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**Hedges and Safe Havens – An examination of Stocks, Bonds, Oil,  
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## **Abstract**

**Keywords:** DCC GARCH, Gold, oil, bonds, equities, safe haven, hedge, dollar  
**JEL Categories:** C52, G12

We investigate five major financial asset classes, examining how and under what circumstances each may act as a hedge or a safe haven to each other. Using the approach of Baur and Lucey (2010) and Baur and McDermott (2010) we find that, in line with conventional investment strategies, gold acts as a safe haven for most assets, except oil. Bonds do not appear to be a longterm hedge against equity price movements but do act as a safe haven for equities.

## Introduction

Traditionally gold has played a significant role as an asset of last resort during times of political and economic crises. However, this is predicated on the assumption that in general gold is negatively correlated to other assets, that it is a hedge. While relatively uncontroversial, this cannot necessarily be assumed to hold at all times. Recent work by Baur and Lucey (2010) and Baur and McDermott (2010) indicates for example that while gold can and does act as a hedge against falling equity returns that this is mainly down to a number of extreme movements when gold “comes into its own”. Gold does not appear to act as a hedge against bonds. When we examine oil we also find some variation in findings as to whether it acts as a hedge against equity prices. There is also the issue of the relationship of these assets with other assets, notable government debt and currencies.

Three questions motivate our paper. First, empirically and conceptually, what constitutes a safe haven (asset) and can we distinguish this from a hedge? Second, when examining gold and oil, how do these perform as hedges or havens vs the dollar, bonds and equities? Third, to what extent is this relationship a function of time, and how does it evolve over time? Our decision to focus on gold and oil as possible safe havens for the traditional financial assets emerges from two strands of thought. First, as we discuss further on in this paper, there is an emergent academic literature that has reappraised the relationship of gold with other assets and the role of gold in a portfolio. Second, however, there is a prevailing sense when one reads the financial and popular press that gold is seen as somewhere to consider as an investment alternative when markets are stressed. To a lesser extent, this is also the case for oil. We follow Baur and Lucey in our categorization of hedges and havens. Kaul and Sapp (2007) define a (financial) safe haven as an “*ideal venue to park money during periods of uncertainty...*” The authors define a safe haven asset as an asset that investors purchase when uncertainty increases. More specifically, we define an asset as a (safe) haven for one asset or portfolio of assets if it does not co-move with the other asset *in times of stress*, defined here as when a move occurs in the lower 5/2.5/1 quartile of the observed distribution. We define a hedge typically as an asset that is

uncorrelated or negatively correlated with another asset *on average*.<sup>1</sup> An asset that functions as a safe haven is uncorrelated or negatively correlated with another asset *in times of stress* and not necessarily on average.

Clearly, the existence of hedges is useful for portfolio solutions. We contend that safe haven assets also assist here, but are perhaps more useful in that they act as quasi-automatic stabilizers. They assist in financial market stability by their very existence. Safe haven assets are also, we suggest, congruent with behavioural finance, namely prospect theory. This suggests that investors' reactions differ as between gains and losses, being more sensitive to losses than gains. Studies and surveys such as Duxbury and Summers (2004) have indicated a general prevalence of loss aversion among financial agents. Ang, Bekaert and Liu (2005) suggest that in this context investors will engage in abrupt switches between assets, which implicitly focuses any analysis not onto average or typical behaviour of related series but to the extremes. Safe havens exist in the extremes, not in the averages.

## **Gold, equities and bonds**

The diversification property of gold and gold's relationship with the equity markets have been subject to significantly increased examination over the last number of years. Jaffe (1989) reported that gold, while risky in its own right, has the propensity to provide valuable diversification qualities. Jaffe examined the role that gold plays in a large portfolio, its correlations with other assets and the relationship between gold and inflation. Over the period 1971 to 1987 the results indicate that gold displays hedging potential with a number of other assets including small stocks, government bonds, corporate bonds, treasury bills and currencies. When 5% of gold is added to each portfolio, with a reduction in holding of other assets held, the return in each portfolio increases while risk decreases. This is also the case, more significantly, when 10% is added to each portfolio. Jaffe (1989) concludes that the inclusion of gold bullion in a portfolio not only reduces risk but also increases expected return. This finding of gold as an efficient diversifier is echoed in Chua (1990), Lucey, Poti and Tully (2006), and Hillier, Draper and Faff (2006).

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<sup>1</sup> Note that this definition of a hedge is relatively strict. A hedge can minimize either loss or risk. The risk of a portfolio is also reduced if an asset that is added to the portfolio exhibits a positive correlation smaller than one.

Chua (1990) asserts that in order to provide diversification in a portfolio of gold and common stocks, the correlation coefficients among gold and common stocks must be low enough to decrease the total risk without reducing the expected return. The most important contribution of gold to a portfolio according to Chua (1990) is that it maintains its value during financial crises. This element of gold returns has been documented by numerous authors over the years, gold providing a crisis cushion during times of distress. It is documented as a hedge against inflation, exchange rates and times of political and economic distress, while possessing diversification properties (Sherman (1982), Fledstein (1990), and Sjaastad & Scacciavillani (1996), Baur and Lucey (2010), Baur and McDermott (2010)).

Scott-Ram (2002) highlights the negative correlation that exists between gold and equities. The authors reports that while gold possesses a negative relationship with international and emerging equity markets, the metal is more negatively correlated to U.S stock markets. More recently, Baur and Lucey (2010) show that gold over the 1985-2005 period acts as a hedge against falls in the USA, UK and Germany, examining gold on a daily basis, while Baur and McDermott (2010) confirmed this while finding gold to be not a safe haven for emerging market equity indices nor for those of large commodity markets. Worthington and Pahlavani (2007) suggest that weakened evidence for gold as a hedge in the 1990s is a statistical artefact, as a number of structural breaks in the series may need to be addressed, particularly around the period of the plaza accord on dollar stability. Davidson, Faff and Hillier (2003) examine the impact of gold on equities by means of the estimation of conditional gold beta's and reject these being jointly zero. We should therefore, all things being equal, expect to see persistent negative relationships between gold and equity returns.

By contrast, gold's relationship with the bond markets is much less researched. The most recent relevant examination is Baur and Lucey (2010) and Baur and McDermott (2010), although the focus there is on tail behaviour. Examining the 1985-2005 period they find no consistent evidence (from quartile regressions and some covariance analysis) of gold as either a longterm or shorterterm hedge with the government bonds of a number of developed countries (US, UK, Germany). Beyond that we are aware of no other paper that has examined the gold-bond relationship. There is of course a large volume of studies on the relationship between equities and

bonds, as asset classes that may conceivably offset each other. In general these papers work on the assumption that the two assets by and large hedge against each other.

## **Gold and the dollar**

While gold provides diversification properties in a portfolio mix with equities, it also is alleged to act as a hedge against the U.S dollar as gold appears to have an inverse relationship with the currency. Gold is believed by many to be a currency without borders, being recognized around the world. While gold is influenced naturally by its supply and demand components, gold responds also to many macro-economic factors including equity markets and exchange rates. In the 2004 period for example as the dollar weakened, gold reached a 16-year high (compounded also by uncertain economic conditions, geopolitical tensions and producer de-hedging). The gold price in U.S. dollars could be a function of the U.S. dollar exchange rate as gold is quoted primarily in U.S. dollars per troy ounce. If gold is quoted in currencies other than the U.S. dollar such as sterling, it is converted using the foreign exchange rate closing price on the same day. Therefore, gold reflects the relative strength of the currency in which it is quoted. Any depreciation in the dollar may fuel increased interest in gold due to the dilution in the dollar's worth. Gold may then be considered to be the anti-dollar.

According to Capie, Mills and Wood (2005) gold has provided a cushion against depreciation in the value of the dollar for two reasons. It firstly provides protection as it is a hedge against (us originated) inflation and secondly it provides a hedge against depreciation. Therefore it is not surprising that gold historically has been considered a hedge against fluctuation in the U.S dollar. Capie, Mills and Wood (2005) find that gold has provided a hedge against the dollar, but the significance of this has altered throughout the years. Whilst it has provided a hedge against foreign exchange fluctuations, this has occurred most significantly during periods of political and economic tensions. The authors note the different role of gold: when gold was used as money; as the basis of a monetary system and the aftermath. When gold is linked to money, an automatic stabilizing mechanism is in place, the price that prevailed was dependant on gold supply relative to the demand for the metal. According to Capie, Mills and Wood (2005) the loss of this automatic stabilizing mechanism did not imply that gold no longer possessed hedging qualities. Rather,

gold's hedging benefits were dependent on the attraction of gold during times of currency changes. Over the period 1971- 2004, using the sterling-dollar and yen-dollar exchange rates, they claim that gold has indeed provided a hedge against exchange rate fluctuations. This finding has also been echoed by Hammoudeh, Sari and Ewing (2009), A conclusion therefore from the literature that over the long term gold and the dollar should be negatively related to each other with gold acting a longterm hedge

### **Oil as a hedge**

There is a vast amount of literature on the relationship between oil prices and stock markets (see for example as recent papers Oberndorfer (2010), Aloui and Jammazi (2009), Bhar and Nikolova (2009), Apergis and Miller (2009), Miller and Ratti (2009), Chiou and Lee (2009), Odusami (2009), Kilian (2008), Park and Ratti (2008),and Nandha and Faff (2008)) . The consensus of studies is threefold: in general, operating through its downward pressure on real economic output increases in crude oil prices are associated (with a lag) in reductions in equity returns; volatility of oil prices are as important as the level of prices, with increased volatility being associated with reduced equity returns, and not all oil shocks are equal, with supply shocks being significantly more important than demand shocks. Oil being priced in dollars there is an assumption that a straightforward relationship exists, which is in marked contrast to the gold. Reading the literature then it seems that over the long term oil and equities should be negatively related to each other with oil acting a longterm hedge

For oil and government bonds there is less research. Scherer (2009) examines the portfolio selection problem for sovereign wealth funds, many of whom are oil based. Combined with the findings of Gintschel and Scherer (2008), this indicates that oil and sovereign debt should be negatively related but at a low level. This is inconsistent with the cross implication of oil being a hedge for equity and equity a hedge for debt, implying a positive relationship. It is also somewhat out of line with other literature. Noting that yields on government stock and prices vary inversely, examination of the literature on interest rates provides significantly greater results, Den Butter and Jansen (2004) and Valckx (2004) note the positive relationship for eurozone interest rates and oil prices. This finding is also noted for China in Ito

(2008), for Russia by Ito, and for the majority of G7 countries by Cologni and Manera (2008). Overall therefore a prior of a (perhaps low) negative relationship between oil and bonds seems indicated, with oil forming at best a very partial hedge against bond prices.

## Data and Methodology

We first examine the conditional relationship between these assets over a 25y period, from January 1985 through October 2009, at a daily frequency. Gold and Oil are captured by nearest month futures contract data, traded on NYMEX. Equities are proxied by the Standard and Poors 500 index, while the bond market is represented by an index of ten year government bonds. The dollar is captured by the Federal Reserve Nominal Trade Weighted Effective Index (Major Countries). All data are sourced from Reuters EcoWin. Table 1 shows some descriptive data while the evolution of the data is shown in Figure 1. Clearly the series show a great deal of variation; the bubble of the late 90's and the crash of 07 dominate the equity series, the bond index is stable, while the secular upward trend of gold is very evident. We use an asymmetric GARCH(1,1) specification in a DCC formulation to extract conditional correlations, providing us with an overview of the longterm hedging potential for each pair of assets.

We apply the hedge-safe haven model of Baur and Lucey (2010) to test for the existence of safe havens and hedges. In brief, the logic is that for an asset to be a hedge it should move consistently and negatively against the asset to be hedged. However, a safe haven by comparison is an asset that may or not be a hedge (on average) but does exhibit hedge like behaviour when the other asset moves very sharply. Thus safe haven assets are more related to joint tail behaviour of assets while hedges reflect the central portion of assets distributions.

Empirically, we estimate the following equation for each asset,

$$R_{i,t} = a + \sum b_{0(i)} r_{i,t-i} + \sum b_{1(i)} r_{j,t-i} + \sum b_{2(i)} r_{j,t-i(q)} + e_t \quad (1)$$

where  $r_i$ ,  $r_j$  are the return of the asset under analysis (eg gold) and the other assets (in this example stocks, bonds, oil and the dollar) respectively. The terms  $r_{j,t-i(q)}$  account for asymmetries of positive and negative (extreme) shocks and are included in order to focus on falling markets. In particular, in this paper we analyze the role of gold and



oil as potential hedge and safe havens in times of stress or extreme market situations and include regressors that contain returns that are in the  $q\%$  lower quantile such as the 5%, 2.5% and 1% quantile.<sup>2</sup> If the return is larger than the  $q\%$  quantile, the value of  $r_{j, \tau(q)}$  is zero. We estimate this equation with a Asymmetric GARCH(1,1) specification, with a GED distribution to capture any residual thicktailed behaviour, and robust standard errors<sup>3</sup>.

We estimate this initially over the entire period of analysis, to provide a snapshot. We then estimate it on a rolling basis, with a moving window of 100 observations (equal to approximately four months of data). This allows us to focus on the evolving nature of safe-haven versus hedge status.

## Results

In this section, we discuss our major findings and report on the results from the full sample period. Recall that we estimate equation (1) for the pairs of the assets in our sample and infer on the properties as “hedgers” or “safe havens” against each other. Our analysis generates several noteworthy findings.

### *Conditional Correlations*

Initially, we examine the DCC correlations. Shown in Figure 3 are the estimated dynamic conditional correlations for the US data. A number of points of note emerge. First, the stable near zero correlation between oil and the dollar breaks down sharply in early 2003, turning negative and remaining so for the remaining 6 years. The expected low to negative relationship between oil and bonds is evident, with some significant breaks in the relationship notably in the period around the two Gulf Wars. Surprisingly the relationship between oil and equities is close to zero, with two exceptional periods. The first is fundamental driven we can assume, coming as it does in the period around Gulf War 1, the relationship becoming sharply negative for a two year period. The second is in the 2008-9 period, the relationship becoming positive in the time of the oil “bubble”. The negative and persistent gold-dollar relationship is found, with some tendency for the relationship to become more pronouncedly negative, moving from approx -0.25 in the early years of the sample to -

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<sup>2</sup> The choice of the quantiles is arbitrary to some degree. However, these quantiles have also been analyzed in other papers such as Bae, Karolyi and Stulz (2003).

<sup>3</sup> We omit discussion of the GARCH parameters for brevity.

0.50 or greater in later years. Gold shows the expected general negative relationship with equities, and no clear pattern regarding bonds, generally near zero with the exception of the 2000-2004 period when it turned significantly positive.

With respect to the UK results, one of the noteworthy points is the conditional correlation between oil and equities. Specifically, we observe an increasingly negative correlation between these two markets, while the correlation was in fact positive in the beginning of our sample. This seems to indicate that oil may be acting as a hedge or safe haven the UK equities in the latter part of the sample, which we observe in the following section further. In the correlation between gold and equities, we also observe a noteworthy point that during the recent financial crisis, a largely negative correlation emerges, while the correlation is in general more positive during the rest of the sample. There is no clear pattern of correlation between stock and bond markets, while we observe an increasingly positive correlation between bond gold markets, again for the period that coincides with the recent global financial crisis.

### *Regression Analysis*

We now turn to the hedge/safe haven analysis. Shown in Table 3 are the results of running equation (1) for the US data. The UK findings are reported in Table 3.

For the US data, our initial finding is that gold seems to be remarkable as a hedge against all of the assets in our study, save for oil, in the full sample analysis. There is a negative and statistically significant relation between the gold market returns and equity, bond and dollar returns. This, on average, indicates that gold prices react differently to shocks and events than the other markets and can be regarded as an illustration of gold as an effective diversifier in investment portfolios, which is consistent with several papers in prior work as mentioned above. In fact, as it will be further discussed below, gold is the only market that can be regarded as a hedge against equities at least when the full sample period is considered.

Secondly, a noteworthy relation exists between bond, dollar and gold markets, in which they act as long term hedges against each other. More specifically, bond returns have a significant negative contemporaneous relation with gold and dollar markets and dollar returns are also, on average, negatively correlated with both gold and bond returns. One could argue that such a linkage between these markets is not unexpected as a common variable, the inflation rate, is likely one of the most

important factors determining price movements for these assets. For instance, according to the Fisher relation, bond markets reflect expected inflation rates and the dollar value is primarily determined by inflationary differentials by the purchasing power parity. For the value of gold, several papers suggest a long term linkage between inflation and gold price as discussed in the Introduction.

Thirdly, oil does not act as a long term hedge to any of the assets in our sample. This is in stark contrast to the role played by gold in financial markets. One explanation for this finding could be that gold is generally regarded as a monetary/financial variable, while oil is viewed strictly as a commodity. According to this viewpoint, oil prices are determined by supply and demand shocks specific to its market, which tend to be different from those that affect the gold market at least in the long run. The findings for oil also seem to suggest that the hedging and diversification properties of gold noted above may not be applicable to full set of commodities. It is particularly interesting the lack of any long term relation between oil and dollar markets, considering the fact that oil is priced in dollars. And finally, equities do not act as a hedge against any of the other markets in our analysis. This also seems to indicate that the long term forces that determine price movements in stock markets are not closely related to those in the other markets.

We proceed with the analysis to investigate whether we can identify markets that act as safe havens in our sample. Recall the premise of our model that a safe haven instrument may or may not be a long term hedge market. We present several noteworthy findings. For example, we report that gold can be regarded as a safe haven for equities as well as dollar. Hence, gold seems to act as both a safe haven and a long term hedge against both of these markets. This further supports the notion that the gold market can be considered an effective risk diversifier in equity portfolios and also, the notion that gold may be regarded as a monetary variables (as an anti-dollar as it is frequently suggested).

Bond markets, on the other hand, act as a safe haven for equities although they are not a hedge against the equity risk as our results report above. This is an example of a market that plays different roles during short term drastic price movements and long term stable relations. In other words, it appears that during stock market crises investors seem to be placed in gold and/or bond markets.

A noteworthy finding is in regards to the oil markets. As discussed above, in the long term there is not a significant negative relation, or a hedge property, between the oil market and the other instruments. However, oil does seem to act as a safe haven for both bonds and the dollar. Hence, there is some truth for the above mentioned a priori expected relation between the dollar and oil price. The reverse relation is also correct. In other words, we find that the dollar acts as a safe haven for oil as well as for bonds. Similarly, the equity market is a safe haven for the dollar and oil markets.

As mentioned above, we also provide evidence from the UK, which permits us to determine at least to some extent whether the US results represent universal conclusions. However, we can observe that the analysis using the UK data, reported in Table 3, yield rather different outcomes relative to the US results discussed above. Perhaps the most interesting finding in regards to understanding hedges stems from the fact that gold no longer serves as a hedge against equities. This important property of gold seems to disappear for the UK data. In fact, no market acts as a hedge for the UK equities at least in the long term. The statistical analysis indicates that bonds and the sterling are hedges for oil and gold returns as there is a significantly negative contemporaneous relation detected for these markets. These findings may indicate for the market participants that diversification attempts may not be as fruitful in the US.

However, the analysis presents different results when safe haven properties between these asset markets are considered. First, we find that several markets, namely gold, sterling and bonds, act as a safe haven for equities. This is, of course, more consistent with the traditional role generally attributed to gold and bonds; and also in line with the US results. It is noteworthy that this finding also further illustrates the usefulness of the method applied in the paper to determine that a market can be a safe haven although not a hedge on average. Moreover, we also show that sterling is a safe haven for gold and oil in the UK data.

### *Time Variation*

In the remainder of the empirical analysis, we aim to provide further detail on the extent to which these asset classes can act as safe havens for each other. In other words, we recognize that there may linkages between the markets during specific time periods, for instance during financial market crises, that may not be uncovered in our full sample analysis. For this purpose, we estimate our main equation using rolling

regressions and set the sample period for each case to 100 observations (approximately 4 months of data). We acknowledge that the number of observations is somewhat arbitrary, although it should provide a reasonable account of time-specific dynamics. Shown in Figure 3 are analyses of the evolution of the hedge/haven status for the US data.

Our analysis here yields several noteworthy findings. We show, in particular, that as we expected a priori there are linkages between the variables that are not detected in the full sample analysis. For example, our results discussed above indicate that the oil market does not act as a safe haven for stocks. However, we find that oil in fact acts as a safe haven during specific periods, such as around 1990, which is presumably related to the first Gulf War and recently, after the 2007-2009 financial crisis (the “credit crunch”). Moreover, the role of oil following the most recent crisis seems to be continuing. Similarly, oil acted as a safe haven for bonds after the 1987 stock market crash and also, after 2000, which is presumably related to the crash in technology and telecommunications stock on the NASDAQ. These results seem to create a pattern for the role of oil that has not been reported before. Similarly, we find specific periods in which gold market acts as a safe haven. In particular, for equities, we detect evidence for this after 1990, again presumably related to the war, and also, for the recent credit crunch. The role of gold as the anti-dollar is further confirmed in this analysis, also. Gold can be considered a safe haven for dollar in most of the last decade.

We analyze the time variation in safe haven property for the UK data in a similar manner. Our main finding perhaps is that we continue to observe a significant role for the oil market as a safe haven when short time periods are targeted in our rolling regression analysis. Perhaps, this is to be expected as the UK is a major oil producer. In particular, oil acts as a safe haven for the UK stocks around 2001-2002, which coincide with the technology stocks collapse, and as well as around 2007-2008, which coincide with another crash in stock values during the “credit crunch”. Moreover, oil is a safe haven for the UK bonds also around 2001-2002 period. On the other hand, gold cannot be considered a safe haven for the UK stock during these equity markets turmoil periods, which should be of interest to market participants.

Gold, however, continues to play its role as a safe haven against paper currencies with regards to the Sterling, also. Hence, our findings indicate that the attributes of gold in this regards are not confined to the US dollar. We find that gold is

a safe haven for Sterling around 1998, which was a period of turmoil in financial markets due to the collapse of the hedge fund LTCM; around, 2001, again a period of turmoil due to collapse in technology stocks as mentioned above; and further around 2007-2008, which is of course the recent global financial crisis.

## **Conclusion**

We have investigated the timevariation and overall role for a variety of assets as hedges or as havens against other common assets. Using a newly developed classification of hedge versus haven status, we find that Gold and Oil remain useful tools to consider as portfolio additions. Gold acts as a safe haven against equities and the dollar, while oil acts as a safe haven against the dollar and against bonds.

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