtosis of 2.65 and the skewness of 0.88). Right skewed fat tails show that positive returns dominate negative ones. Based on the Jarque –Bera statistics, gold return series do not show a normal distribution pattern at 1% significance level.

Table 5: Descriptive Statistics

Statistics	**XAUUSD**	**BIST XLT1**	**COMEX**
Mean	1357.03	1357.06	1356.51
Median	1293.16	1293.85	1292.50
Max.	1900.31	1895.40	1888.70

Min.	1052.94	1053.05	1050.80
Standard Deviation	188.82	187.07	188.83
Skewness	0.879081	0.88465	0.876749
Kurtosis	2.651511	2.663152	2.647346
No. of Observations	2093	2093	2093

To check the stationarity of series a unit root test is implemented to the return series. The Augmented Dickey Fuller (ADF), Phillips Perron (PP) and Dickey Fuller- Generalized Least Squares (DF-GLS) tests are adopted to check stationarity of price series. We use test statistics with no drift and time trend. We also employ Kwiatkowski, Phillips, Schmidt and Shinunit (KPSS) stationary tests. It has a null hypothesis of stationarity, which is reverse of the first three tests. Test results regarding to level and first differences of the all series are stated in the table. Although we observe unit roots for all level of each variable, first differences of all series are stationary which means series are integrated in order one I (1) (Table 6).

Table 6: Stationarity Analysis

Test Statistic Variable	s_t	f_t	Δs_t	Δf_t
ADF	-1.65533	-1.647647	*-46.59665	*-45.87550
PP	-1.662655	-1.658431	*-46.58840	*-45.87522
DF-GLS	**-1.574538	**-1.560587	-5.102173	-2.904521
KPSS	**3.418544	**3.37437	***0.07229	***0.072398

s_t: Level Series Of Cash Market Prices
f_t: Level Series Of Futures Market Prices
Δs_t , Δf_t: First Differenced Series
* Statistical Significance of 1%
**KPSS Significant at 1% for all the lags
**DF-GLS for all lags, less than 10% significance level
***KPSS for all lags, less than 1% significance level
***DF-GLS for all lags, significant at 1%

Since all variables are integrated in the same order, Johansen test is used to determine the long-term relationship between gold spot and future markets. Optimum lag selection is important for conducting the Johansen test for cointegration. In this regard, we first find the optimal VAR lag length (q). To determine the optimal VAR lag length, we took minimum information criteria Akaike (AIC) and the Hannan Quinn (HQC) into account for each bivariate VAR in leves. Optimal VAR length q=6 is found according to information criteria. Then, we run cointegration test and the results depicted in the Table 7 reveal that there is a long-term relationship between markets, which means that the spot and future markets move together in the long run.

Table 7: Johansen Test Result

Variable	$\lambda_{trace}(r)$
r(π)=0	122.0465*
r(π)=1	3.062705

* Statistical significance of 1%.

We employ VECM analysis to investigate the short run dynamics of the market and causality effects. As we find that our series are stationary at the same level and there is at most one co-integration between the gold spot and futures market, we run the VECM and the model results are depicted in the Table 8. The results of VECM analysis indicates the existence of causality in both market. There is a unilateral relationship originating from the spot to futures markets both in the long run and short run. Further, there is a long run causality stem from the spot to futures market, as the speed of adjustment parameters is negative and significant at 1% level. In our model, gold future markets are adjusted forty six percent (-0.466211) every year in the long run. Causality can be seen within the future market prices for its past price since coefficient of lagged values of independent variable Δf_{t-1} on dependent variable $\boldsymbol{\Delta f_t}$ are significant. To determine short-run causality, we run Wald Test and detect that there is a short run causality stem from the spot to futures market and the coefficient of lag values of parameters is significant at 5% level.

Table 8: VECM results

Variables	**Spot ΔS_t**		**Futures Δf_t**	
	Coeff.	**Prob**		**Prob**
$(S_{t-1} - a - \beta f_{t-1})$	0.079936	0.3514	-0.466211	0.0000
ΔS_{t-1}	-0.133539	0.1298	0.351118	0.7076
Δf_{t-1}	0.124128	0.1613	-0.340345	0.0000
C	-0.000047	0.8335	-0.000040	0.8380

We then look at the linkage between the Turkish gold markets and US COMEX. We calculate the pairwise correlations between the gold cash and derivative markets in the Turkish capital markets and COMEX gold prices. The results show that there is a very high correlation, implying an increased global integration of the Turkish market (Table 9).

Table 9: Turkish gold markets and COMEX gold market correlations

Variable	**LNXAUUSD**	**LNXLT1**	**LNCOMEX**
LNXAUUSD	1		
LNXLT1	0.999355775	1	
LNCOMEX	0.999862771	0.999293622	1

Finally, we investigated the global effects on spot market volatility. For this purpose, we use COMEX return as exogenous variable. To run GARCH Model, we first check the

clustering volatility and ARCH effect. As shown in Figure 3, we suspect that there is a cluster period of high volatility preceding by high volatility or low volatility preceding by low volatility. To test the ARCH effect, we run heteroscedasticity ARCH test. Probability of F statistic is less than 5% (Table 10). We can then reject the null hypothesis and accept that there is ARCH effect. Presence of clustering volatility and Arch effect indicate us that we can run the GARCH model.

Table 10: ARCH Test Results

F-statistic	424.3447	Prob. F(1,2089)	0.0000
Obs*R-squared	353.0374	Prob. Chi-Square(1)	0.0000

For volatility analysis, a GARCH (2,1) model is estimated. In the model, the gold spot market return is the dependent variable. We included the daily returns of the COMEX as independent variable to observe the volatility effect.

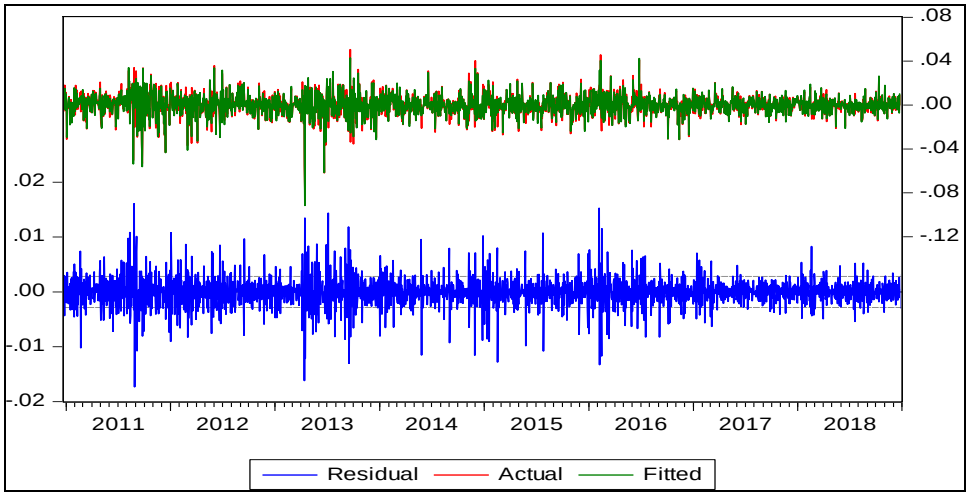

Figure 3: Clustering volatility in the residuals

Forecasted result of generalized autoregressive conditional heteroskedastic model (GARCH -2, 1) are shown in Figure 3. Mean equation of GARCH (2,1) model implies the significant impact of COMEX and positive relations between COMEX and spot gold markets.

As depicted in Table 11; intercept parameter of the conditional variance equation is positive and statistically significant. It implies the existence of other factors in the return generating process. The coefficients of ARCH and GARCH parameters are significant at

1% level, which infers that today's volatility can be explained by past period volatilities. Sum of ARCH (0.36, -0.34) and GARCH (0.97) coefficients are nearly 1 which ensures unity, implying shocks or changes to the gold spot have persistent effect. Since GARCH coefficient is larger than ARCH coefficients, own lagged values of volatility of returns has greater effect than to its new shocks. Consequently, the effects of preceding period's forecast variance is more obstinate.

Table 11: GARCH model forecast results

Variable	**Coefficient**
Mean Equation	
$return_{comex(t)}$	0.940757***
C	-0.000006
Variance Equation	
C	0.000000***
ε_{t-1}^2	0.364363***
ε_{t-2}^2	-0.340332***
h_{t-1}	0.971149***

*** 1% statistical significance

5. Conclusion

Commodity markets have important functions in capital markets in stabilizing the economy and helping market participants to hedge their risks. Turkish commodity market is not an exception. Although the Turkish OTC gold market provides more liquidity than gold derivatives market, the latter has been growing progressively.

This study analysis interaction and price discovery process of the gold cash and future markets in the Turkish financial markets over the period of 2011-2018, by means of Johansen cointegration test and VECM. We further examine the relation of the Turkish local gold market with that of an international market, namely COMEX, which is one of the liquid commodity markets in the globe. We also investigate the effect of gold future contracts on the volatility of gold spot market via GARCH model.

There is limited analysis on the Turkish gold spot and future market interaction. Compared to Ozdemir's (2020) study result that there is a two-way relationship of the spot and future gold markets, our study results indicate that the gold cash market is leading the futures market both in the long and short term. There is a long run causality running from spot to futures market with a 1% statistical significance. There is also a short run causality running from the gold spot to futures market, which means that gold price is first determined in the spot market. One can infer that, due to global financial crisis and political disturbances like concerns make investors prefer to put their savings to safe heaven like gold for liquidity and has taken their money out of risky derivatives investments.

The findings also show that Borsa Istanbul and the COMEX traded gold future contracts prices are highly correlated. This evidence provides an advantage for local market

participants to trade similar contracts in the Turkish market without facing cross-border transaction costs. It also shed light for policy makers on designing commodity futures market (e.g. contract design, leverage ratio, margining). The findings also reveal that new shocks have less effect on the volatility of returns, which are more sensitive to its own lagged values, and the effects of variance of previous years is more tenacious. Moreover, the total of ARCH and GARCH terms is large enough to indicate persistency of volatility in the gold market.

To conclude, although the launch of the gold future contracts help enhancing the maturity level of the Turkish financial markets, the direction of the relationship is still from the cash to futures market. This is in line with the findings of Ahmad and Fun (2016), Arık and Mutlu (2014) and Srinivasan (2012). Limited influencing power of futures market on the spot market for gold contradicts with the findings of Jin *et al.* (2018), Samna and Sadar (2018), Gupta and Bhardwaj (2018)and Reichsfeld and Roache (2011). This relation may be expected to turn to two sided as the Turkish gold futures market becomes more deep in terms of trading volume and market participation as argued by Kumar *et al.* (2018).

Further research on investigating the reasons behind the infrequent use of gold futures contracts in hedging in the Turkish market may be complementary to this study.

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