International Journal of Social Science and Economic Research

ISSN: 2455-8834

Volume:01, Issue:10

EMPIRICAL ANALYSIS OF THE DETERMINANTS OF GOLD PRICES IN TURKEY: VAR MODEL ANALYSIS

[1]Assist. Prof. Dr. Nuru Giritli, [2]Assist. Prof. Dr. Nezahat K. Dogan

[1]Department of Banking & Finance, European University of Lefke, Lefke, Mersin 10/Turkey

[2]Final International University, Department of Business, Catalkoy, Kyrenia North Cyprus, via Mersin 10, Turkey

ABSTRACT

In our study, we aimed to identify the determinants of the price of gold using unrestricted VAR model in Turkey, for the periods from January 2003 to August 2013. Results obtained by VAR analysis (Granger causality, impulse responses, and variance decomposition) shows that the most important variables affecting the gold prices in Turkey are exchange rate and silver price. The results show that gold price is not depending on intra-country factors in Turkey such as interest rate, gold reserves of the Central Bank, and Turkey is gold price taker.

Keywords: Gold Price, VAR Model, Turkey

INTRODUCTION

Financial market crisis that started in the USA economy in 2007 caused huge losses at financial institutions. World economy real sector production slowed down and that has led to an increase in unemployment in the USA and within the Euro zone. Due to the negative impact of the financial crisis along with the contraction of the world economy, instability of the financial markets has led to variations in the gold prices especially in Turkey. Nowadays, gold is an important investment tool since it is used as a means of transaction, as well as a reserve in Turkey. Until the last ten years gold had seen as a safe haven rather than an investment vehicle and it was preferred choice by the risk adverse people.

Due to the financial crises in recent years, deterioration of the economies and higher risk perception caused investors to enter into different pursuits provided. Investors are now starting to turn to precious metals such as gold and silver that are most liquid and easy that can be converted into money. Therefore, demand for gold has increased among these precious metals. In general, price of gold is determined mostly by various factors and those factors are divided into two as

ISSN: 2455-8834

Volume:01, Issue:10

demand side and supply side factors. The first source of the supply side factor is the production of gold by mining and recovery of gold as the result of economic activity depending on making profit. The second source of the gold supply side factor can be obtained from Central Banks' and/or financial institutions' activities. These institutions via sales or contracts can control the amount of gold in the market. However, empirical studies show that gold plays an important role in monetary system as quantity of gold and its price fluctuates as policy actions take place. Kitchen (1996), Christie-David at al. (2000) and Tandon and Urich (1987). On the other hand demand side factors of gold can be divided into two. Firstly, due to the nature, its physical characteristics and its value, gold can be seen as prestige in some countries; and thus, those factors increase the use of gold as jewelry and its price in turn. Secondly, the common belief for the gold is that the gold has a store of value and can be used for hedging strategies among the investors to protect the wealth in the case of losing some fraction of wealth due the reduction in the value of some other assets.

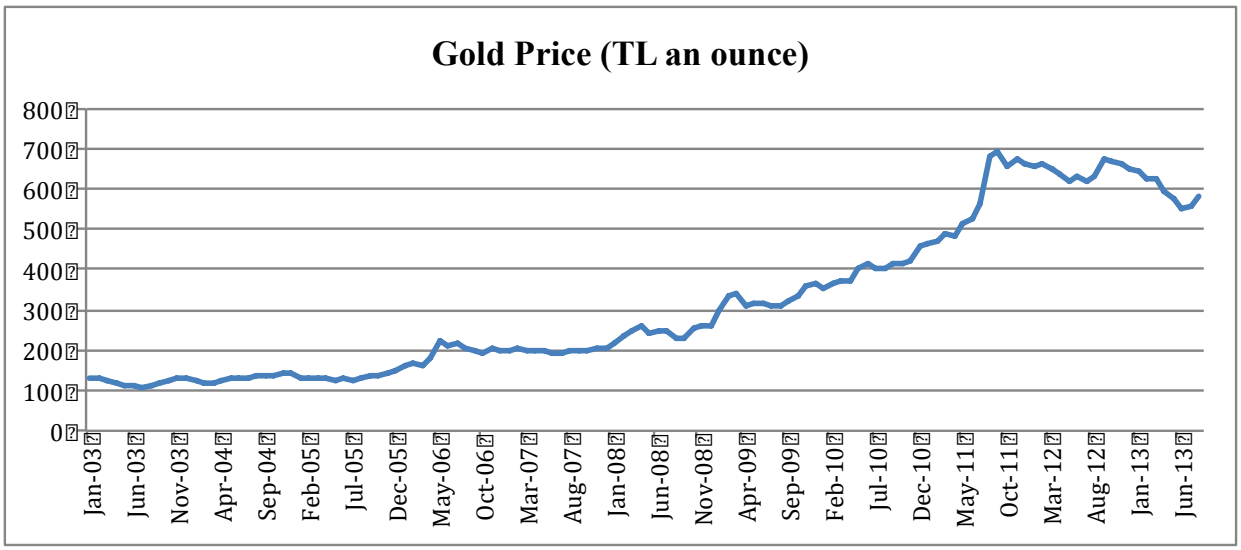
There are a large number of studies that have attempted to model the determinants of the price of gold. *Anssi (2007)* assumed that short-term price of gold is determined by supply and demand of gold. Therefore, determinants affecting the supply such as extraction of gold from the reserves, time and cost of production affect the gold prices. On the other hand, demand for gold consists of two components; use demand and asset demand, and are affected by the real interest rates and dollar exchange rate expectations. According to the author, the long-run price of gold is tied to the cost of extraction of gold and thus, the long-run price of gold is expected to move with the inflation. A simple empirical model based on the supply and demand by *Levin and Wright (2006)* has attempted to study the determinants of gold in the USA using world price levels, US and world inflation, USA and world inflation volatility, world income, world exchange rate, gold lease rate, alternative investment opportunities, credit risk and time-specific uncertainty caused by political and financial risk. The results of the empirical analysis showed that there is a long-term one-to-one relationship between the price of gold and the general price level in the USA. These finding is consistent with results from *Gorton and Rouwenhorst(2006)* and *Ranson and Wainwright (2005)* and Barsky and Summers (1988)

In Turkey, production of gold is very limited to meet the demand. Since gold is an investment vehicle that is imported to Turkey, conditions in the gold price are influenced by the formation of different factors in Turkey. Figure 1 shows the variations in gold prices since January 2003. From this graph, it is clear that there is a upward trends in gold prices from 2003 to August of 2011 in Turkey. However, more formal tests were used in data section to analyze the nature of the data.

ISSN: 2455-8834

Volume:01, Issue:10

Figure 1. Price of Gold (TL an ounce)



Source: Tuik, Turkey

Research by *Omag (2012)* studied the relationship between the gold prices and some financial indicators such as interest rates, consumer price index, exchange rates, Istanbul stock exchange index in Turkey between 2002 and 2011; according to the regression model, the author found a positive relationship between the gold prices, Istanbul stock exchange index and exchange rate between Turkish lira and the Dollar.

Through some of the work done in this field, *Abken (1980)* although the price of gold is an indicator of the economic and political stability in Turkey, this macroeconomic relationship is reciprocal and has a complex structure. According to the study by *Vural (2003),* for the period 1990 to 2003 the price of gold moves in the same direction with silver, oil and copper prices, but moves in opposite direction with the Dow-Jones Index. For the periods 2003-2011, *Aksoy and Gunner (2013)* found that, there is an inverse relation between gold returns and stocks. *Kutan and Aksoy (2004)* concluded that the Istanbul Gold Exchange is not effected by CPI news. Another study conducted by *Demireli and Torun (2010)* found that gold prices are affected by exchange rates and interest rates. *Gokdemir and Ergun(2007)* argued that there is negative relationship between price of gold and Dollar.

According to studies conducted in recent years in Turkey, there are many variables that emerge as determinants of the gold prices and different conclusions drawn by different econometric techniques that are used to define the variables that affect the gold prices significantly. In our study we attempt to identify the determinants of the price of gold using unrestricted VAR model.

ISSN: 2455-8834

Volume:01, Issue:10

The paper is organized as follows. Data section summarizes the data used in the model. Model section sets out the research methodology adopted and its detail. Finally, the results are concluded in result section.

DATA

Monthly prices of gold (GOLD) and silver (SILVERP), dollar exchange rate (ER) , interest rate (INT) share prices in BIST100 (BIST100), and gold reserves (GOLD_RES) of The Central Bank are used in this study. It covers the date from January 2003 to August 2013. The data is obtained from The Electronic Data Delivery System of The Central Bank of Republic of Turkey. The gold and silver are traded at the Istanbul Gold Exchange and their prices are valued in US dollars per ounce. The entire data series is expressed in natural logarithms. Descriptive statistics and correlation matrix are given in Table1 and Table2, respectively. Table 2 shows the correlation matrix between the gold price and other variables. Gold and silver have 97% correlation, which gives them the highest positive correlation among the variables. Figure 2 also plots each variable against gold prices. It shows that there is positive direct relationship between gold reserves, Bist100, silver price, exchange rate with gold price, and negative relationship between interest rate with gold price. Linear regression fits are also given in each graph.

Table 1. Descriptive Statistics

	LGOLD	LER	LGOLD_RES	LSILVERP	LBIST100	INT
Mean	6.687691	0.403783	8.162834	2.624612	10.55019	17.40695
Median	6.732342	0.396626	8.079897	2.611172	10.67254	16.63000
Maximum	7.483711	0.672026	10.00086	3.829076	11.40862	47.72000
Minimum	5.795663	0.162204	7.154146	1.536867	9.219970	7.440000
Std. Dev.	0.534927	0.125541	0.813111	0.618099	0.543741	9.582379
Skewness	-0.061550	0.175416	0.812131	-0.040306	-0.785249	1.669652
Kurtosis	1.637080	2.270007	2.712216	1.974581	2.820960	5.540328
Jarque-Bera	9.987762	3.498528	14.51226	5.642573	13.32544	93.88917

ISSN: 2455-8834

Volume:01, Issue:10

Probability	0.006779	0.173902	0.000706	0.059529	0.001278	0.000000
Sum	856.0245	51.68416	1044.843	335.9504	1350.424	2228.090
Sum Sq. Dev.	36.34068	2.001580	83.96608	48.51991	37.54813	11661.39
Observations	128	128	128	128	128	128

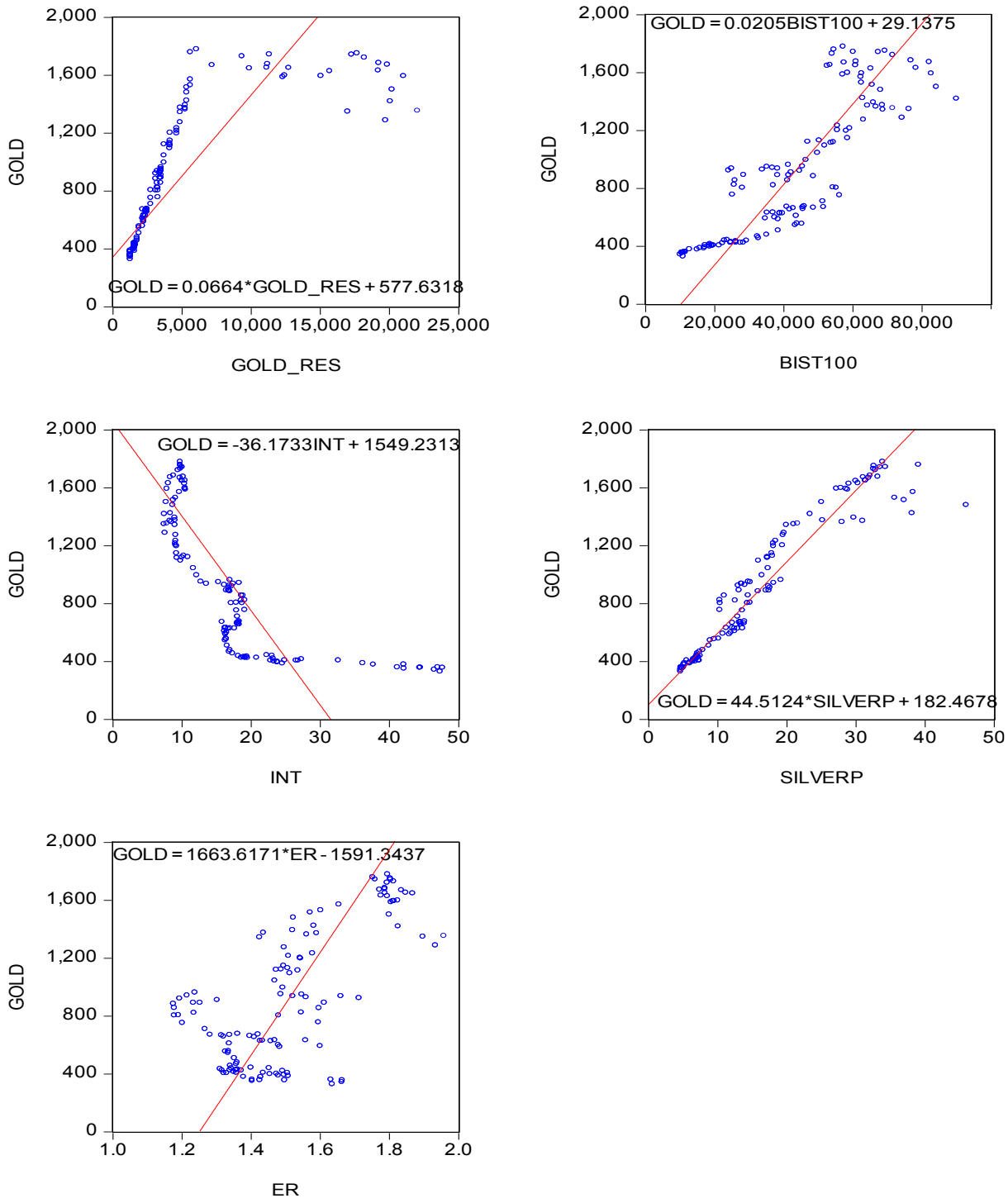
Table 2. Correlation Matrix

	LGOLD	LER	LGOLD_RES	LSILVERP	LBIST100	INT
LGOLD	1.000000					
LER	0.572111	1.000000				
LGOLD_RES	0.913128	0.700316	1.000000			
LSILVERP	0.972385	0.494329	0.868672	1.000000		
LBIST100	0.868367	0.305224	0.805289	0.896663	1.000000	
INT	-0.814214	-0.306091	-0.722363	-0.832481	-0.927060	1.000000

ISSN: 2455-8834

Volume:01, Issue:10

Figure 2. Gold Price and Other Variables



ISSN: 2455-8834

Volume:01, Issue:10

METHODOLOGY

The VAR model is used in this study, because of the nature of the VAR model. It becomes very popular among the time series models nowadays. The VAR model takes all variables as system and analyzes it. There is no need to specify which variables are exogenous or endogenous, and no need to determine pre-constraints about the relationship between variables in VAR models.

Since we are using time series data, we test the fundamentals of our data generating process by conducting the standard Augmented Dickey and Fuller (ADF) tests ,and Phillips and Perron(PP) unit root tests. The results of unit root tests are given in Table 3.

Table 3. Unit Root Test Results

		ADF	DFGLS	PP	KPSS
Level					
Intercept	LER	--1.129609 (2)	-1.126770 (2)	-1.280079	0.770046***
	LGOLD	-1.215812 (0)	1.120240 (0)	-1.190980	1.345405***
	LSILVERP	-1.521474 (0)	0.138081 (0)	-1.34276	1.257986***
	LBIST100	-1.997985 (1)	0.401395 (1)	-2.109197	1.119185***
	INT	-4.574493***(1)	-0.197184 (3)	-4.342284***	1.050396***
	LGOLDRES	2.058076 (0)	4.379038 (0)	2.047827	1.267908***
Intercept & trend	LER	-2.901920 (2)	-1.398889 (0)	-2.743048	0.253022***
	LGOLD	-0.851118 (0)	-1.334729 (0)	-1.299236	0.118934
	LSILVERP	-2.239909 (1)	-2.390112 (1)	-2.017771	0.084449***
	LBIST100	-2.270390 (1)	-1.552102 (1)	-2.358340	0.159549**
	INT	-5.113263***(3)	-1.488509 (5)	-3.306874**	0.176334**
	LGOLDRES	-0.652810 (0)	-0.402294 (0)	-0.676041	0.252058***
First differences					
Intercept	DLER	-8.565427***(1)	-4.585455***(2)	-7.692356***	0.225116
	DLGOLD	-10.10525***(0)	-10.14618***(0)	-10.10782***	0.190426
	DLSILVERP	-9.32812***(0)	-8.596477***(0)	-9.298578***	0.130842
	DLBIST100	-8.794193***(0)	-7.391481***(0)	-8.956483***	0.162676

ISSN: 2455-8834

Volume:01, Issue:10

	DINT	-3.086059**(2)	-2.920641***(2)	-8.369411***	0.512046**
	DLGOLDRES	-10.51472***(0)	-10.08311*** (0)	-10.57364***	0.504020**
Intercept & trend	DLER	-8.778349***(1)	-8.710734***(1)	-7.752084***	0.032358
	DLGOLD	-10.15062***(0)	-10.04488***(0)	-10.14466***	0.121256*
	DLSILVERP	-9.374378***(0)	-8.843190***(0)	-9.325565***	0.060372
	DLBIST100	-8.856180***(0)	-8.604443***(0)	-8.942238***	0.056313
	DINT	-8.700073***(0)	-8.743991***(0)	-33.07088***	0.161212**
	DLGOLDRES	-10.92641***(0)	-10.82902***(0)	-10.92641***	0.072061

Note:: D stands for first difference operator while L stands for natural log operator. (***),(**) and (*)represent significance at 1%,,5%, and 10% levels respectively. Lag lengths are determined by the SIC and are represented in parenthesis.

The shortfalls of these standard tests necessitate the use of more robust tests like Dickey-Fuller GLS detrended (DFGLS) and KPSS unit root tests. These are also given in the table. Then, The unrestricted VAR model of order p is represented in Eq. (1)

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + ... + \alpha_p y_{t-p} + \beta z_t + \varepsilon_t \quad (1)$$

Where y_t is an $m \times 1$ vector of endogenous variables, α_0 is the intercept, z_t is the vector of exogenous variables, α_1 and β are coefficient matrices and p is the lag length. Table 4 shows the lag selection criteria results. According to the results, almost all selection criteria indicates the lag length $p = 1$ in the model.

ISSN: 2455-8834

Volume:01, Issue:10

Table 4. Lag Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	585.5387	NA	2.37e-12	-9.740145	-9.600022	-9.683246
1	884.0063	561.8214*	2.88e-14*	-14.15137*	-13.17050*	-13.75307*
2	911.2437	48.52388	3.35e-14	-14.00410	-12.18249	-13.26440
3	937.2719	43.74479	4.01e-14	-13.83650	-11.17415	-12.75540
4	965.5177	44.62372	4.67e-14	-13.70618	-10.20308	-12.28368
5	999.1850	49.79363	5.03e-14	-13.66698	-9.323135	-11.90308
6	1025.508	36.27703	6.25e-14	-13.50434	-8.319753	-11.39904
7	1060.500	44.69556	6.87e-14	-13.48739	-7.462067	-11.04070
8	1095.526	41.20676	7.76e-14	-13.47102	-6.604950	-10.68293

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

We test the stability[1] of the VAR and find that all the characteristic or inverted roots of the AR polynomial lie within the unit circle. However, VAR models are difficult to interpret. One solution is to construct the impulse responses and variance decomposition. While determining the effectiveness of variable on a macroeconomic variable, causality tests are used. Then the availability of variables as a policy tool is determined with impulse response functions, and the degree of impact is determined by variance decomposition. Table 5 gives the granger causality test results. The results show that there is significant granger causality relationship only from exchange rate to gold price. However, there is no granger causality relation from the other variables through gold price. And also, it can be seen that there is significant causality relation

[1]All results of the stability test are available and can be provided upon the author's request.

ISSN: 2455-8834

Volume:01, Issue:10

from gold prices only through silver prices as expected. These results contrast the studies performed before, which considers the gold as "safe haven". Due to our main concern, we focused on the causality from gold price to other variables and from other variables to gold prices. Therefore, we don't discuss the other causality relationships among the other variables.

Then, the availability of the variable on a gold price as a policy tool is determined by impulse responses. In order to consolidate the results obtain from causality tests, the response of gold prices due to change in pattern of other variables, and the response of other variables due to the shocks from gold prices are examined by using impulse response function graphs. Impulse responses trace out the responsiveness of the dependent variables in the VAR to shocks to the error term. A unit shock is applied to each variable and its effects are noted. Figure 2 shows the impulse responses of gold prices to shocks from other variables, and response of other variables to shocks from gold prices. From the Figure 2, gold price is found to be unresponsive to a shock from other variables, except exchange rate and silver prices. And, there is no response from other variables to shocks from gold price, except the silver price, as expected.

Variance decompositions offer a slightly different method of examining VAR dynamics. They give the proportions of the movements in the dependent variables that are due to their own shocks, versus shocks to the other variables. Therefore, it gives information about the importance of each shock to variables in the VAR. Table 6 gives the variance decomposition of variables in the model.

Table 5. VAR Granger Causality/Wald Test Results

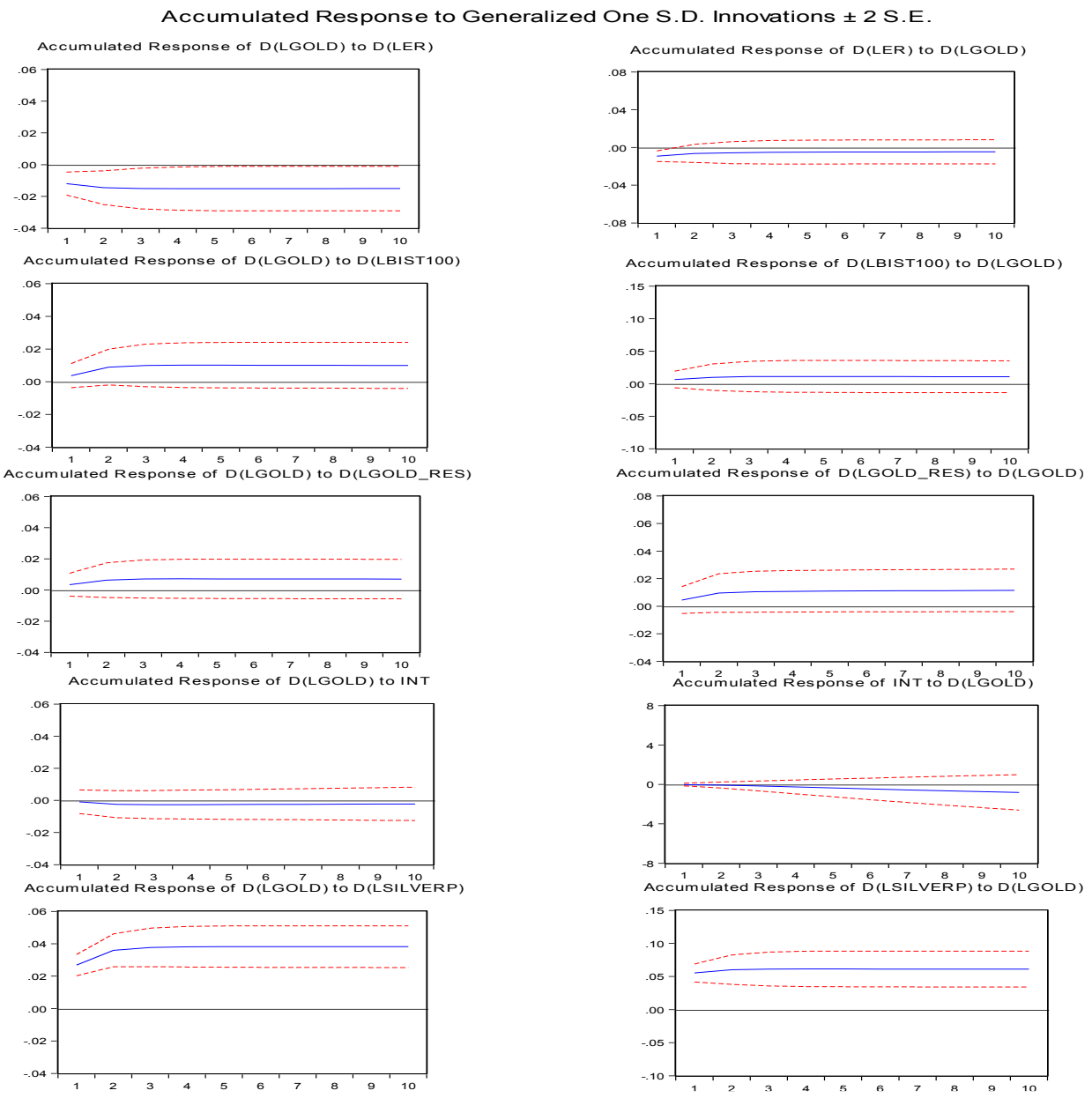
	D(LGOLD)	D(LER)	D(LBIST100)	D(LGOLD_RES)	INT	D(LSILVERP)
D(LGOLD)		3.965**	0.048	1.104	0.076	0.691
D(LER)	0.819		0.037	0.481	3.935**	0.026
D(LBIST100)	1.515	0.006		0.716	12.113***	0.292
D(LGOLD_RES)	0.179	6.920***	0.919		2.571	1.052
INT	0.774	2.906*	1.132	1.939		0.168
D(LSILVERP)	4.977**	0.151	0.273	0.000	0.189	

(***),(**) and (*)represent significance at 1%,,5%, and 10% levels respectively. Table shows the causality from the variables in the columns through other variables in the rows.

ISSN: 2455-8834

Volume:01, Issue:10

Figure 3. Impulse Responses



ISSN: 2455-8834

Volume:01, Issue:10

Table 6. Variance Decomposition of Variables

Variance Decomposition of D(LGOLD):

Period	S.E.	D(LGOLD)	D(LER)	D(LBIST100)	D(LGOLD_RES)	INT	D(LSILVERP)
1	0.041432	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.042814	94.35560	0.142940	1.420745	0.195844	0.007456	3.877416
3	0.042864	94.20902	0.145129	1.475567	0.208777	0.007456	3.954052
4	0.042866	94.20078	0.145140	1.478246	0.208923	0.007672	3.959236
5	0.042867	94.20009	0.145181	1.478284	0.208939	0.007957	3.959549
6	0.042867	94.19975	0.145194	1.478302	0.208966	0.008241	3.959551
7	0.042867	94.19941	0.145198	1.478363	0.208987	0.008508	3.959536
8	0.042867	94.19908	0.145200	1.478439	0.209003	0.008754	3.959524
9	0.042867	94.19878	0.145201	1.478514	0.209017	0.008980	3.959512
10	0.042867	94.19849	0.145203	1.478584	0.209029	0.009188	3.959502

According to the results from Table 6, the variable, which has highest share in predicted error variance of gold price for the next periods, is silver price with a share of about 4%. Then the other variables are BIST100, GOLDRES, ER, and INT, respectively. The share of gold price in the predicted error variance of other variables is pretty low, except in the silver price.

RESULTS AND CONCLUDING REMARKS

In this study, the relationship between gold prices and other macroeconomic variables is examined by using unrestricted VAR model. Three outputs obtained by VAR analysis (Granger causality, impulse responses, and variance decomposition) shows that the most important variables affecting the gold prices in Turkey are exchange rate and silver price. This results show that gold price is not depending on intra-country factors in Turkey, and Turkey is gold price taker. When we think about that the Turkey is importing gold and there is no gold production within the border of the country, all these results are expected. Therefore, we can conclude that the gold may not be a "safe haven" for hedging for the people living in Turkey in the case of local currency depreciation against US dollar. As a result, the value of the dollar determines the price of gold in Turkey. Finally, it is observed that gold prices are not affected by interest rates,

ISSN: 2455-8834

Volume:01, Issue:10

gold reserves and share prices. Concerning these results and positive relationship between gold prices and silver prices, it is possible to say that gold could be used as substitutes for other precious metals such as silver with the aim of hedging.

REFERENCES

Akben, P.A. (1980). The Economics of gold price movements, Web site:http://www.richmondfed.org/publications/research/economic_review/1980/pdf/er660201.pdf

Aksoy, M., Topcu, N. (2013). Altın İle Hisse Senetlerive Enflasyon Arasındaki İlişki. *Atatürk Üniversitesi İ.İ.B.F. Dergisi*, 27, 1, 59-78.

Anssi, L. (2007). *Gold investments and short-and-long-run price determinants of the price of gold*, Lappenranta University of Technology, School of Business Finance. August 29.

Barsky, R.B. and Summers, L.H. (1988). Gibson's paradox and the gold standard, *Journal of Political Economy, Vol.96, No.3, pp.528-550.*

Christie-David, R., Chaudhry, M. and Koch, T.W. (2000). Do macroeconomics news releases affect gold and silver prices? *Journal of Economics and Business, Vol.52, No. 5, pp. 405-421*.

Demireli, E.&Torun, E. (2010). Alternatif Piyasa Oynaklıklarında Meydana Gelen Kırılmaların ICSS Algoritmasıyla Belirlenmesi ve Süregenli**g**e Etkileri: Türkiyeve Londra Örne**g**i, *Muhasebe ve Finansman Dergisi*. 46, 129-145.

Gorton, G. and Rouwenhorst, K.G. (2006). Facts and fantasies about commodity futures, *Financial analyst journal*, vo.l 62, no. 2.

Gökdemir, L.& Ergün, S. (2007). Altın Fiyatlarındaki stikrarsızlı**g**ın Altın Ticareti Üzerindeki Etkisi: Türkiye Örne**g**i. *Journal of Yasar University*. Vol. 2, 5, 461-476.

Kitchen, J. (1996). Domestic and international financial market responses to federal deficit announcements, *Journal of International Money and Finance, Vol.15, No.2, pp 239-254.*

Kutan, A. &Aksoy, T. (2004). Public Information Arrival and Gold Market Returns in Emerging Markets: Evidence from the Istanbul Gold Exchange. *Scientific Journal of Administrative Development*, 2, 13–26.

Levin, E. &Wright R.E. (2006). Short run and long run determinants of the price of gold. *World Gold Council, Research Study*, No 32, June 2006.

ISSN: 2455-8834

Volume:01, Issue:10

Omag, A. (2012). An observation of the relationship between gold prices and selected financial variables in Turkey.*MuhasebeveFinansDergisi*, July 2012, 195-206.

Ranson, D. & Wainwright, H.C. (2005). Inflation protection: why goldworks better than Linkers", The World Gold Council, available:http://www.gold.org/deliver.php?file=rs_archive/inflation_linkers.pdf

Tandon, K. and Urich, T. (1987), International market response to announcements of US macroeconomic data, *Journal of International Money and Finance, Vol.6, No.1, pp.71-83*

Vural, M. G. (2003). AltınPiyasasıveAltınFiyatlarınıEtkileyenFaktörler. TCMB UzmanlıkYeterlilikTezi. Web Site:http://www.tcmb.gov.tr/kutuphane/TURKCE/tezler/goknilvural.pdf

