Economics Bulletin

Volume 31, Issue 2

# Gold and financial assets: Are there any safe havens in bear markets?

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## Abstract

This paper looks into the role of gold as a safe haven or a hedge against stocks. We extend the existing literature in two ways. First, we consider crisis periods successively defined by recessions and bear markets. Second, we use a bivariate ARMA-GARCH-X model to estimate conditional covariances between gold and stocks returns. The regressions are run on monthly data for gold and several stock market indices (France, Germany, the UK, the US, the G7). We find that gold qualifies as a safe haven against all these stock indexes. This result holds for crises defined as recessions or bear markets, as the covariance between gold and stocks returns is found negative or null in all cases. Gold is also able to hedge against stock losses in most cases, although results are less clear-cut.

**Citation:** Virginie Coudert and Hélène Raymond-Feingold, (2011) "Gold and financial assets: Are there any safe havens in bear markets?", *Economics Bulletin*, Vol. 31 no.2 pp. 1613-1622.
**Submitted:** Apr 26 2011. **Published:** June 05, 2011.

## 1. Introduction

Safe haven assets are particularly sought after during episodes of economic and financial turmoil. In these periods, the prices of risky financial assets tend to plummet simultaneously, as realized losses on one market create a drying-up of liquidity, triggering sell-offs of risky assets over the board. Conversely, investors rush into buying safe assets, such as Treasury bills and bonds, gold or other commodities. As this “flight to quality” takes place (Caballero and Krishnamurthy, 2008), the prices of these safer assets surge. This crisis was no exception: the S&P500 stock index lost 55%, while gold rallied by 40% (from 2 July 2007 to 9 March 2009).

The ability of commodities to offer positive returns during downturns has been documented by Gorton and Rouwenhorst (2006). The economic literature on gold also hints at gold playing the part of a hedge or a safe haven during crises. According to Jaffe (1989), gold is a hedge against both stock losses and inflation: including gold in financial portfolios can reduce their variance, while slightly improving returns. However, Johnson and Soenen (1997) assess that gold is an attractive investment in terms of diversification only in very specific periods, for example in 1978-1983. McCown et al. (2007) also argue that gold can be a hedge against stock losses and expected inflation in the long-run, but only intermittently and mostly during the seventies when inflation was especially high. More recently, Baur and Lucey (2010) and Baur and McDermott (2010) take stock of the idea of a discontinuous relation between gold and financial assets. Interestingly, they distinguish between the two functions of gold as a hedge, which is a long-term property, and as a safe haven, which is characterized by non-positive correlations with stocks during crises. According to their results, gold is a safe haven only in the very short-term: on average, gold holders earn a positive return the day of an extreme negative stock return, but the return on gold is likely to be negative the day after, as well as on average in the two following weeks. Baur and McDermott (2010) have extended this analysis by showing that gold is a safe haven during periods of turmoil on the stock market.

Baur and Lucey (2010) define periods of crises as days of extreme negative stock returns, whereas Baur and McDermott (2010) also consider days of extreme volatility and three more arbitrarily defined crisis episodes[1]. We extend their results in three ways. First, we consider longer crisis periods, without arbitrarily setting their lengths and starting dates, as we successively use the NBER recession dates and the periods of US bear market derived from the algorithm by Pagan and Sossounov (2003). Second, we allow for continuously time varying conditional covariances between gold and stocks returns through a bivariate ARMA-GARCH-X modelling. In this

[1] Three episodes of 20 trading days are considered starting, respectively, on October 16, 1987 (the 1987 Stock market crash), on October 22, 1997 (the Asian crisis) and on September 10, 2008 (the global financial crisis).

framework, we test the hypothesis of a rupture in the covariance between gold and stock prices across crises and non crisis periods. Third, we consider real returns rather than nominal returns to control for the role of inflation.
The rest of the paper is organized as follows. Section 2 characterizes gold and stock returns along the business cycle, and according to bear and bull markets. Section 3 describes the methodology used to test for safe havens. Section 4 displays the econometric results and comments on them. Section 5 concludes.

## 2. Data and comparison of real returns of US stocks and gold

We use data for gold total returns in US$ that come from Standard and Poors' and Goldman Sachs Commodity Index database (S&P GSCI) and are extracted from Bloomberg. For stocks, we also consider total returns in US$, including both changes in prices and dividends, based on stock indexes extracted from Datastream for the US, the UK, Germany and France, as well as the MSCI index for the G7. All series are taken in real terms, deflated by the US CPI. All series are integrated of order one[2].

Data are monthly and run from February 1978 to January 2009 for regressions (and up to July 2009 in this section). The choice of a monthly frequency allows us to use exogenously defined periods of crises and to take the series in real terms. As detailed below, our choice of the NBER recession dates, as a first way to define periods of crises, relies on the results of Gorton and Rouwenhorst (2006), which are confirmed on our dataset. To allow for a more financial definition of crises we also use the periods of US bear stock markets derived from the implementation of the Pagan and Sossounov methodology[3]. The NBER recession dates would not be available on a higher than monthly frequency, as well as the Pagan and Sossounov dating methodology could not be used for higher frequency data. By using monthly data, we therefore limit the risks of arbitrary choices of dates and of data mining in defining the periods of crises (Boyer et al., 1999). Moreover this frequency reduces the noise inherent to daily data.

In this section, we only consider the US stocks for our comparison with gold. Figure 1 compares the real cumulated returns on gold futures and US stocks from January 1978 to July 2009. Gold is much less profitable on the long run. Over the whole period, the purchasing power of an investment is multiplied by 9.4 if invested in stocks, and only by 1.5 for gold futures. However, the graph in double scale suggests an interesting property of gold, as returns do not seem to co-move with those of stocks.

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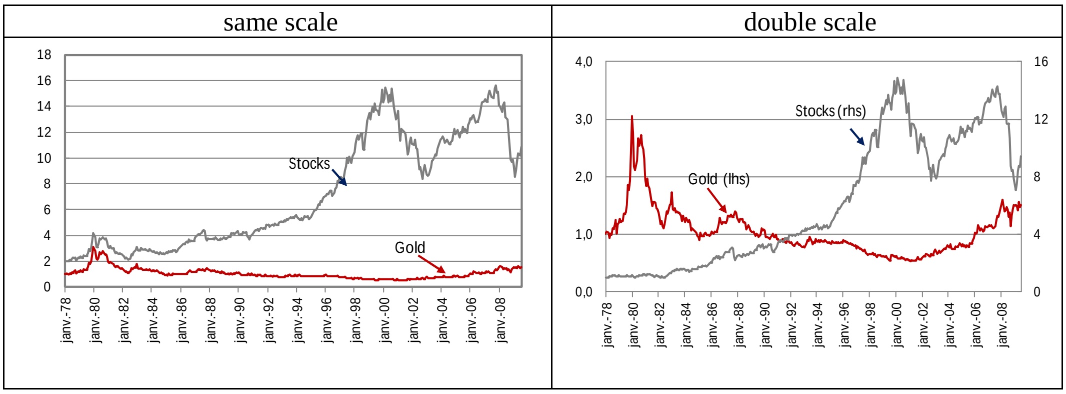
[2] The results of the unit root tests are available upon request.

[3] Applying the methodology of Pagan and Sossounov (2003) on US data (the SP500), allows us to reproduce and update the bear stock market dates found by these authors. Focusing on the US stock market to date financial crises can also be motivated by the leading roles of the US economy and stock market.

Over the whole period, the average real returns on gold are far smaller than those on stocks (3.2% versus 8.3% per year), although their volatility is greater (19.6% versus 15.4%), as shown on Table IA. Extreme real returns are also more frequent on gold than for stocks, as the kurtosis is higher. However, one advantage of gold is that its extreme returns tend to occur more often upwards than downwards, contrary to stocks. Hence the skewness coefficient is positive for gold, whereas negative for stocks.

**Figure 1: Cumulated real returns on gold futures and US stocks, base 1 January 1978**




Source: Bloomberg and Datastream data, authors' calculations.

Another interesting property is the cyclicality of the relative returns between the two assets. Gorton and Rouwenhorst (2006) found that during the recession periods dated by the NBER, a balanced index of commodity futures yields positive returns, contrary to stocks. Following these authors, we use the NBER recession dates and check if their conclusion holds for gold futures over the period running from February 1978 through January 2009. Indeed we get similar results for gold as shown on Table IB. Gold clearly outperforms stocks during recessions as it yields an average real return of 8.5% versus -9.0% for stocks, while underperforming stocks during expansions (2.5% against 11.4%). Moreover, contrary to a broad index of commodities, whose returns were found higher than stocks only during the earlier part of the recession (Gorton and Rouwenhorst, 2006), returns on gold are higher in both halves of recession periods. This result hints at a safe haven role for gold. Indeed, a long position in gold futures protects against the fall in stock prices that generally occurs during slowdowns.

A more straightforward way to look into this safe haven role of gold is to consider its returns during the periods of bear markets. If gold is able to yield positive returns when equity prices tumble, it could qualify for being a safe haven. To check that, we first have to identify the periods of bear and bull markets. According to Pagan and Sossounov (2003), a bear market occurs every time the stock prices have declined

**Table I: Real returns on gold and US stocks**, February 1978-July 2009, annualized

| I.A. Descriptive statistics, all periods | | | | | |
|---|---|---|---|---|---|
| | Gold | Stocks | | Gold | stocks |
| Mean | 3.2 % | 8.3% | Skewness | 0.61 | -0.64 |
| Standard error | 19.6% | 15.4% | Kurtosis | 4.02 | 1.94 |

| I.B. Mean real returns by subperiods, in % | | | | | |
|---|---|---|---|---|---|
| | Gold | Stocks | | Gold | Stocks |
| Expansion | 2.5 | 11.4 | Bull market | 5.9 | 18.9 |
| Early Expansion | 1.1 | 13.7 | | | |
| Late Expansion | 3.7 | 9.4 | | | |
| Recession | 8.5 | -9.0 | Bear market | -5.2 | -24.2 |
| Early Recession | -7.6 | -23.5 | | | |
| Late Recession | 24.7 | 5.4 | | | |

Source: Bloomberg data, authors' calculations. The periods are those defined by the NBER. Early expansion (recession) is the first half of expansion (recession). Late expansion (recession) is the second half of the period.

for a “substantial period since their previous (local) peak”, which meets the definition given by Chauvet and Potter (2000). Pagan and Sossounov (2003) use the algorithm developed by Bry and Boshan (1971) for detecting turning points in the business cycle, after having adapted it to financial series (for example on the length of the phase and of the whole cycle). The bear phases span from peak to trough. Using Pagan and Sossounov's algorithm on the S&P500 stock price index, we have replicated their calculations and updated their bear market dates. Gonzalez et al. (2005) also identify bull and bear markets by applying the Bry and Boshan's algorithm on long-run series of the US stock market. The dates that we obtain match the dates reported in the two papers over the common period.

Then we calculate average returns on both assets over these two types of periods, bulls and bears. We find that on average, gold increased by 5.9% in real terms during bull markets, whereas stocks surged by 18.9%. The relative performances are inverted during bear markets, with average real returns on gold equal -5.2%, while equity prices tumble by 24.2% a year. On the whole, the inclusion of gold futures in a portfolio seems able to limit the losses on stocks during the two types of crises defined as recessions or bear markets.

## 3. Methodology

Following Baur and Lucey (2010) and Baur and McDermott (2010), we define a safe haven as an asset with a negative correlation with stocks during crises. As previously, we successively define crises in two ways: recessions, and periods of bear markets.

To test for gold being a safe haven, we fit a bivariate ARMA-GARCH(1,1)-X process on the real returns of gold and stocks. In the ARMA(p,q) part of the model, lags are set individually for gold and stocks, so as to ensure white residuals:

$$r_t^k = c^G + \sum_{i=1}^{p_k} a_i^k r_{t-i}^k + \sum_{i=1}^{q_k} b_i^k \varepsilon_{t-i}^k \qquad \text{for } k = G, S \tag{1}$$

where $r_t^k$ are the monthly real returns on asset *k, k= G*, for gold and *k= S* for stocks.

Then we use a diagonal VECH GARCH with an asymmetric effect formulated according to Glosten et al. (1993) and a dummy for crises as an additional explanatory variable. This specification has the advantage of not restricting the dynamics of the correlation. It also keeps the number of parameters to estimate at a manageable level in the bivariate case.

The model to be estimated is composed of the following set of equations:

$$\begin{cases} h_t^k = c^k + \alpha^k \varepsilon_{k,\,t-1}^2 + \beta^k h_{t-1}^k + d^k dum_{\varepsilon_G<0}\, \varepsilon_{k,\,t-1}^2 + \delta^k dum_{crisis}, \; k = G, S \\ h_t^{GS} = c^{GS} + \alpha^{GS} \varepsilon_{G,\,t-1} \varepsilon_{S,\,t-1} + \beta^{GS} h_{t-1}^{GS} + d^{GS} dum_{\varepsilon_S<0,\varepsilon_G<0}\, \varepsilon_{G,\,t-1} \varepsilon_{S,\,t-1} + \delta^{GS} dum_{crisis} \end{cases} \tag{2}$$

where $h_t^k$ is the conditional variance for asset *k*, $h_t^{GS}$, the conditional covariance between gold and stocks; $dum_{crises}$ is a dummy for crises; $dum_{\varepsilon k<0}$, a dummy equal to 1 when $\varepsilon_k < 0$ and 0 elsewhere, $dum_{\varepsilon G<0\ \varepsilon S<0}$, a dummy equal to 1 when both $\varepsilon_G$ and $\varepsilon_S$ are negative; changes in covariance between both assets during crises are captured by the coefficient $\delta^{GS}$. This simple modeling allow us to account both for time varying covariance between gold and stocks and for breaks during crises, whereas Baur and Lucey (2010) and Baur and McDermott (2010) assume that the change in the degree of interdependence between gold and stock is discontinuous and may only be triggered off by crises.

Asymmetries are captured through the parameters $d^{k.}$ Negative shocks increase volatility more than positive shocks, if $d^k$. is positive. This is typically the case for stocks, therefore we expect $d^G$>0. For gold, as gold returns are skewed positively, we expect $d^G \leq 0$. Discontinuities are taken into account through the parameters $\delta^k$. We expect a rise in volatility during crises for stocks $(\delta^s > 0)$, whereas the expected sign of $\delta^G$ is less clear-cut.

If gold is a safe haven against stocks, its covariance with stocks should be negative during crises. In order to check this hypothesis, we consider the sign of the unconditional covariance. When $\left|\alpha^{GS} + \beta^{GS} + d^{GS} dum_{\varepsilon_S<0,\varepsilon_G<0}\right| < 1$, the unconditional covariance between gold and stocks can be written as:

$$\sigma^{GS} = \frac{c^{GS} + \delta^{GS} dum_{crisis}}{\left(1 - \alpha^{GS} - \beta^{GS} - d^{GS} dum_{\varepsilon_S < 0, \varepsilon_G < 0}\right)} \tag{3}$$

and its sign is given by that of the numerator.

In this framework, we consider gold to be a safe haven against stocks if and only if the condition (C1) is fulfilled.

$$\text{“Gold is a safe haven”} \Leftrightarrow c^{GS} + \delta^{GS} \leq 0 \tag{C1}$$

More precisely, gold will be called a “strong safe haven” if the inequality holds strictly, and a “weak safe haven” if $c^{GS} + \delta^{GS}$ is not significantly different from zero. To differentiate between these two situations, once we have observed a negative sign on the sum of the estimated coefficient $c^{GS} + \delta^{GS}$, we will test for the strict inequality by a Wald test.

Another interesting property is that gold be a “hedge” against stocks. This would occur if it was negatively correlated with stocks on average over all periods. We therefore consider gold as a hedge against stocks if and only if condition (C2) is met:

$$\text{“Gold is a hedge”} \Leftrightarrow \frac{h^{GS}}{\sqrt{h^G h^S}} \leq 0 \text{ on average.} \tag{C2}$$

A weak hedge is defined by an average correlation not significantly different from 0, and a strong one by the strict inequality in the former condition. We will run a standard Student test to test for this latter condition.

## 4. Econometric results

We run regression (2) where stocks are successively taken as the stock market indexes in France, Germany, the UK, the US and the G7. We run each regression twice, defining crises successively by recessions and bear markets. Table II reports the main results for the covariance equation.[4] Three interesting features emerge from these results.

First, the conditional covariance between gold and stock returns decreases during crises, whether the crises are defined by recessions or bear markets. This is shown by

[4] Results on the parameters not reported in the Table are available from the authors upon request.

**Table II: Estimation results of the GARCH part of the bivariate models of gold and stock returns:** $h_t^{GS} = c^{GS} + \alpha^{GS}\varepsilon_{G,t-1}\varepsilon_{S,t-1} + \beta^{GS}h_{t-1}^{GS} + d^{GS}dum_{\varepsilon_S<0,\varepsilon_G<0}\,\varepsilon_{G,t-1}\varepsilon_{S,t-1} + \delta^{GS}dum_{crisis}$

| | France | Germany | UK | US | G7 |
|---|---|---|---|---|---|
| Crises defined as recessions | | | | | |
| $c^{GS}$ | -0.0001 | 0.0001 | 0.0005** | -0.0002* | 0.0001 |
| | (0.0001) | (0.0001) | (0.0002) | (0.0001) | (0.0001) |
| $\alpha^{GS}$ | -0.0369 | -0.0338 | -0.1746*** | -0.1113* | -0.0997** |
| | (0.1222) | (0.0573) | (0.0364) | (0.0634) | (0.0419) |
| $\beta^{GS}$ | 0.2057 | 0.5934 | -0.6175*** | -0.4052* | -0.0763 |
| | (0.6608) | (0.3736) | (0.1008) | (0.2361) | (0.3173) |
| $d^{GS}$ | -0.0952 | -0.0094 | 0.2227*** | 0.0936 | 0.1497 |
| | (0.1785) | (0.0800) | (0.0594) | (0.1106) | (0.0919) |
| $\delta^{GS}$ | -0.0006 | -0.0003 | -0.0005 | 0.0003 | -0.0006 |
| | (0.0008) | (0.0004) | (0.0006) | (0.0005) | (0.0005) |
| $c^{GS} + \delta^{GS}$ | -0.0007 | -0.0002 | -0.0001 | 0.0001 | -0.0005 |
| $W_1$ | 0.6950 | 0.3325 | 0.0037 | 0.0433 | 1.1690 |
| p-value | 40.4% | 56.4% | 95.2% | 83.5% | 28.0% |
| Average correlation : | | | | | |
| whole sample | -0.08 | 0.08* | 0.13*** | -0.07 | 0.03 |
| expansions | -0.05 | 0.11** | 0.15*** | -0.08 | 0.05 |
| recessions | -0.22* | -0.08 | 0.03 | 0.04 | -0.08 |
| Crises defined as bear markets | | | | | |
| $c^{GS}$ | -0.0001 | 0.0001** | 0.0004*** | -0.0002** | 0.0002* |
| | (0.0001) | (<0.0001) | (0.0001) | (0.0001) | (0.0001) |
| $\alpha^{GS}$ | -0.0664 | -0.0613** | -0.1933*** | -0.1226*** | -0.1158*** |
| | (0.0450) | (0.0302) | ( 0.0292 ) | (0.0438) | (0.0368) |
| $\beta^{GS}$ | -0.0403 | 0.7484*** | -0.5733*** | -0.3742 | -0.1243 |
| | (0.3873) | (0.0857) | (0.1542) | (0.3102) | (0.3771) |
| $d^{GS}$ | -0.0590 | 0.0263 | 0.2182*** | 0.1284 | 0.1552 |
| | (0.0672) | (0.0629) | (0.0443) | (0.1270) | (0.0964) |
| $\delta^{GS}$ | -0.0007* | -0.0002*** | -0.0005* | -0.0004 | -0.0008** |
| | (0.0003) | (0.0001) | (0.0003) | (0.0004) | (0.0003) |
| $c^{GS} + \delta^{GS}$ | -0.0008** | -0.0001** | -0.0001 | -0.0006 | -0.0006** |
| $W_1$ | 4.2863 | 4.3697 | 0.1000 | 2.3526 | 4.0732 |
| p-value | 3.8% | 3.7% | 75.2% | 12.5% | 4.4% |
| Average correlation : | | | | | |
| whole sample | -0.12** | 0.08 | 0.13** | -0.10* | 0.02 |
| bull markets | -0.05 | 0.12** | 0.15** | -0.09 | 0.10* |
| bear markets | -0.19* | -0.10 | 0.01 | -0.13 | -0.16 |

*** 1%, ** 5%, * 10% significance level.

the negative coefficients on all the crisis dummies $\delta^{GS}$ (except for the US stocks when crises are defined as recessions). The decline in covariance is significant in 4 cases out of 5 (France, Germany, UK, G7) when crises are defined as periods of bear markets. Therefore the conditional correlation between gold and stocks is lower during crises than during periods of economic or financial expansions on average.

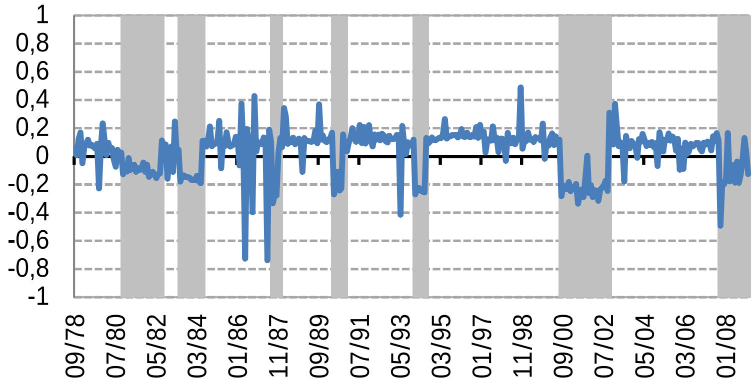
Second, the results show that gold is a safe haven against stocks, as condition (C1) $c^{GS} + \delta^{GS} \leq 0$ is met in all cases. This is evidenced by the sum $c^{GS} + \delta^{GS}$ being always either not significantly different from zero or negative. Gold is a weak safe haven in most cases since $c^{GS} + \delta^{GS}$ is not significantly different from zero. It is a strong safe haven for French, German and G7 stocks during bear markets.

Third, gold is a hedge against stocks in most cases. Condition (C2) is met in most cases, as average correlations are negative or not significantly different from zero in seven cases out of ten. Still, results are less-clear-cut than for the safe haven property.

To check for the robustness of the results, we have conducted the same estimations, using the precious metals instead of gold. The results are quite similar.[5] During recessions the covariance between precious metals and stocks is not significantly different from zero, which shows that precious metals are a weak safe haven against stock losses.

Figure 2 illustrates the dynamics of the correlation between gold and stocks, computed from the conditional covariance and variances for the G7. The correlation slightly decreases during bear stock markets as $\delta^{GS}$<0. What is also apparent from this figure is that the correlation is on average close to zero, but subject to large fluctuations as it quickly switches from negative to positive values.

**Figure 2: Correlation between gold and the G7 stock returns and periods of bear stock market**




[5] Detailed results are available upon request. They are based on the precious metal SP&GSCI total return index. As those data are available before 1978, we begin the estimation in February 1976, just after the Jamaïca agreement.

## 5. Conclusion

In this paper, we have investigated if gold is a safe haven and/or a hedge against stocks, by estimating a time varying conditional covariance between gold and stocks returns from four countries (France, Germany, the US, the UK) and the G7. Three main results emerge from our estimations. First, the conditional covariance between the two types of assets generally decreases during crises, whether defined as recessions or bear markets. Second, gold qualifies for being a safe haven, as it does not co-move with stock returns on average neither during recessions nor bear markets. This result holds for all the considered stock indexes. More precisely, gold is a "weak safe haven" in most cases, as its correlation with stocks is not significantly different from zero during crises. Third, gold appears to be a hedge against stocks in most cases, but not all of them. Overall, gold appears as an interesting asset to diversify a portfolio away from stocks, especially in times of bear markets.

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