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The Application of Gold Price, Interest Rates and Inflation Expectations in Capital Markets

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Abstract

The aim of this research is to determine a forecasting model of the price of gold in relation to the rate of interest from 1971–2013 that would benefit wealth managers in their forward interpretation of capital market expectations. It is not a model for market makers, since the price-setting dominance of banks in the physical as well as derivative markets presents a problem for any economic agent participating in these markets. Nonetheless, the ability to understand the variability of gold, interest rates and prices would clearly enhance financial planning and investor performance. This research models a full population of the price of gold with the rate of interest, in order to assess what impact a change in the interest rate would have on a change in the gold price (and *vice versa*). In developing a model price of gold that is strongly correlated with the actual price, the outcome of the research expects to show that not only is the interest rate and the gold price manipulated in relation to each other, but would also affirm the Gibson's Paradox, that real gold is inversely related with the real interest rate, so that real prices are positively related with the real interest rate.

Keywords: gold price, inflation, interest rates

1. Introduction

In terms of the background to this study (Note 1), whilst the area of research is financial economics, the aim is to benefit wealth management including Islamic wealth management. The wealth management industry is global in nature and asset allocation is strongly influenced by the behaviour of the USD, as the international reserve currency, in its relation to other currencies such as the Malaysian *ringgit* (RM). Hence, the research has a strong impact upon the Malaysian domestic wealth management industry in terms of portfolio allocation and re-balancing. Ahmad Husni Hanadzlah, Minister of Finance II, Malaysia, at the official launch of Labuan IBFC Wealth Management Year 2013, stated that "The wealth management industry is one of the fastest, if not THE fastest growing financial services sector in Malaysia and Southeast Asia. It is estimated that the number of our domestic high net worth individuals will double from its current 32,000 to 68,000 persons in 2015; with their net worth increasing in tandem from USD140 billion to USD330 billion (Bank Julius Baer, Switzerland, Asia Wealth Report, 2011)" (LIBFC). The research is essentially a quantitative study involving a systematic investigation of empirical evidence and statistics to develop a model price of gold that may be measured against the actual price to assess the accuracy of the forecasting performance. Qualitative interpretation of the empirical evidence is also required in order to analyze the causal significance between gold, interest rates and prices.

The current problem is that even though paper trades derive their price discovery from underlying physical trades, derivatives are clearly not simple hedging mechanisms, but in reality are highly speculative and even deemed potentially dangerous, when considered in aggregate. Warren Buffet stated in the Berkshire Hathaway annual report of 2002, that "derivatives are financial weapons of mass destruction" (Berkshire, 2002, p. 15). As at the end of 2013, the top five (5) U.S. banks have a combined notional value of derivatives of USD225.2 Tn (OCC), which is 13.4 times U.S. GDP of USD16.8 Tn, or 3 times global GDP of USD74.9 Tn (World Bank). Specifically, J.P. Morgan has an alarming derivatives-to-risk-based capital ratio of 424:1, and Goldman Sachs' ratio has an astonishing 2,406:1. Banks such as J.P Morgan are heavily trading in interest rate as well as gold

derivatives. Moreover, some commercial banks are on the gold fixing panel and also the LIBOR panel, and thus set both the gold price and the interest rate. Notwithstanding the level of risk and moral hazard that exists, it seems that banks with inside information are prepared to accept trading risks, confident in the knowledge that the financial markets are operating in their favour, given that the extent of forward volatility in relation to gold and interest rates is known.

The significance of this research is that an accurate gold price model would obviously be of interest to wealth managers, investors, indeed all economic agents interested in the future direction of returns within capital and commodity markets. On the other hand, it would also reveal that financial markets are not behaving in a free and fair manner, but are being "rigged" in the interests of those banks that are engaged in the price-setting manipulation of the value of money (in terms of the rate of exchange between the USD and an oz of gold) and the value of debt (in terms of the rate of interest, being the price of the supply of, and demand for, loanable funds), which has an effect on prices (inflation). Accordingly, the justification for the research is that since domestic wealth managers allocate their assets according to capital market expectations, then commodities (gold), interest rates and inflation (real interest rates) are all variables taken into consideration in the research. The USD and the returns on USD denominated assets are benchmarks for wealth managers, and LIBOR is the leading global interest rate impacting U.S. yields and also KLIBOR (being the benchmark interest rate for Malaysia). Essentially, this research involves three primary objectives: (i) to investigate the relationship between real short-term interest rates and the price of gold (PG) in relation to the Gibson's Paradox, from 1971–2013; (ii) to assess whether an equilibrium rate exists at which little or no movement occurs in the price of gold and investigate the extent of gold volatility in relation to changes in real interest rates; (iii) to evaluate the accuracy of a forecasting model for the price of gold in relation to the actual nominal price of gold.

This paper is organized into five sections. In the first section we have provided an introduction, which includes a background to the research, highlighting the relevant issues and detailing the significance of the research. The second section provides a review of literature. The third sections details the methodology, the fourth section provides a discussion and analysis of the findings, and the fifth section provides concluding remarks.

2. Literature Review

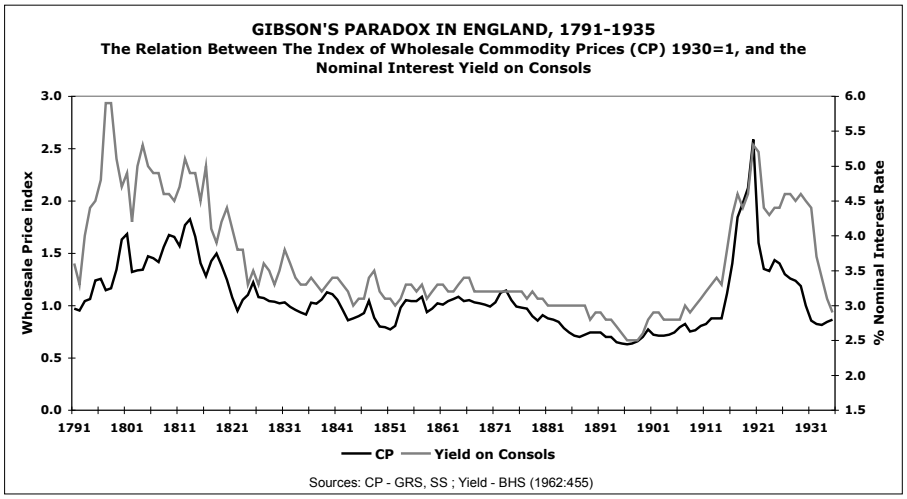

Figure 1. Yields on consols and prices in England, 1791–1935 (Abdullah, 2013, p. 37)

Essentially, our research finds it origins in the Gibson paradox, which involves the co-movement of interest rates and prices, initially observed by a financial journalist, A.H. Gibson (1923, 1926), that has been referred to as a paradox (by Keynes, 1930, p. 198), for it seemed to contradict the prediction of classical monetary theory that the interest rate is independent of the price level, being the price of the supply of, and demand for, loanable funds, whilst the price level is determined by the money supply, as described by the quantity theory of money. Many economists have failed to provide a satisfactory explanation including Wicksell (1907), Keynes (1930), Sargent (1973), Macaulay (1938), Friedman (1976), Fisher (1930), Shiller and Siegel (1977), and Barsky and Summers (1988). Abdullah (2013) provided empirical evidence that "under the gold standard, with the value of gold being held constant…nominal prices expressed in pounds coincided with real prices expressed in gold (the correlation

coefficient is unity from 1821–1914). With the gold price constant, interest rates were low and held within a narrow band of 2–5%. The Gibson paradox is observed in the co-movement of interest rates and prices. Under the gold standard, in the absence of devaluation, nominal interest rates are real rates of interest, as gold is acquired at the nominal rate, given the convertibility of the currency" (Abdullah, 2013, p. 37).

Accordingly, the paradox was, and continues to be, a function central banking, whether under the 19th century gold standard or a 20th century *fiat* standard. Under the 19th century gold standard, "monetary policy was anchored to convertible bank notes (redeemable in gold coins), where the discount rate was a tool to adjust the supply of bank money in accordance with the gold standard, whilst the *fiat* standard is floating and anchored to the volume of debt, with *fiat* money being debt organized into money, so that the supply of money via the supply of debt, is the tool by which the market interest rate is adjusted in accordance to a central bank interest rate target" (Abdullah, 2013, p. 37).

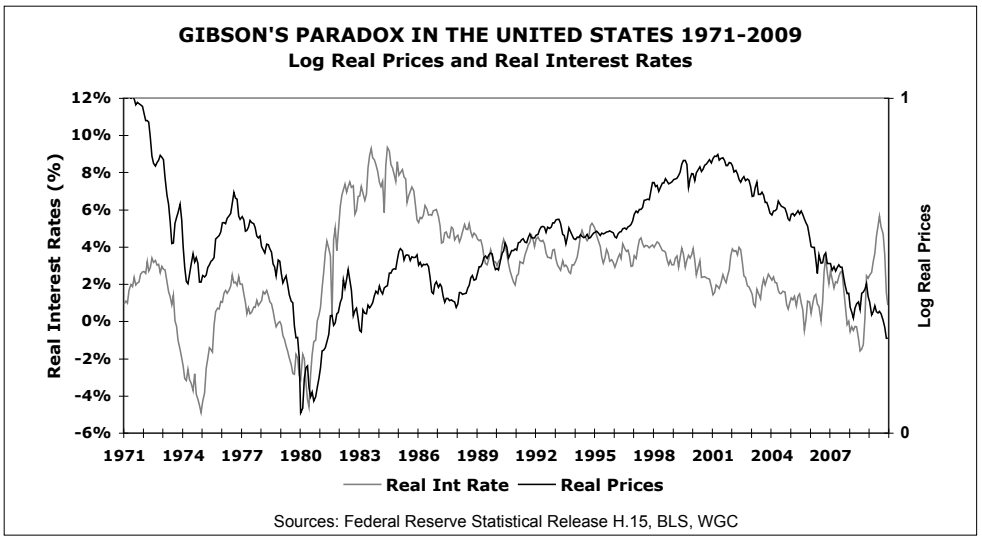

Figure 2. Real prices and real interest rates in the U.S., 1971–2009 (Abdullah, 2013, p. 40)

Hence, in either case, monetary authorities vary the value of money in relation to the cost of borrowing, such that real interest rates have a positive relationship with real prices and an inverse relationship with the purchasing power of gold or real gold (Abdullah, 2013, pp. 39–40), so that the gold price can be managed by varying real interest rates (Abdullah, 2013, p. 42). Indeed, this was confirmed by the former Federal Reserve Governor Wayne Angell, whom admitted that "the price of gold is pretty well determined by us…but the major impact on the price of gold is the opportunity cost of holding the U.S. dollar…we can hold the price of gold very easily; all we have to do is to cause the opportunity cost in terms of interest rates and US Treasury bills, to make it unprofitable to own gold" (FOMC, 1993, pp. 40–41).

"Despite the importance of gold in central bank reserves and its value to investors as a store of wealth and potential risk diversifier, there is relatively little academic literature that attempts to estimate the price determinants [of gold]" (Oxford Economics, 2012). Others studies that have endeavoured to explain the determinants of the price gold purely in terms of the supply and demand of physical gold production, or through differing combinations of macro-economic variables, including inflation and associated volatility, exchange rates, money supply and stock prices, whether using moving averages (Khan, 2013) or regression techniques (Kaufmann, 1989), have adopted variables and approaches that involve historical data to forecast future movements in the price of gold (Shafiee, 2010). Moreover, further studies have highlighted the role of gold as a long run hedge against inflation, short-run hedge against exchange rate movement and a diversifier of risk in investment portfolios (Levine & Wright, 2006; Ghosh et al., 2002; Capie et al., 2005; Ibrahim, 2010; Erb & Harvey, 2013). Notwithstanding their approaches, the explanatory variables adopted, as key drivers of the gold price, largely reflect the underlying symptoms, which in reality relate to changes in the price of gold as a function of real interest rates. Since the purchasing power of money (PPM), or real money, is the inverse of nominal prices (CPI) expressed in fiat money (PPM = 1/CPI), then the purchasing power of gold (PPG), or real gold, is the inverse of real prices expressed in gold (PPG = 1/CPIg). The empirical evidence of the inverse

relationship between real gold and real interest rates, or a positive relationship between real prices and real interest rates, analyzed and presented by Abdullah (2013) is also echoed in the empirical findings of Summers (Barsky, 1988) and Abken (1980), affirmed with the admission of gold and interest rate manipulation from the Federal Reserve in July 1993 (FOMC, 1993, pp. 40–41).

3. Methodology

Our research involves a full population of monthly gold price, inflation and interest rate secondary data are derived from various sources including the U.S. Department of Labor, the Federal Reserve, the World Gold Council, the Office of Comptroller of Currency (OCC), The Bank of International Settlements (BIS) and the World Bank. The descriptive statistics of this data will be used to test the hypothesis that the price of gold and interest rates are manipulated, which may be modelled through sensitivity analysis by showing the impact of a change in the level of interest rates with a change in the value of gold and *vice versa*. Accordingly, the conceptual framework assumes that the price of gold is the dependent variable as a function of changes in the real interest rates as the explanatory or independent variable, such that the nominal price of gold (PG) and real gold are inversely related with real interest rates.

As detailed by Abdullah (2013), the purchasing power of gold (PPG) or real gold, is defined as the index for the price of gold (PG) adjusted by inflation, which in this case is the consumer price index (CPI),

$$PPG = PG / CPI \tag{1}$$

The inverse of real gold (PPG) is real consumer prices expressed in gold (CPIg),

$$PPG = 1 / CPIg \tag{2}$$

The usual definition of real rate of interest rates (r) involves the nominal yield or rate of interest from 3-month Treasury bills (i), less the inflation rate as reflected in the CPI (π),

$$r = i - \pi \tag{3}$$

We may assume that the change in the price of gold will vary against the change in short term real interest rates, but there may be an equilibrium real interest rate at which level, generally, little or no variance in the PG occurs. The following linear equation may be adopted as the basic model for our research:

$$E(Y_1) = Y_{t-1}(ab+1) \tag{4}$$

$\mathbf{E(Y_1)}$ = expected nominal price of gold (USD per oz);

a = the difference between real interest rates and the equilibrium real interest rate (***r***);

b = the (monthly) percentage rate of change in the nominal price of gold;

$\mathbf{Y_{t-1}}$ = nominal price of gold in the preceding period (USD per oz).

The rate of change in real interest rates is statistically defined in the form of an index of real interest rates (***i***), derived from published Federal Reserve and Bureau of Labor statistics. By discounting or adjusting the index of (3-month U.S. Treasury bill) real interest rates (***i***), with the equilibrium real interest rate (***r***), and inverting the result, we obtain (***a***), being the difference between real interest rates and the equilibrium real interest rate (***r***). By applying a (monthly) rate of change in (***a***) to a percentage change in the nominal price of gold, we obtain the (monthly) percentage rate of change in the nominal price of gold (***b***), from which we can determine the model price of gold $\mathbf{E(Y_1)}$. Additional statistical analysis involves determining the correlation coefficient for a full population of monthly gold and real interest rate data to measure the strength of dependence between the model price of gold and the actual nominal price of gold, in order to assess its forecasting accuracy.

4. Discussion and Analysis

In this section we will present the nominal price of gold, the inflation adjusted price of gold and highlight specific instances of gold price suppression and in relation to nominal and real interest rates that could only realistically arise from central bank intervention on the gold price through interest rate manipulation. We will also indicate our equilibrium real interest rate, with which to factor into our equation (4.0.). This might also vary given changes in monetary policy and interest rate targets set by central banks. In any case, it provides a starting point to apply sensitivity analysis to the change in the price of gold in relation to real interest rates. We will then also present our model price of gold derived from changes in real interest rates and measure the accuracy through correlation in relation to the actual nominal price of gold.

With regard to the nominal price of gold from 1970–2013, we notice in figure 3, that the historical high of USD 850/oz that occurred on 21 January during the Iran-Iraq War, was surpassed on 5 September 2011 when it

reached a new high of USD 1,895/oz, before settling back down to USD 1,200/oz by the end of 2013. However, when we adjust the January 1980 high for inflation, the price of gold in constant 2013 dollars should be USD 2,546/oz as at 31 December 2013 (Note 2). If this were so, gold would certainly retain its role as a hedge against inflation under a fiat standard. That it did not, clearly requires investigation as to why the price of gold did not reach its full potential.

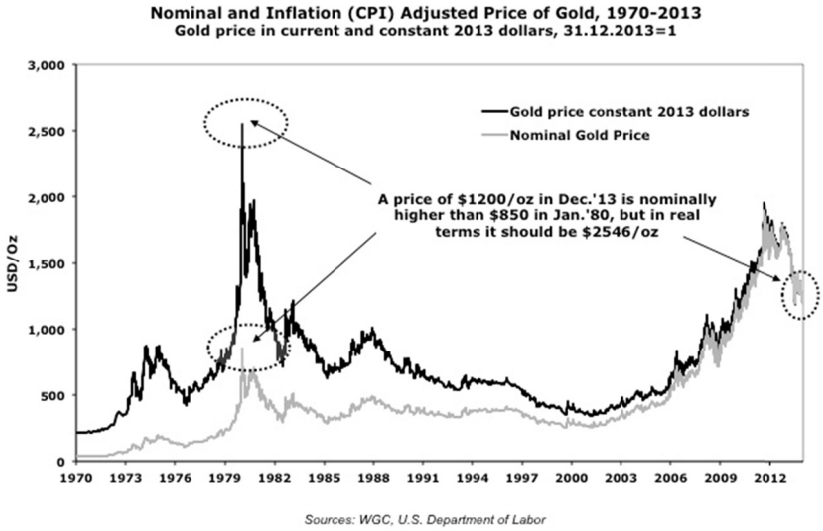

Figure 3. Nominal and inflation adjusted price of gold, 1970–2013

When we observe again the nominal price of gold in figure 4, it might seem stochastic, but in fact, reveals a considerable deterministic pattern of behaviour, if for example, we highlight the period between 1992–1996. Recall the timing of the Federal Reserve's monetary policy committee over 6–7 July 1993, when Governor Angell disclosed that, "the price of gold is pretty well determined by us…we can hold the price of gold very easily; all we have to do is to cause the opportunity cost in terms of interest rates and US Treasury bills, to make it unprofitable to own gold" (FOMC, 1993, pp. 40–41).

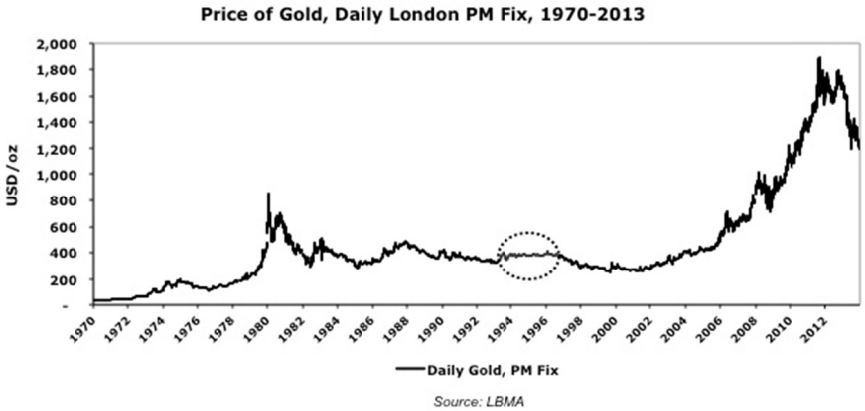

Figure 4. Gold price, 1970–2013

In figure 5, we can see the period from 1992–1996 more clearly, the timing of the FOMC meeting and the subsequent constant price of gold (PG), held at an intervention level of USD 400/oz, so that the PG has clearly been suppressed.

Figure 5. Gold price, 1992–1996

Earlier in Figure 2, we observed that real prices are positively related to real interest rates, as reflected in the Gibson's Paradox under the fiat standard in the U.S. from 1971–2009. Indeed, over the same period, since the PPM = 1/P and since gold is money, Abdullah also showed that real gold, being the PPG, therefore has an inverse relationship with real interest rates (Abdullah, 2013, p. 40), as reflected Figure 6.

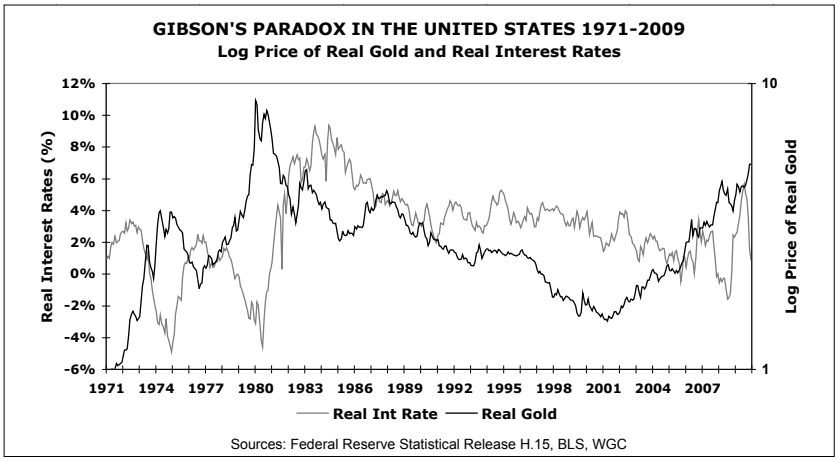

Figure 6. Real gold and real interest rates in the U.S., 1971–2009 (Abdullah, 2013, p. 40)

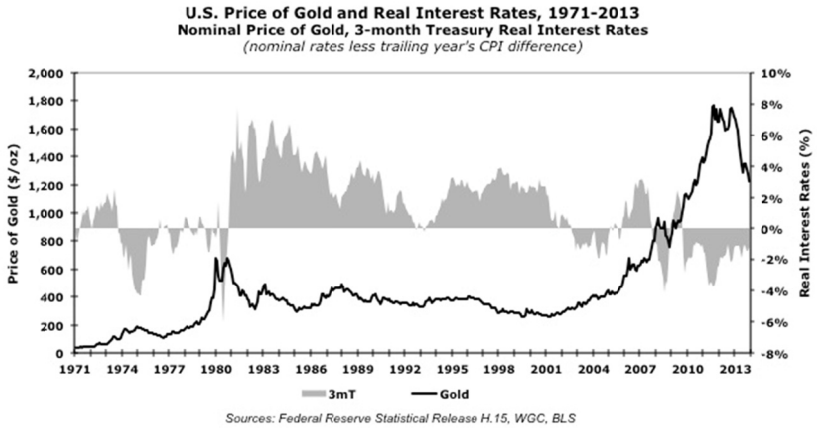

Figure 7. Nominal gold price and short term real interest rates, 1971–2013

In fact, and in satisfying our first objective, a similar pattern exists between the nominal price of gold and real

interest rates. In figure 7, we have introduced short-term, 3-month Treasury Bill real interest rates, of the sort the July FOMC meeting was alluding to, in conjunction with the nominal PG from 1971–2013. The inverse relationship between real interest rates and the nominal PG is clearly evident, especially during the 1980s and 1990s, not just the particularly period referred to above in mid 1990s.

More recently, since 2000, as real rates turned negative, the relationship still holds true. Indeed, as can be observed in figure 8, the behavioural connection between gold prices and interest rates, certainly suggests that there is a high correlation between the nominal price of gold and nominal interest rates even in recent years from 2000–2013 (with an R^2 of 0.81). However, what it cannot identify, is causality, as to whether the change in the price of gold influenced nominal yields, even at the back of the yield curve with 10-year U.S. Treasuries, or did interest rates affect the price of gold.

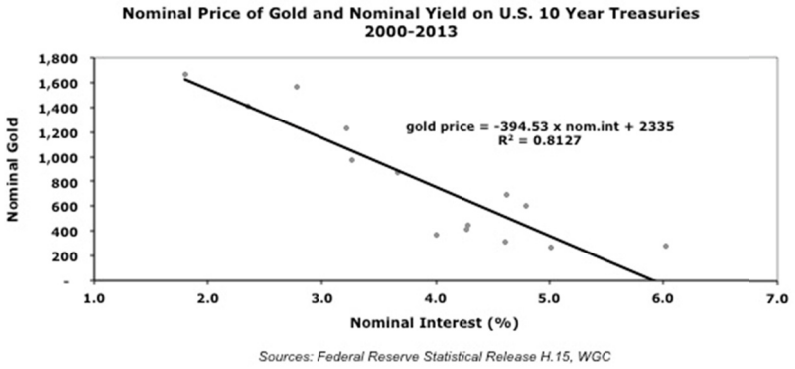

Figure 8. Nominal price of gold and long term nominal interest, 2000–2013

Before we present the results of our model price of gold, we must satisfy our second objective in evaluating whether an equilibrium real rate of interest exists in relation to changes in the nominal price of gold. This requires investigating short-term U.S. Treasury Bill real interest rates in relation to the subsequent year-over-year performance in the nominal price of gold, which we present in figure 9. We may observe that gold has performed well over the period 1971–2013 when real interest rates are below 2%, and as they go negative, increasingly the subsequent year-over-year returns become generally stronger. Conversely, once real interest rates increase beyond 2%, the returns for gold are increasingly negative. The 2% equilibrium rate, or tipping point, for returns on investing in gold, is also reflected in a report by Hinde Gold Fund for the period since 1978 (Hinde Capital, 2014, p. 6), and by U.S. Global Investors between 1970–2010 (U.S. Global Investors, 2013, p. 2).

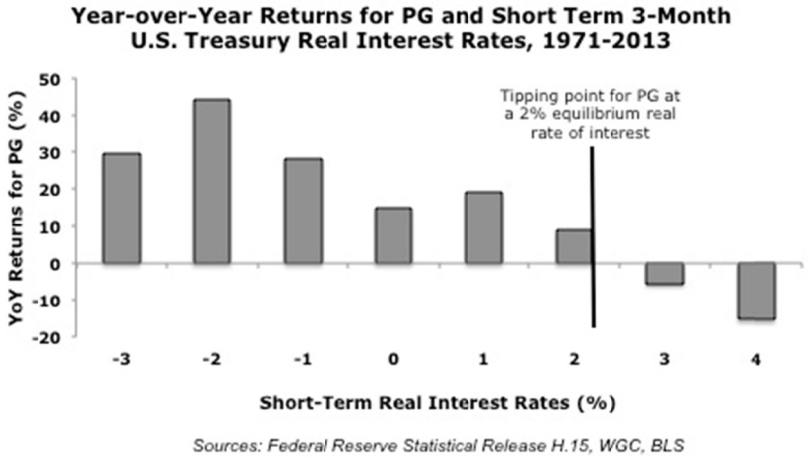

Figure 9. YOY returns on the price of gold and short term real interest rates, 1971–2013

We can finally present our third and final objective in Figure 10, with our model price of gold in relation to the

actual nominal price of gold, against the backdrop of short-term 3-month U.S. Treasury Bill real interest rates. We targeted a 2% equilibrium real interest rate and through sensitivity analysis, we allowed for a 7% annualized rate of change in the nominal price of gold to one percentage point change in the difference between real interest rates and the equilibrium real interest rate. In order to assess its forecasting accuracy, the strength of dependence between the model price of gold and the actual nominal price of gold, revealed that it was strongly correlated with a coefficient of 0.93.

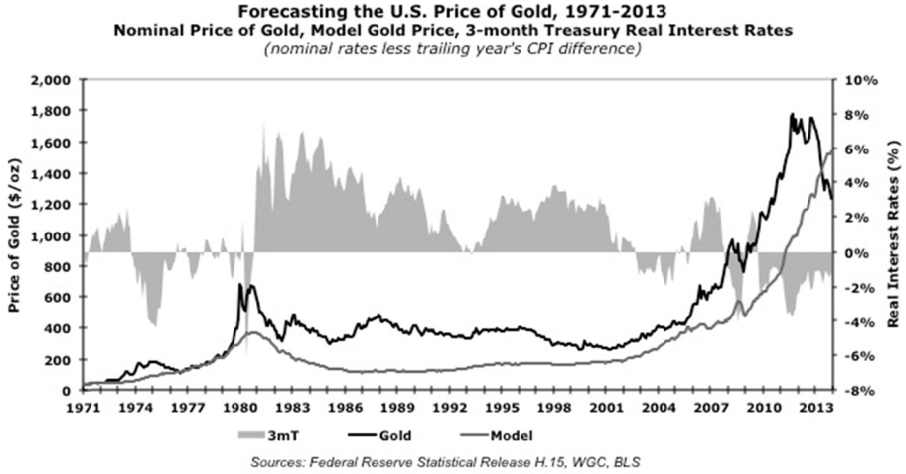

Figure 10. Actual and model price of gold, and short term real interest rates, 1971–2013

In the presence of central bank interest rate and gold price suppression, the performance of the nominal price of gold is not ultimately linked to inflation, but rather low real rates of interest. When rates are low, prices can increase quickly, as we experienced in the run-up to 2011. Since 2012, prices have decreased in a low nominal interest rate environment, causing real rates to rise, which quickly depressed the price of gold by the end of 2013, to the same level at the end of 2009 (USD 1,200/oz). Low rates of interest may remain for some time, but inflation targeting in reality is done in relation to real interest rates and controlling the price of gold, which itself is an exchange rate involving the number of U.S. dollars required to purchase a fixed amount of gold. Accordingly, the price of gold (PG) is a measure of value (Abdullah, 2014), and its manipulation is required, as an extension of modern monetary policy, to give a false impression of the value of the dollar as the international reserve currency (Abdullah, 2013).

5. Conclusion

In the preceding sections, we have demonstrated that the price of gold and real interest rates are inversely related as revealed through the Gibson's Paradox. We established an equilibrium real interest rate of 2%, such that below this level, gold performed well, whilst above this rate, it's returns decreased. Through sensitivity analysis, with the price of gold varying by 7% for every 1% change in real interest rates beyond the equilibrium real rate of interest, the result showed that our forecasted model price of gold was strongly correlated to the actual nominal price of gold, with a coefficient of 0.93.

The significance of understanding the relationship between gold, interest rates and prices, involves recognizing that inflation is a monetary phenomenon - that it exists may not be of concern to financial planners, but its variability is significant, since it affects financial planning, which may be adversely affected in terms of capital market expectations. Accordingly, gold and interest rates are precisely the variables, which are of concern in this regard, given their inter-dependence.

As mentioned, we can conclude that real gold is inversely related to real rates and real prices, hence nominal rates are positively related to commodity prices (Gibson's Paradox). Assuming a 3-month short-term USD rate of interest (equilibrium rate) of 2%, then gold remains relatively stable at this equilibrium real interest rate. For every 1% real rates of interest moves away from an equilibrium 2%, the price of gold moves at a 7% annualized rate. Therefore, the price of gold can be manipulated by the Federal Reserve in order to lower the price of gold by raising interest rates, or allowing real interest rates to rise in order to increase the price of gold. Since, the nominal price of gold, nominal interest rates and nominal prices are inter-related and these are manipulated by

the central bank, financial and capital markets are neither free nor fair, but in reality, are highly manipulated and rigged. For the financial or wealth planner that understands this, interest rate and inflation expectations take on new meaning in generating and preserving wealth.

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Notes

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Note 2. Nominal PG 21 Jan.'80 x (CPI Dec.'13 / CPI Jan.'80) = Real PG adjusted by inflation at Dec.'13. '850 x (233.049 / 77.8) = 2,546.

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