It is possible to use gold and WTI to protect portfolio loses?

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Abstract

The aim of the paper is to investigate the role of gold and crude oil as a hedge and a safe haven for the stock and currency markets. The analysis is carried out in two stages. During the first one flights to safety moments are identify and two different market regimes are distinguished. During the second one the relations between variables are analysed with the use of the rolling regression. The analysis is based on daily data of gold prices, oil prices, the S&P 500 index and the US dollar exchange rate from January 2, 1995 to July 15, 2015. The results reveal that all the relations are not stable. Although gold and crude oil are positively correlated, they do not play the same role. In the last subperiods Gold acts as a safe haven for equity market and can be used to protect portfolios against depreciation of the US currency.

Keywords: *hedge, safe haven, gold, WTI, financial market*
JEL Classification: G10, G11, G15

1. Introduction

In recent decades portfolio management has proved a very difficult endeavour due to co--movement of numerous classes of instruments observed in this period, especially during financial crises in the market. Indicating instruments whose behaviour do not depend on the behaviour of other instruments or which follow different paths in face of turmoil is particularly challenging. In their seminal paper, Baur and Lucey (2010) examine the role of gold as an instrument which potentially behaves differently than stocks and can be used as a hedge or a safe haven. They identify two financial market regimes: a normal one and a turmoil one (the latter is also called: market stress regime, extreme market regime or flights to safety moments) and define two categories of instruments connected with them: a hedge (which can be weak or strong) for the normal market regime and a safe haven (which can also be weak or strong) for the turmoil market regime. An instrument is defined as a strong (weak) hedge for assets if its rates of return are negatively correlated (uncorrelated) with the rates of return of other assets in the normal market regime, while an instrument is defined as a strong (weak) safe haven if its rates of return are negatively correlated (uncorrelated) with the rates of return of other assets in times of market turmoil.

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In their paper, Baur and Lucey (2010) focus on prices of gold and demonstrate that this metal is a hedge and a safe haven for stock and bond markets in the US, the UK and Germany. Other authors also investigate the possibilities of using gold as a hedge or a safe haven for stock and bond markets (e.g. Baur and McDermott, 2010; Hood and Malik, 2013; Beckmann et al., 2015), for oil (e.g. Reboredo, 2013a), and for exchange rates (e.g. Joy, 2011; Reboredo, 2013b; Reboredo and Rivera-Castro, 2014; Wanat, 2015a, 2015b). Ciner et al. (2013) test hedge and safe haven properties of gold, oil, currency, stock and bond markets.

The authors use various methods, which focus on defining flights to safety moments, i.e. on identifying two financial market regimes, and various ways of assessing relations between instruments. Baur and Lucey (2010) and Baur and McDermott (2010) define flights to safety moments as quantiles of the distribution (1%, 5%, 10% of extreme negative returns) and they use a distributed lag model regression including different dummy variables given by the flights to safety moments. The regression model and the same way of identification of market regimes are used by, for example, Hood and Malik (2013), Ciner et al. (2013). Additionally, Ciner et al. (2013) use a rolling regression procedure to investigate time-varying safe haven relations. Joy (2011) uses DCC–(M)GARCH model, while Reboredo (2013a, 2013b) uses the copula function and dependencies in the tails of distribution to define the relations in turmoil. Reboredo and Rivera-Castro (2014) use the extreme value theory to classify extreme returns as those that exceed a specific threshold. Beckmann et al. (2015) use a STR model.

The main aim of the paper is to analyse the role of gold as a hedge and a safe haven for the stock, currency and commodity markets. The paper investigates whether its role is unique or typical also for other commodities by checking the role of oil prices as a hedge and a safe haven for stock and currency markets and comparing it with the role of gold.

The analysis is based on daily data of gold prices, oil prices, the S&P 500 index and the US dollar exchange rate from January 2, 1995 to July 15, 2015. The study is divided into two stages. During the first one, normal and turmoil market regimes are identified. In order to distinguish market's regime, we compare returns with long-term volatility. However, we take into account possible structural breaks using Inclan and Tiao's (1994) approach and Sanso et al. (2004) test. Such an approach allows us, firstly, not to impose an exogenously defined number (percentage) of flights to safety moments for each instrument (which do not have to be the same), and, secondly, to take into account possible structural changes of market volatility. Thus, we are able to identify flights to safety moments in long periods with low volatility (in comparison to other periods). During the second stage, we analyse the role of gold and oil as a hedge or a safe haven for other assets using univariate ARMA– (E)GARCH

models with external regressors in different market regimes. This way, out approach is more robust and offers a more precise description of relations between different classes of instruments.

Due to a dynamic nature of the study, the period of analysis is divided into 17 (overlapping) subperiods, each lasting for about 5 years. Then, the rolling window procedure is used, which allows us to follow the changes in the roles played by financial instruments.

2. Methodology

The aim of the empirical strategy applied in the study is to investigate the possibility of using gold and crude oil as a hedge and a safe haven for the equity market, the currency market and for one another. The analysis consists of two main stages. During the first one, market regimes or flights to safety moments are identified as periods in which the rates of return exceed the assumed multiple of variance. In order to account for changes in long time variances, which could affect the results, we use the iterative cumulative sum of squares (ICSS), the volatility structural break methodology developed by Inclan and Tiao (1994), and the modified test proposed by Sanso et al. (2004). Next, we identify flights to safety moments with (extreme) negative financial instrument returns, whenever these returns exceed a given threshold $z_{i,t}$. The flights to safety moment indicator (FTS) for instrument *i* at time *t* is calculated as: $FTS_{i,t} = I\{r_{i,t} < z_{i,t}\}$, where $r_{i,t}$ denotes *i* -asset returns, and *I* is the indicator function returning a value of one if the logical argument is true, and zero otherwise. The threshold $z_{i,t}$ can be defined by using standard deviation of the returns in a particular market regime:

$$z_{i,t} = -B \cdot \sigma_{i,t} \tag{1}$$

where $\sigma_{i,t}$ is time-varying volatility of the returns for asset *i* at time *t,* and *B* is the positive threshold parameter. Changing the value of B allows us to take into account the adequate percentage of the most negative returns.

During the second stage, in order to examine the role of gold and crude oil as a hedge or a safe haven for other assets, we use univariate ARMA–EGARCH models with external regressors in different market regimes. We define the regressors in a normal market regime as:

$r_{i,t}^{N} = r_{i,t}\left(1 - FTS_{i,t}\right)$, and the regressors in a market turmoil regime as: $r_{i,t}^{FTS} = r_{i,t}FTS_{i,t}$. The regression model used to investigate whether gold acts as a hedge or a safe haven is given by[3]:

$$r_{gold,t} = \delta_0 + \sum_{i=1}^{4}\delta_i r_{i,t}^{N} + \sum_{i=1}^{4}\rho_i r_{i,t}^{FTS} + \varepsilon_t \tag{2}$$

where i = oil, equity, currency. The conditional variance of the error term is modelled as the conventional GARCH process or the exponential GARCH process (EGARCH) with skewed Student's t-distributed innovations. If parameters δ_i, (ρ_i) in Eq. (2) are negative (significantly), asset i is treated as a strong hedge (a strong safe haven), respectively. However, if parameters δ_i, (ρ_i) are non-statistically positive, asset i is a weak hedge (a weak safe haven), respectively. To test the stability or constancy of the parameters of GARCH models, we use the Nyblom (1989) and Hansen (1992) stability tests.

3. Data and empirical results

The data set comprises daily observations of gold prices, oil prices, equity, and the US dollar exchange rate spanning from January 2, 1995 to July 15, 2015. The gold price is represented by the gold futures contracts traded on the COMEX and is based on U.S. dollars per troy ounce (GOLD), and the price of crude oil is represented by contracts of crude oil futures traded on the NYMEX and is based on U.S. dollars per barrel (WTI). Equity is represented by the S&P 500 index (S&P 500). The last variable – the exchange rate – is represented by the Nominal Broad Trade Weighted Exchange Index[4] (USD) of the US Federal Reserve (the data is sourced from the Federal Reserve Bank of Saint Louis). To investigate the hedge and safe haven properties of gold and oil against other assets, the returns are computed as the first difference of logarithm of each series, which we next convert into the percentage.

During the first step we indicate flights to safety moments as days in which the return is large enough and negative. However, to decide which returns are large enough, we have to compare them to the variance of the series. So, at first we estimate the long-term variance for every analysed series. It needs, however, to be checked if the analysed variables contain structural breaks which should be taken into account. To investigate the existence of structural

[3]Analogous regressions are used in investigating the role of oil as a hedge or a safe haven against other assets.

[4] Trade Weighted U.S. Dollar Index: Broad, Index Jan 1997 = 100, Weekly, Not Seasonally Adjusted - https://research.stlouisfed.org/fred2/series/TWEXB.

breaks in variance, we use the modified ICSS algorithm proposed by Sanso et al. (2004)[5]. The modified ICSS algorithm selects two structural breaks in the unconditional variance of S&P 500, a single structural break for GOLD and for WTI, and six structural breaks for USD.

In order to define flights to safety moments, it is necessary to establish the level of threshold $z_{i,t}$ (see Eq. (1)) below which returns are considered as extreme. We assume that parameter B is equal to 1.5. In our case it means that the percentage of flights to safety moments spans from 5.32 per cent for S&P 500 to 6.01 per cent for WTI of the total number of returns. Such situation closely corresponds to a conventional level of 5% of quantile of returns accepted as flights to safety moments in literature.

Regression model results

Following previous studies, in this paper we focus our attention on the properties of gold and oil against the stock market, currency market and commodity market. The results of regression (Eq. (2)) for variables GOLD and WTI are demonstrated in Table 1. Other columns in this table report the estimates of the regression model with the significance levels and the results of the Nyblom–Hansen stability test. External regressors in each model include both the returns in normal market regimes (denoted as N) and in turmoil market regimes (denoted as FTS). The latter are related to flights to safety moments.

We find that gold can be considered as a strong hedge and a strong safe haven for the S&P 500 and the USD exchange rates (negative and significant relations are obtained for both returns in both normal and turmoil market regimes). There are positive relations between the gold returns and the WTI returns in each market regime. The Nyblom–Hansen stability test results obtained for gold regression indicate, however, that the estimates of parameters are not stable. Exceptionally large test values are obtained for the returns in normal market regimes for the USD exchange rates and the WTI, which indicates that relations between these returns and gold are not stable in the analysed period. The results of regression obtained for the WTI returns indicate negative relations with the USD exchange rates returns during normal and turmoil market regimes. The WTI returns are positively correlated with the gold returns (in both market regimes), which most likely results from the fact that both instruments belong to the commodity market. The WTI cannot be treated as a hedge or a safe haven for the equity market (as opposed to gold).

[5] We implement the modified ICSS algorithm using the GAUSS procedures available at Sansó's web page at http://www.uib.cat/depart/deaweb/personal/profesores/personalpages/andreusanso/in.htm.

	ARMA(1,0) GARCH(1,1) Student	Nyblom's Parameter Stability Test	ARMA(1,0) GARCH(1,1) Skewed Studen	Nyblom's Parameter Stability Test
	GOLD		WTI	
Cst(M)	0.013	0.788***	0.025	0.333
AR1	-0.060***	0.187	-0.044***	0.987***
S&P 500_N	-0.061***	0.245	0.312***	9.789***
S&P500_FTS	-0.133***	0.167	0.586***	1.291***
USD_N	-1.202***	9.940***	-0.905***	4.022***
USD_FTS	-0.807***	0.319	-0.426	0.501**
GOLD_N	-	-	0.342***	0.793***
GOLD_FTS	-	-	0.318***	0.157
WTI_N	0.049***	3.799***	-	-
WTI_FTS	0.025*	0.033	-	-
Omega	0.006***	1.196***	0.020***	0.564**
Alpha1	0.056***	0.742**	0.053***	0.180
Beta1	0.942***	0.898***	0.945***	0.380*
Skew	0.988***	1.079***	0.956***	0.499**
Shape	4.260***	0.816***	8.124***	0.272
Nyblom statistics	16.371***		18.579***	

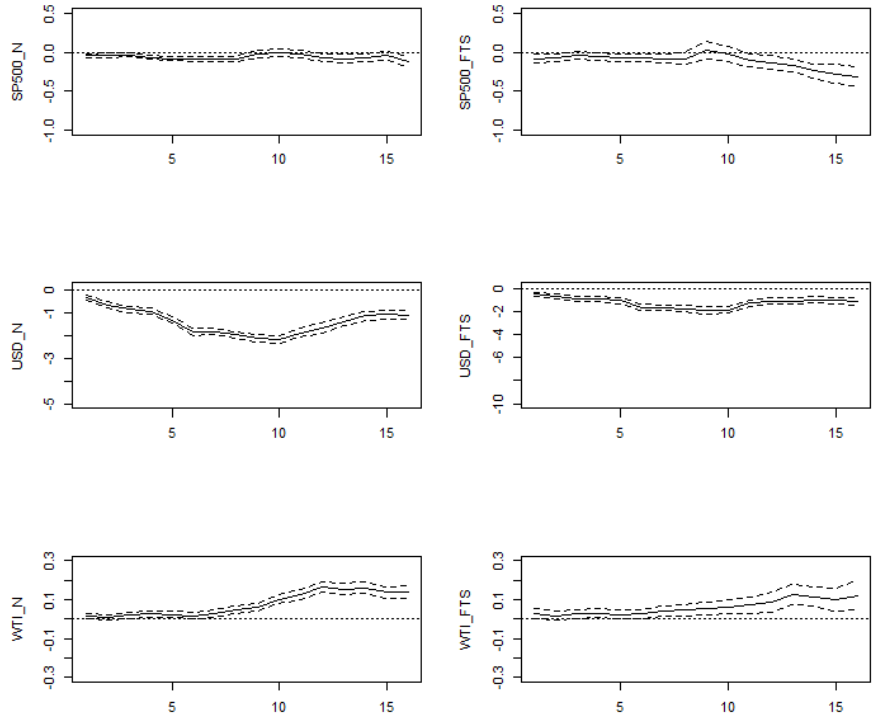
Notes: ***, ** and * indicate significance levels at 1%, 5% and 10%, respectively.

Table 1. The results of univariate GARCH models with external regressors with the joint statistics of the Nyblom–Hansen test of stability and the individual Nyblom statistics.

The results of rolling regression model

Using the results of the Nyblom–Hansen stability test obtained for all regressions (Table 1), the next step consists of the analysis of stability of the role of gold and oil as a hedge or a safe haven for other assets (such as currency, stocks, oil, and gold, respectively). The whole sample is divided into 17 (overlapping) subperiods, each including 1240 daily returns (i.e. each lasting for about 5 years), and regressions are estimated in rolling windows. Each subsequent subperiod of the analysis is moved by 248 observations in relation to the earlier period (which corresponds to one year). The first subperiod starts on January 2, 1995 and ends on December 31, 1999. The second subperiod starts on January 2, 1996 and ends on December 31, 2000. The final (17^{th}) subperiod starts on January 2, 2011 and ends on July 15,

2015. The width of subperiods allows for a sufficient number of observations to draw conclusions regarding the significance of the estimates of the model and a sufficient number of flights to safety moments and to observe the moment of the change in relations.



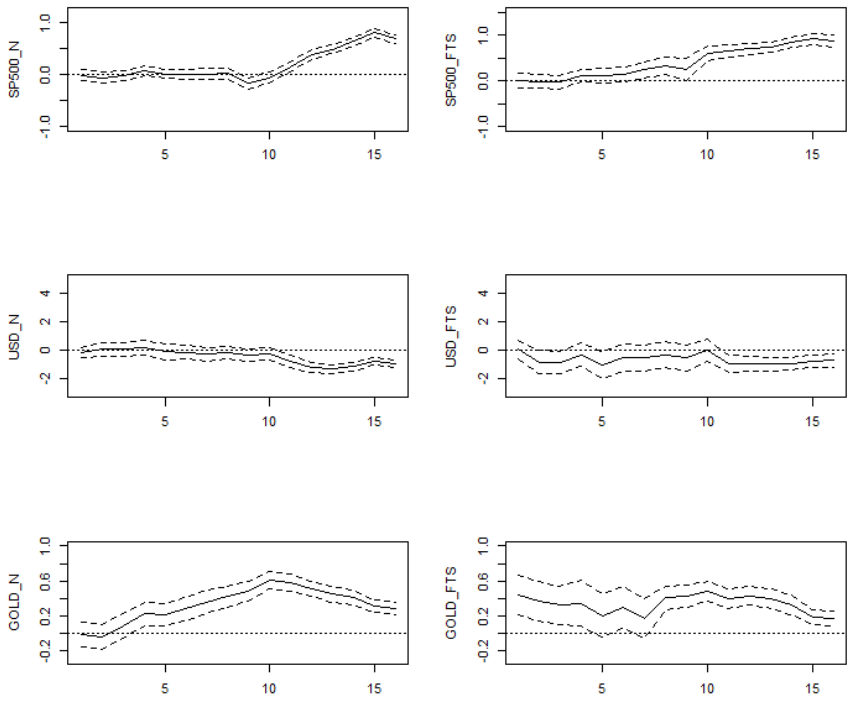
Notes: Dashed lines correspond to 95% confidence interval for estimates.

Fig. 1. The rolling procedure for univariate ARMA(1,0) – GARCH(1,1) models with external regressors: dependent variable – GOLD.

Fig. 1 and 2 present the estimates with 95% confidence interval for external regressors in the model for the gold and WTI returns. A solid line in each figure represents a point estimator of the parameter of interest for the consecutive rolling windows. Dashed lines represent 95% confidence interval for these parameters.

Fig. 1 presents the results obtained for the gold returns. As can be noticed, for many subperiods, the S&P 500 returns are negatively correlated with the gold returns. In case of large drops in stock prices, from 11th subperiod, which begins January 2, 2005, onwards, gold acts as a strong safe haven against equity market declines. An evident change in the strength of response of gold to the US exchange rates is noted, although in all subperiods the relations remain negative for both market regimes. The strongest negative relationship is observed between 6th and 10th subperiod for both markets. So, we find that it is possible to use gold as

a strong hedge or a strong safe haven against currency movements. In case of the WTI, the correlation increases in consecutive subperiods, which means that in further subperiods gold and the WTI behave in a similar manner. The same conclusions can be drawn while analysing extreme slumps in crude oil prices, which are accompanied by deep slumps in gold prices in the consecutive subperiods.



Notes: Dashed lines correspond to 95% confidence interval for estimate.

Fig. 2. The rolling procedure for univariate ARMA(1,0) –GARCH(1,1) models with external regressors: dependent variable – WTI.

Fig. 2 presents the estimate of external regressors in the model for WTI obtained for rolling windows. As can be noticed, up to the 11th subperiod (excluding the 9th subperiod) crude oil acts as a weak hedge against the equity market. Only in the 9th subperiod, i.e from January 2, 2003 to December 31, 2007 crude oil can be regarded as a strong hedge against equities. Since the 11th subperiod the correlations between the S&P 500 and oil in normal market regimes become more and more positive. However, during the market turmoil, we find that there is a positive correlation between the S&P 500 and oil since the 4th subperiod, which begins on January 2, 1998. So, crude oil cannot be considered a safe haven for the US stock during these turmoil periods in the equity market. The results presented in Fig. 2 show that oil also acts as a strong hedge and a strong safe haven against declines in the US dollar since the

11th subperiod, which starts from January 2, 2005. Similarity between the behaviour of gold and the WTI is obvious, especially in later periods of the analysis. Beginning with the 4th subperiod, which starts on January 2, 1998, for a normal market regime and for all subperiods in a turmoil market regime, both instruments are positively correlated.

Conclusion

The objective of this study is to examine the possibility of using gold and oil as a hedge and a safe haven for the equity market, the currency market, and the commodity market. Our main findings can be summarized as follows.

Firstly, there are no stable relationships between the pairs of instruments. There are either changes of the direction of correlations (or a change from no correlation to significant correlation) or changes of the strength of relationships. So, when the response to stock prices is analysed, we can conclude that gold and WTI prices behave differently during the first (up to the 10th subperiod) and the last part of the sample. The response of gold prices to extreme slumps of stocks becomes stronger and negative since the 10th subperiod. At the same time, however, WTI prices are more and more positively correlated with the stock market. The strongest correlations (negative) between gold and USD exchange rates are obtained for middle subperiods. The similar response of WTI to depreciation of US dollar is noted in several last subperiods.

Secondly, although gold and WTI prices are positively correlated (for most the subperiods), they do not play the same role in the financial market. Gold seems to be the first option for investors looking for safe havens against slumps in the equity market, as only gold is negatively correlated with stocks. Similarly, negative correlations between USD exchange rates and gold prices make it possible to use gold in order to protect portfolios against depreciation of the US currency.

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