Gold-Stock Market Relationship: Emerging Markets versus Developed Markets

Jalal Seifoddini
Islamshahr Branch, Islamic Azad University | jalal.seifoddini@iiau.ac.ir

Fraydoon Rahnamay Roodposhti
Science and Research Branch, Islamic Azad University | f-rahnamayroudposhti@srbiau.ac.ir

Elahe Kamali
Central Tehran Branch, Islamic Azad University | ela.kamali.mng@iauctb.ac.ir

Volume 7 No 1 (2017) | ISSN 2158-8708 (online) | DOI 10.5195/emaj.2017.126 | http://emaj.pitt.edu |

Abstract

We perform a comparative study on the gold-stock market relationship in U.S. stock market as a developed market and in Iran stock market as an emerging market. By considering appropriate variables for emerging markets and by providing a more proper methodology, we improve earlier studies. According to our findings, the relationship between stock market returns and gold price returns does not follow any specific regimes and that this relationship changes in short and long term returns. It is necessary to mention that in the present research, we did not consider this relationship in major structural changes in the economies and instead considered usual economic circumstances that investors are regularly faced with in their investment decisions.

Keywords: Gold, Stock Market, Safe Haven, Hedge, Regime Switching

Volume 7 No 1 (2017) | ISSN **2158-8708** (online) | DOI 10.5195/emaj.2017.126 | http://emaj.pitt.edu

Gold-Stock Market Relationship: Emerging Markets versus Developed Markets

Jalal Seifoddini
Fraydoon Rahnamay Roodposhti
Elahe Kamali

1. Introduction

Investors always look for different assets, to lower the risk of their portfolios as low as possible, and gold is conceived to have great potentials for this purpose. In the present research, we will investigate whether gold is an asset with the characteristic of a safe haven or hedge. In this regard, we will improve past studies by further investigating the difference in the role of gold in developed markets and emerging markets, because we guess that developed markets have a greater effect on gold compared to emerging markets. According to Pierdzioch et al. (2016), investigating the data of other markets can be interesting, because recent studies have obtained interesting results about the gold market efficiency in various countries. Therefore, we will consider Iran's stock market, which is recognized as an important emerging market in recent years and frequently mentioned as one of the Next Eleven emerging economies (Pradhan et al. (2016), Heirati & O'Cass (2016), and Rancic & Jakovljevic (2016)). Nevertheless, past studies in this field, which we addressed in the literature review, have not covered Iran's market and studying Iran's market is one of our contributions.

In addition, given that the official global gold price is denominated in U.S. dollars, currency exchange rate changes in the financial markets of different countries other than U.S. can influence the relationship between gold and stock market in these countries. Therefore, comparing the relationship between gold and stock market in U.S. whose currency is dollar and has a very developed financial market with another country whose currency is not U.S dollar and is also recognized as a small emerging market can reveal the differences in the role of gold in different economies. We investigate this matter in the present paper as one of our contributions.

Another contribution of this paper is the modelling of the relationship between gold and stock market using a regime switching approach and determining the regimes based on the data characteristics, the details for which are presented in the methodology section of the paper.

2. Literature Review

Primary studies about safe havens focus on the behavior of investors at the times of crises in a market, for example, Upper (2000) focused on market turmoil in 1998. Kaul & Sapp (2006), and McCauley & McGuire (2009) also studied in this field. In this type of studies, only Capie *et al.* (2005), clearly investigated the role of gold as a hedge against U.S. dollar. Baur & Lucey (2010), presented a specific definition of safe haven and hedge concepts, and investigated this subject in the markets of the U.S., U.K., and Germany and discovered that gold is normally a hedge for the stock market; and at times of a market collapse, it acts as a safe haven. However, they discovered that the safe haven property of gold is short lived. Next, Baur & McDermott (2010) presented a more detailed definition of safe haven and hedge assets and also expanded the investigation scope (U.S., U.K., Switzerland, Russia, Japan, Italy, India, Germany, France, China, Canada, Brazil, and Australia). According to Baur & McDermott (2010), "a strong (weak) hedge is defined as an asset that is negatively correlated (uncorrelated) with another asset or portfolio on average, and a strong (weak) safe haven is defined as an asset that is negatively correlated (uncorrelated) with another asset or portfolio in certain periods only, e.g. in times of falling stock markets".

Baur & McDermott (2010) discovered that the role of gold as a safe haven is short lived and especially observed in daily fluctuations of developed markets but in lower frequencies like weekly or monthly, no such relationship exists. Iqbal (2017), added Pakistan's market to the population of markets in which this subject has been investigated. Hood and Malik (2013) focused on extreme situations in the stock market and found that in periods of extremely low or high volatility, gold does not have a negative correlation with the U.S. stock market. The above mentioned studies, use assumptions and methodologies similar to Baur and Lucey (2010) and their main characteristic is that researchers directly set a price decrease level defined as a market collapse and they use this predetermined criteria for all the markets under consideration. However, we think that it is not appropriate to use the a predefined criteria with no regard to different markets charachteristics. We will address this subject in the methodology section of the paper. Other researchers such as Beckmann *et al.* (2015), investigated the role of gold as a hedge or safe haven based on the same definitions, but through the smooth transition methodology. However, they concluded that the transition between the two extreme regimes appears to be very fast in some cases. Besides, they used data with monthly frequencies while the studies of Baur & Lucey (2010) and Baur and McDermott (2010) show that the

gold role as a safe haven for stock market is only observed in daily data.

Baur and McDermott (2010) believe that the safe haven effect does not exist in emerging markets. This can be interpreted in this way that investors in emerging markets like Iran, are not among the main players of the global gold market and their behavior does not influence the global price of gold. Iran's demand only comprise 3% of the global gold investment demand through coins and bullions (World Gold Council 2016). Thus, the assumption that Iranian investors behavior would influence the global gold price does not seem reasonable. It is better to focus on the domestic price of gold in every country. In this regard, Beckmann *et al.* (2015) converted the global gold price from U.S. dollar to the national currency of each country under consideration. However, this is not enough, because changes in the domestic gold price can be due to exchange rate fluctuations. Beckmann *et al.* (2015) admited this problem, but ignored it. Iqbal (2017) in his model for investigating the relationship between gold and stock market also converted the global gold price into India and Pakistan currencies without considering the effects of exchange rate changes. But in the present research, in order to resolve this issue, we will consider the global gold price and exchange rate as other factors influencing the relationship between the domestic gold price and stock market in Iran. Because according to Samadi *et al.* (2015) , Iran's currency exchange rate against U.S. Dollar and global gold prices fluctuations have a significant effect on Iran's domestic gold coins prices. Their relationships are especially stronger in the long term than in the short term. Accordingly, in this paper, these two factors are considered in investigating the relationship between Iran's stock market and domestic gold coins prices. Kaffash Hosseini and Rostami (2013) investigated this subject based on Baur and Lucey's (2010) and Baur and McDermott's (2010) model though they did not consider other factors influencing the relationship between gold and stock market.

3. Research Methdology

Baur and Lucey (2010), Baur and McDermott (2010), Hood and Malik (2013), Lucey and Li (2015) and Iqbal (2017) manually classified stock market returns into categories based on a rule of thumb (e.g. 5%, 2.5% and 1% quantiles) and distinguished the relationship between stock market returns and gold price returns when the stock market return was at each of these categories. However, using the same rule of thumb for all markets cannot be appropriate and may lead to incorrect results, because every market has different microstructure. Therefore in the present research, we use a model that makes it possible to identify the existence of different regimes based on the data characteristics that are derived from different markets. These kind of models are known as regime switching models which estimate the relations between variables in different regimes. In these models, the relations between the variables is nonlinear and the advantage of these models is in their flexibility which provides the possibility to consider different means and variances in different regimes. Two main categories of regime switching models include the Markov Regime Switching and Threshold Regime Switching models. The Markov Regime Switching model is useful for cases where the factor causing the regime switching is not visible. But in Threshold Regression (TR) models, it is assumed that the variable determining the regime changes is visible (Gonzalo and Pitarakis 2013). In this research, since the value of the variable determining the regime is important for us, we will use the TR model to see whether a regime switching has occurred in the gold-stock market relationship or not. One of the advantages of the TR model is that without using the rule of thumb, it is possible to determine the number of existing regimes in a way that the F-Statistics of the regression is maximized.

Therefore, the model used for Iran's market will be as follows. Later, by making some changes in the model, we will also present the U.S. market model. Moreover, after analyzing the data series, it is possible to adjust the model and change it from a static model to a dynamic model and we will do this in the next section after we describe our data. Now as a primary model, if we consider Iran Stock Market Return IMR_t as the threshold variable with $j=0, 1, \ldots m$ regimes, we will have the following model:

$$GC_t = c + \alpha_1 GO_t + \alpha_2 USD_t + \beta_j IMR_t + \varepsilon_t \quad (1)$$

Where

GC_t: domestic gold coins returns in Iran
GO_t: global gold returns
USD_t: U.S. Dollar to Iran's Rial exchange rate
α_i: coefficients of regime-independent variables
β_j: coefficients of regime-dependent variables

So, if IMR_t is the regime determinant variable, its threshold values will be as ($\gamma_1 < \gamma_2 < \ldots < \gamma_m$) and we will be in j regime if: $\gamma_j \leq IMR_t < \gamma_{j+1}$. Here, γ_j are different stock market returns and therefore based on the number of determined thresholds, we will have a range of regimes from a very negative market regime to a very positive one. Therefore, based on equation (1) we can investigate the relationship of gold coin returns with Iran stock market returns, global gold returns and exchange rates in different regimes of the stock market. If like Baur and Lucey (2010) and Baur and McDermott (2010), we manually determine these regimes, for example if we consider two regimes of a negative market (less than zero return) and a positive market ($j=1,2$ and $\gamma_1=0$), then our model will be as follows:

$$GC_t = c + \alpha_1 GO_t + \alpha_2 USD_t + \beta_1 IMR_t + \varepsilon_t \quad if\ -\infty < IMR_t < \gamma_1$$

$$GC_t = c + \alpha_1 GO_t + \alpha_2 USD_t + \beta_2 IMR_t + \varepsilon_t \quad if\ \gamma_1 \leq IMR_t < \infty \qquad (2)$$

Now, by defining a regime determination function $L_j(IMR_t, \gamma_j)=L_j(\gamma_j \leq IMR_t < \gamma_{j+1})$, whose value equals 1 when the regime determining variable is within the range of the chosen threshold and equals 0 when its value is outside that threshold, we can combine the above two equations and we will have:

$$GC_t = c + \alpha_1 GO_t + \alpha_2 USD_t + \sum_{j=1}^{2} L_j(IMR_t, \gamma_1)\beta_j IMR_t + \varepsilon_t \qquad (3)$$

Since we manually determined the number of regimes ($j=1,2$) and threshold values ($\gamma_1=0$), we only have to estimate the values of α_i and β_j in equation (3). However, in order to avoid manually applying the regimes, we must consider the number of the regimes and their subsequent γ values as unknown, therefore we will have the following model:

$$GC_t = c + \alpha_1 GO_t + \alpha_2 USD_t + \sum_{j=1}^{m} L_j(IMR_t, \gamma_j)\beta_j IMR_t + \varepsilon_t \qquad (4)$$

Where, we have to estimate the values of γ_j, α_i and β_j. A common method to do so is to use nonlinear least squares. Therefore, if we define the following sum-of-squared residuals (SSR) function:

$$S(\beta, \alpha, \gamma) = \sum_{t=1}^{T}(GC_t - c - \alpha_1 GO_t - \alpha_2 USD_t - j=1mLjIMRt,\gamma j\beta jIMRt-\varepsilon t2 \qquad (5)$$

By minimizing $S(\beta, \alpha, \gamma)$ with respect to the sample data in the time period of ($t=1,.....T$), we can obtain the different regimes. Now, to determine the regimes based on our data, it is possible to use three methods: In the first method called the global estimation of thresholds, SSRs are compared for all possible sets of thresholds to find a possible set that minimizes the SSR of equation (4). In the second method, called sequential estimation of thresholds, first, a value will be obtained as a primary threshold, which minimizes the SSR, next, by moving from this value, other possible thresholds will be discovered that decrease the SSR. The third method is actually a combination and comparison of the two global and sequential methods. In the present research, we will use all three estimation methods based on the approach provided by Bai & Perron (2003).

The primary model for the U.S. market, given that the prices in U.S market are denominated in U.S. dollar and the U.S. is considered a developed market, is now specified as:

$$GO_t = c + \sum_{j=1}^{m} L_j(UMR_t, \gamma_j)\beta_j UMR_t + \varepsilon_t \qquad (6)$$

Where

UMR_t: U.S. stock market returns
GO_t: global gold returns
α_i: coefficients of regime-independent variables
β_j: coefficients of regime-dependent variables

4. Data and Findings

We collected daily data on Iran's domestic gold spot prices, Iran stock market index, U.S. dollar/Iran's Rial exchange rates (USD/IRR), global gold spot prices and U.S stock market index for this study. Data on Iran are obtained from RahAvard Noin database and data on global gold price and the U.S stock market index are obtained from Quandl database. We used TEDPIX as an index of Iran stock market, Bahar Azadi gold coins prices as a measure of the domestic gold prices in Iran, and S&P500 Index as an index of U.S. stock market. Our sample covers the period from Dec 2013 to Dec 2016. We chose this period to make sure that, during this period, no significant structural changes have occurred in the general economic system of Iran and the U.S. (things like the Sep 2013 significant USD/IRR exchange rate increase in Iran). Therefore, we can focus on the usual macroeconomic conditions in these countries and avoid structural breaks.

Table 1 presents the descriptive characteristics of the sample:

Table 1: Descriptive characteristics of the sample

	Iran Gold Coins Prices	Global Gold Ounce Prices	USD/IRR	TEDPIX	S&P500
Mean	9721943	1227.375	33510.76	72380.82	2014.174
Median	9537000	1231.990	33830.00	73752.20	2039.680
Maximum	11287000	1382.790	38150.00	89500.60	2213.350
Minimum	8480000	1052.100	28800.00	61163.70	1741.890
Std. Dev.	699522.9	74.88440	2001.188	6942.380	106.3761
Observations	724	733	724	724	733

The results from the test for stationary of the variables presented in Table 2 show that the variables are stationary at the first difference level. Therefore, in investigating the relationship between the variables, we will use their first difference.

Table 2: The Augmented Dickey-Fuller Test Results

Augmented Dickey-Fuller test statistic

Null Hypothesis: variable has a unit root	level	1st Difference
MacKinnon (1996) one-sided p-values.	Prob.	Prob.
TEDPIX	0.4128	0.0000
Iran Gold Coins Prices	0.7282	0.0000
USD/IRR	0.7216	0.0000
Global Gold Ounce Prices	0.2860	0.0000
S&P500	0.2935	0.0000

Now we will investigate the relationship between the stock market return and gold market return using equations (4) and (6). In daily analysis, variables are specified with the prefix of LND, and in weekly analysis, the prefix of LNM and in monthly analysis the LNM prefix are used.

We start with analyzing the relationship between gold market and stock market daily returns, but first, we investigate the existence of a serial correlation of error terms using the Breusch-Godfrey Serial Correlation LM Test, whose results are presented in Table 3:

Table 3: Serial Correlation Test on Daily Returns

Breusch-Godfrey Serial Correlation LM Test:

	Iran	U.S.
Prob. F-statistic	0.0000	0.1467
Prob. Chi-Square(2)	0.0000	0.1458
Test Equation (Dependent Variable: RESID):		
Variable	Prob.	Prob.
RESID(-1)	0.0000	0.1807
RESID(-2)	0.0000	0.1346

Test statistics on Iran's daily data show that the error terms are serially correlated. Autocorrelation in the residuals is often caused by a dynamic structure in variables that has not been modelled and so has not been captured in the fitted values. It is possible to extend the model to a dynamic model by adding lagged variables (Brooks 2008). In order to justify the model to consider the effect of the autocorrelation, we will add lagged independent and dependent variables. Therefore, the justified model of the relationship between Iran stock market and gold market daily returns is as follows:

$$GC_t = c + \alpha_1 GO_t + \alpha_2 USD_t + \alpha_3 GO_{t-1} + \alpha_4 USD_{t-1} + \alpha_5 GO_{t-2} + \alpha_6 USD_{t-2} + \alpha_7 GC_{t-1} + \alpha_8 GC_{t-2} + \sum_{j=1}^{m} L_j(IMR_t, \gamma_j)\beta_j IMR_t + \varepsilon_t \qquad (7)$$

We also consider the existence of heterogeneous error distributions for different regimes in our model. Table 4, presents the results of implementing the model:

Table 4: Investigating the Existence of Different Regimes in the Relationship between the Daily Returns of the U.S. and Iran's Stock Markets and Gold

Threshold type: Bai-Perron tests of L+1 vs. L sequentially determined thresholds

Iran			U.S.		
Dependent Variable: LND_GC			Dependent Variable: LND_GO		
No thresholds selected			No thresholds selected		
Variable	Coefficient	Prob.	Variable	Coefficient	Prob.
C	0.000237	0.3161	C	-6.16E-05	0.8589
LND_IMR	-0.059327	0.0868	LND_UMR	-0.200609	0.0000
Non-Threshold Variables			Non-Threshold Variables		
LND_GO	0.550997	0.0000			
LND_USD	0.459631	0.0000			
LND_GO(-2)	0.171385	0.0000			
LND_GO(-1)	0.221299	0.0000			
LND_GC(-2)	-0.206815	0.0000			
LND_GC(-1)	-0.221765	0.0000			
LND_USD(-2)	0.179828	0.0000			
LND_USD(-1)	0.210168	0.0000			
R-squared		0.410425	R-squared		0.032910
Adjusted R-squared		0.402962	Adjusted R-squared		0.031561
F-statistic		54.99475	F-statistic		24.39944
Prob(F-statistic)		0.000000	Prob(F-statistic)		0.000001
Durbin-Watson stat		2.021885	Durbin-Watson stat		2.122678

According to the results presented in Table 4, the relationship between gold market and stock market daily returns in Iran is not regime-specific and these two do not have a meaningful relationship. In the U.S. market, there is an inverse meaningful relationship between stock market and global gold daily returns, which does not follow different regimes. Therefore, in the short term, gold is a weak hedge for Iran stock market and a strong hedge for U.S. stock market. We used the sequential method to determine the threshold values in Table 4. The use of the other two methods did not cause any changes in the results; therefore, to summarize the matter, we do not present their results. Also, if like Baur and Lucey (2010) and Baur and McDermott (2010) we manually apply our own regimes, the F-Statistic of the model decreases which shows that in practice, no such regime existed. Table 5 shows the results of manually applying the two regimes of negative market (returns below zero) and positive market (above zero returns) to the model, for which, the F-statistics can be compared with this very statistic in Table 4.

Table 5: Manually Applying the Regimes to the Relationship of the Daily Return of the U.S. and Iran's Stock Markets with Gold

Method: Threshold Regression
Threshold type: Fixed number of user-specified thresholds
Threshold value used: 0

Iran			U.S.		
Dependent Variable: LND_GC			Dependent Variable: LND_GO		
Variable	Coefficient	Prob.	Variable	Coefficient	Prob.
LND_IMR < 0			LND_UMR < 0		
C	-0.000725	0.0977	C	0.000430	0.5217
LND_IMR	-0.217875	0.0006	LND_UMR	-0.107922	0.1849
LND_IMR >= 0			LND_UMR >= 0		
C	0.000175	0.6678	C	0.000649	0.3816
LND_IMR	0.003612	0.9524	LND_UMR	-0.302774	0.0003
Non-Threshold Variables			Non-Threshold Variables		
LND_GO	0.550155	0.0000			
LND_USD	0.458802	0.0000			
LND_GO(-2)	0.172339	0.0000			
LND_GO(-1)	0.218829	0.0000			
LND_GC(-2)	-0.209756	0.0000			
LND_GC(-1)	-0.226282	0.0000			
LND_USD(-2)	0.179584	0.0000			
LND_USD(-1)	0.205129	0.0000			
R-squared		0.416553	R-squared		0.036776
Adjusted R-squared		0.407501	Adjusted R-squared		0.032735
F-statistic		46.01742	F-statistic		9.099637
Prob(F-statistic)		0.000000	Prob(F-statistic)		0.000006
Durbin-Watson stat		2.021139	Durbin-Watson stat		2.124803

According to Table 5, the researchers can manually apply the two positive and negative regimes and show that in the short term, in Iran, gold is a strong safe haven, and in the US, it is a weak safe haven for the stock market. However, as mentioned before, determination of the two regimes led to a decrease in the F-statistic of the model and in fact, we applied regimes to the model that did not practically exist. It is also possible that if instead of considering the two positive and negative regimes, we consider more regimes (like Baur & McDermott (2010) Baur & Lucey (2010)) we may obtain different results.

We investigated the relationship between stock return and gold coin return of the subsequent day, which led to a significant drop in the goodness of fit of the model. This is because the working hours of Iran stock market are from 8:30 a.m. to 12:30 p.m., whereas the official trading hours of Iran gold market start from 11:30 a.m., and if the stock market drops, investors will have the opportunity to turn to the gold market in the same day as a safe haven. The global gold market is open 24 hours and U.S. investors can access this market at any time using various gold investment tools and markets (Learn2succeed.com Inc 2014).

Now we investigate the weekly relationship between the variables. According to the results presented in Table 6, which indicate autocorrelation, we justified the equations (4) and (6) similar to what we did in equation (7) for weekly returns and investigated the existence of different regimes in the relations between the variables.

Table 6: Serial correlation test of weekly returns

Breusch-Godfrey Serial Correlation LM Test:

	Iran	U.S.
Prob. F-statistic	0.0000	0.0000
Prob. Chi-Square(2)	0.0000	0.0000
Test Equation (Dependent Variable: RESID):		
Variable	Prob.	Prob.
RESID(-1)	0.0000	0.0000
RESID(-2)	0.0678	0.1770

The results presented in Table 7 show that weekly relations do not follow different regimes, and in Iran, there is no meaningful relationship between the gold and stock market weekly returns, whereas in the US, there is a meaningful inverse relationship between the weekly returns of gold and stock market. Therefore, gold continues to hold its role as a strong hedge in the U.S and a weak hedge in Iran.

Table 7: Investigating the Existence of Different Regimes in the Relationship between the Weekly Return of the Stock Markets of the U.S. and Iran and Gold

Method: Threshold Regression
Threshold type: Bai-Perron tests of L+1 vs. L sequentially determined thresholds

Iran			U.S.		
Dependent Variable: LNW_GC			Dependent Variable: LNW_GO		
No thresholds selected			No thresholds selected		
Variable	Coefficient	Prob.	Variable	Coefficient	Prob.
C	0.000347	0.2953	C	-0.000192	0.7071
LNW_IMR	0.020957	0.1155	LNW_UMR	-0.068118	0.0041
Non-Threshold Variables			Non-Threshold Variables		
LNW_GO(-1)	-0.286722	0.0000	LNW_GO(-1)	0.853904	0.0000
LNW_GO	0.527254	0.0000			
LNW_USD(-1)	-0.227892	0.0000			
LNW_USD	0.460853	0.0000			
LNW_GC(-1)	0.671685	0.0000			
R-squared		0.8311	R-squared		0.7369
Adjusted R-squared		0.8296	Adjusted R-squared		0.7361
F-statistic		581.49	F-statistic		911.99
Prob(F-statistic)		0.0000	Prob(F-statistic)		0.0000
Durbin-Watson stat		1.9957	Durbin-Watson stat		2.0008

As Table 8 shows, in Iran, even if we manually determine the regimes, the relations between the weekly return of the stock market and gold coin are not meaningful and only the goodness of fit of the model decreases. In the U.S. market, if we manually determine the regimes, gold will be considered a weak safe haven but still the goodness of fit of the model decreases.

Table 8: Manually Applying the Regimes to the Relationship of the Weekly Return of the U.S. and Iran Stock Markets with Gold

Method: Threshold Regression
Threshold type: Fixed number of user-specified thresholds
Threshold value used: 0

Iran			U.S.		
Dependent Variable: LNW_GC			Dependent Variable: LNW_GO		
Variable	Coefficient	Prob.	Variable	Coefficient	Prob.
LNW_IMR < 0			**LNW_UMR < 0**		
C	-2.50E-06	0.9970	C	-0.000294	0.7806
LNW_IMR	-0.005640	0.8573	LNW_UMR	-0.051352	0.3286
LNW_IMR >= 0			**LNW_UMR >= 0**		
C	-0.000268	0.7186	C	0.001574	0.1673
LNW_IMR	0.045873	0.0764	LNW_UMR	-0.141094	0.0031
Non-Threshold Variables			**Non-Threshold Variables**		
LNW_GO(-1)	-0.290154	0.0000	LNW_GO(-1)	0.853640	0.0000
LNW_GO	0.525898	0.0000			
LNW_USD(-1)	-0.228795	0.0000			
LNW_USD	0.462219	0.0000			
LNW_GC(-1)	0.670933	0.0000			
R-squared		0.8315	R-squared		0.7382
Adjusted R-squared		0.8296	Adjusted R-squared		0.7366
F-statistic		436.16	F-statistic		457.65
Prob(F-statistic)		0.0000	Prob(F-statistic)		0.0000
Durbin-Watson stat		2.0041	Durbin-Watson stat		2.0077

The results from investigating the monthly relations are given in Table 9, Table 10 and Table 11, which show that gold performed as a weak hedge in both Iran and the U.S. markets.

Table 9: Serial Correlation Test of Monthly Returns

Breusch-Godfrey Serial Correlation LM Test:

	Iran	U.S.
Prob. F-statistic	0.0000	0.0000
Prob. Chi-Square(2)	0.0000	0.0000
Test Equation (Dependent Variable: RESID):		
Variable	Prob.	Prob.
RESID(-1)	0.0000	0.0000
RESID(-2)	0.0000	0.0000

Table 10: Investigating the Existence of Different Regimes in the Relationship between the Monthly Returns of the U.S. and Iran Stock Markets and Gold

Threshold type: Bai-Perron tests of L+1 vs. L sequentially determined thresholds

Iran			U.S.		
Dependent Variable: LNM_GC			Dependent Variable: LNM_GO		
No thresholds selected			**No thresholds selected**		
Variable	Coefficient	Prob.	Variable	Coefficient	Prob.
C	0.000535	0.1437	C	-0.000216	0.7244
LNM_IMR	0.007616	0.2039	LNM_UMR	0.029141	0.0588
Non-Threshold Variables			**Non-Threshold Variables**		
LNM_GO(-2)	-0.128183	0.0011	LNM_GO(-2)	0.072099	0.0975
LNM_GO(-1)	-0.312346	0.0000	LNM_GO(-1)	0.896401	0.0000
LNM_GO	0.552388	0.0000			
LNM_USD(-2)	-0.140346	0.0014			
LNM_USD(-1)	-0.256292	0.0000			
LNM_USD	0.499069	0.0000			
LNM_GC(-2)	0.105783	0.0060			
LNM_GC(-1)	0.757657	0.0000			
R-squared		0.9552	R-squared		0.9290
Adjusted R-squared		0.9546	Adjusted R-squared		0.9286
F-statistic		1617.8	F-statistic		2313.5
Prob(F-statistic)		0.0000	Prob(F-statistic)		0.0000
Durbin-Watson stat		2.0577	Durbin-Watson stat		2.0303

Table 11: Manually Applying the Regimes to the Relationship of the Monthly Returns of the U.S. and Iran Stock Markets with Gold

Method: Threshold Regression
Threshold type: Fixed number of user-specified thresholds
Threshold value used: 0

Iran			U.S.		
Dependent Variable: LNM_GC			Dependent Variable: LNM_GO		
Variable	Coefficient	Prob.	Variable	Coefficient	Prob.
LNM_IMR < 0			**LNM_UMR < 0**		
C	0.000984	0.2799	C	0.000451	0.7022
LNM_IMR	0.018352	0.2953	LNM_UMR	0.050955	0.1032
LNM_IMR >= 0			**LNM_UMR >= 0**		
C	0.000963	0.2483	C	0.000384	0.7719
LNM_IMR	0.000341	0.9771	LNM_UMR	0.006789	0.8254
Non-Threshold Variables			**Non-Threshold Variables**		
LNM_GO(-2)	-0.126947	0.0013	LNM_GO(-2)	0.073154	0.0946
LNM_GO(-1)	-0.311697	0.0000	LNM_GO(-1)	0.893820	0.0000
LNM_GO	0.555627	0.0000			
LNM_USD(-2)	-0.138904	0.0016			
LNM_USD(-1)	-0.256134	0.0000			
LNM_USD	0.498217	0.0000			
LNM_GC(-2)	0.105154	0.0066			
LNM_GC(-1)	0.756730	0.0000			
R-squared		0.9553	R-squared		0.9291
Adjusted R-squared		0.9545	Adjusted R-squared		0.9285
F-statistic		1321.1	F-statistic		1385.6
Prob(F-statistic)		0.0000	Prob(F-statistic)		0.0000
Durbin-Watson stat		2.0580	Durbin-Watson stat		2.0299

As Table 11 shows, manually applying the regimes did not cause any changes in the research results in the monthly returns.

5. Conclusion

In the present paper, we presented a new approach to improve previous studies performed to determine the specific relationships between stock markets and gold markets. We used threshold regression to determine the

potential different regimes in the gold and stock markets relationships based on data characteristics and improved the rule of thumb approach introduced by Baur and Lucey (2010). We also improved other studies like Beckmann *et al.* (2015), by considering higher frequency data and taking into account the role of currency exchange rates and finally providing the possibility to make quick transition in regimes by implementing a different regime switching model.

The main conclusion of the present research is that we showed that studies like Baur and McDermott (2010) and Baur and Lucey (2010) who found that gold acts as a safe haven for stock market, may have suffered from manually applying the regimes. Because our findings showed that, if we investigate the existence of different regimes based on the data characteristics, the relationship between the stock market and gold market does not follow any specific regimes, both in the short and the long terms.

Another point is that, according to our findings, in the short term, the relationship between the stock market and gold in the developed market of U.S. differs from that of the relatively small emerging market of Iran. However, in the long term using monthly returns, in both Iran and the U.S. markets, there was no meaningful relationship between gold and stock market. In other words, in both markets, in the long term, gold performed as a weak hedge. This can be because in the long term, the price of gold is heavily influenced by the demand for gold as jewelry, which encompasses a major part of the global gold demand (World Gold Council 2016).

Therefore, based on the research results, we recommend that investors should distinguish the relationship between gold and stock market in different markets, especially in developed and emerging markets. They should also consider the importance of other factors influencing the price of gold in each market. In addition, turning to gold when the market turns negative may not be an effective strategy, because according to our findings, the relationship between gold and stock market does not follow different regimes, rather, it acts as a hedge, and to use its risk reduction advantage, it is better to always allocate a part of the portfolio to it.

Finally, since the existence of regimes is specified based on the data characteristics, the type of the relationship may change in different periods or in different markets. In the present research, we considered a period in which no major structural economic changes occurred in the U.S and Iran.

REFERENCES

Bai, Jushan, and Pierre Perron. 2003. "Computation and analysis of multiple structural change models." Journal of applied econometrics 18 (1): 1-22.

Baur, Dirk G., and Thomas K. McDermott. 2010. "Is gold a safe haven? International evidence." Journal of Banking & Finance 34 (8): 1886-1898.

Baur, Drik G, and Brian M Lucey. 2010. "is gold a hedge or a safe haven? an analysis of stocks, bonds and gold." The Financial Review 45: 217-229.

Beckmann, Joscha, Theo Berger, and Robert Czudaj. 2015. "Does gold act as a hedge or a safe haven for stocks? A smooth transition approach." Economic Modelling 48: 16-24.

Brooks, Chris. 2008. Introductory Econometrics for Finance. 2nd. Cambridge University Press.

Capie, F, T.C. Mills, and G Wood. 2005. "Gold as a Hedge against the dollar." Journal of International Financial Markets 15 (4): 343–352.

Gonzalo, Jesús, and Jean- Yves Pitarakis. 2013. "Estimation and inference in threshold type regime switching models." In Handbook of Research Methods and Applications in Empirical Macroeconomics, edited by Nigar Hashimzade and Michael A. Thornton, 189-205. Edward Elgar Publishing.

Heirati, Nima, and Aron O'Cass. 2016. "Supporting new product commercialization through managerial social ties and market knowledge development in an emerging economy." Asia Pacific Journal of Management 33 (2): 411–433.

Hood, Matthew, and Farooq Malik. 2013. "Is gold the best hedge and a safe haven under changing stock market volatility?" Review of Financial Economics 22 (2): 47-52.

Iqbal, Javed. 2017. "Does gold hedge stock market, inflation and exchange rate risks? An econometric investigation." International Review of Economics & Finance 48: 1-17.

Kafash Hoseini, Eftekhar Sadat, and Ali Rostami. 2013. "The effect of fluctuations of the Tehran Stock Exchange index (TEDPIX) on return of investment in gold." Journal of Investment Knowledge (in Persian) 2 (8): 235-254.

Kaul, Aditya, and Stephen Sapp. 2006. "Y2K fears and safe haven trading of the US dollar." Journal of international money and finance 25 (5): 760-779.

Learn2succeed.com Inc. 2014. Gold Investing for Beginners: An Opportunity for Huge Gains or a Bubble About to Burst? Productive Publications.

Lucey, Brian M., and Sile Li. 2015. "What precious metals act as safe havens, and when? Some US evidence." Applied Economics Letters 22 (1): 35-45.

McCauley, Robert N., and Patrick McGuire. 2009. "Dollar appreciation in 2008: safe haven, carry trades, dollar shortage and overhedging." BIS Quarterly Review December.

Pierdzioch, Christian, Marian Risse, and Sebastian Rohloff. 2016. "Fluctuations of the real exchange rate, real interest rates, and the dynamics of the price of gold in a small open economy." Empirical Economics 51 (4): 1481–1499.

Pradhan, Rudra P., Mak B. Arvin, Neville R. Norman, and Sara E. Bennett. 2016. "Financial depth, internet penetration rates and economic growth: country-panel evidence." Applied Economics 48 (4): 331-343.

Rancic, Nemanja, and Mihajlo Michael Jakovljevic. 2016. "Long term health spending alongside population aging in N-11 emerging nations." Eastern European Business and Economics Journal 2 (1): 2-26.

Samadi, Saeed, Nasrin Ebrahimmi, and Fariba Aghili. 2015. "The Effect of Exchange Rate Fluctuations on the Stock Market Index and the Price of Gold Coins." Financial Monetary Economics (in Persian) 22 (9): 57-73.

Upper, Christian. 2000. How Safe was the'Safe Haven'? Financial Market Liquidity during the 1998 Turbulences. Working Paper No. 1/00, Deutsche Bundesbank.

World Gold Council. 2016. Gold Demand Trends Third quarter 2016. World Gold Council.