

## What Are the Real Drivers of Gold Prices?

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### Abstract

*The aim of this paper is to analyze the key drivers of the gold price. With the changing role of gold in the international monetary system and in the financial markets over the past few decades, the real drivers of gold have evolved significantly in the past century. Therefore, the analysis serves to differentiate between the drivers that have driven gold in the past and to identify the key drivers of gold prices today. Demand composition both by investor type as well as consumer market has changed significantly in the past decades and further changes are expected in the coming years. The main drivers of gold prices at present include expected inflation, money supply expectations and investor speculation, taking into consideration also the geopolitical situation and real purchasing power parity in emerging markets.*

**Keyword:** International monetary system, gold standard, gold, US dollar, money supply, real interest rate

### Introduction

Set up in 1971, the international monetary system, currently 42 years old<sup>1</sup>, does not allow for depressions as in the 1930s. In fact, according to some critics, the threat of severe deflation as in the times of the Great Depression is a persistent illusion to distract from actual inflations levels and the continued significance of gold. To quote Ness (2012): “*Gold is the center of our monetary system. Yet unlike the manifest truth about a heliocentric solar system, the truth about gold is constantly being hidden from both the public and private sectors. An elastic money supply gives a great deal of power to those who control that supply; it enables one to choose just how far the moon should orbit the sun, or when an eclipse should happen. In short, it makes one the master of the universe*”. Therefore, although gold’s role in the international monetary system is held out of view by policymakers, there remains an unbroken connection between gold and money supply dynamics.

Ever since the gold standard was abandoned in 1971, investors and central banks have had varying perceptions of the US dollar versus gold. A number of crises coupled with increased financial instability in the markets have led to an increase in the level of foreign exchange reserves in total and those held in gold deemed as appropriate by central banks. According to Boeckh (2013), this combination of events resulted in increased gold investment and hoarding by central banks and investors alike not only because of the dollar’s relative volatility since the Bretton Woods system ended, but also increasingly due to gold’s image as a great diversifier out of assets driven largely by macroeconomic factors and cycles.

Today, gold has become a key reserve asset, currently accounting for 13% of total official reserves (World Gold Council, 2013). With gold’s decreasing importance for public investors came its increasing importance for private investors.

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<sup>1</sup> On a side note, according to Evans (2012), each monetary system lasts around 50 years, so it will be even more interesting to see what will happen to gold prices by the 2020s.

Growing demand from private investors in emerging market economies especially India and China along with the ease of investing into gold through gold ETFs changed gold's image from that of a monetary instrument to that of a key diversifier, a speculative investment or a form of collateral. Although gold has no yield, its lack of credit or counterparty risk makes it all the more attractive amidst uncertainty in the markets and especially during periods of falling and/or negative real interest rates.

Based on recent developments, it is expected that China will come ahead of India as the world's largest consumer of gold. Considering that People's Bank of China has not published its gold holdings since 2009, at which point their total gold reserves amounted to 1,054 tonnes, the current gold reserves figure is not publicly available. However, China has imported 955 tonnes of gold from Hong Kong from January to October of this year, 376 tonnes more than imports over the same period in 2012. Furthermore, Macquarie estimates that total gold supply into China this year will amount to about 1,800 tonnes and it is unlikely that this magnitude of gold imports is solely due to private consumer demand. Therefore, the total gold reserves figure in China today is most likely well above the 1,054 tonnes announced in 2009. The critical question is why to invest into gold.

## **1. Why Invest into Gold?**

### **1.1 Gold as a Commodity**

Gold is essentially a reserve currency; however, it remains included in the basket of commodities. When a commodity investor picks assets for a portfolio, gold is almost always included due to its relatively low correlation to other commodities.

Compared to other commodities, in particular most industrial metals, gold's price is well above its production cost of only \$654/oz. in Q3 2013 (Clark, 2013). This is due to the significant premium associated with the cost of gold. The table 1 shows the correlations between gold, a number of commodities as well as the S&P Goldman Sachs Commodity Index (GSCI) Commodity and the GSCI Precious Metals Total Return Indices in the decade 1993-2003. With the exception to correlations with precious metals (palladium, silver and platinum), gold has a correlation of 0.27 and under with all selected industrial metals and other commodities as well as the S&P GSCI Commodity Total Return Index. With the GSCI Precious Metals Total Return Index, gold has a very high correlation of 0.98 and therefore it is often a good alternative to gold when choosing to take an exposure to gold price movements.

Looking now at correlations of gold returns with other commodities' and commodity indices' returns in the last decade – 2003-2013, it is clear from a comparison of Figure 1 above and Figure 2 that overall correlations have significantly increased and that correlations increased the most with precious metals (palladium, silver and platinum). For example gold's correlation to silver has gone up from 0.70 to 0.79 and gold's correlation with palladium has increased from 0.34 to 0.43. This could partially be explained by larger investments into precious metals funds, other gold focused funds or gold related ETFs which combine gold with the other three precious metals and perhaps other metals and simultaneously increase correlations between gold and the business cycle indirectly.

Gold's correlations with other commodity or commodity basket returns shown here increased by about 0.02 to 0.05, with the exception of Brent crude oil returns which increased correlation to gold returns by 0.07. This is interesting to note and Brent crude oil was included as a potential driver of gold returns in the quantitative analysis in Section 3 leading to interesting results over the four different periods.

Taking the view of gold as a commodity, it is interesting to look closer at the development of gold prices versus other industrial and precious metal prices in relation to the business cycle. For this analysis, I selected gold, the S&P 500 (which approximately tracks the business cycle), an industrial metal – aluminium and a precious metal – platinum, whose price development is shown in Figure 3. As expected, it is clear from the graph that gold's price has not been driven by the business cycle. The grey fields depict the differences between the gold price and the S&P 500 Index.

Despite the relatively smooth development of the gold price between 1993 and 2007/2008, the S&P 500 has experienced sharp ups and downs. Aluminium's price is very sensitive to business cycles as is most apparent from the graph in 2008 when the stock market crashed. At this point, the S&P 500 fell below the gold price. This period is shown in black in the table. The trend reversed once again in April 2013 with the sudden fall in the gold price and is marked again with a grey area.

Furthermore, according to my calculations, gold returns have been negatively correlated with S&P 500 returns in the past 5-year period (August 15, 2008 to August 15, 2013) with a negative correlation of -0.04. Although platinum is more correlated with the general equity index (correlation of 0.57 with the S&P 500 index also over the period August 15, 2008 to August 15, 2013), it is also quite highly correlated with the gold price with a correlation of 0.55 (see Figure 2).

Further research supports claims made based on Figure 3. A regression study by Bapna (2012) further supported the notion that gold does not seem to be driven by business cycles in comparison to other commodities. For comparison, even silver, with a relatively high correlation to gold and often referred to as ‘poor man’s gold’, is nevertheless very dependent on the health of the economy. Furthermore, due to the lack of cyclicity, during the past 10-year period (2003-2013), gold’s price significantly overperformed a basket of commodities over this same period, while providing less volatile returns according to Merk (2013). During the uncertainty period for gold is important its stable store value.

### **1.2 Gold as a Stable Store of Value**

The second motive for investing into gold is capital preservation. Gold is held by central banks as a component of reserves and by investors as a hedge against inflation. Due to the before-mentioned limited and relatively inelastic supply of gold, devaluation of gold is unlikely and this serves as further motivation for investors looking to hedge against uncertainty in the markets as concluded by Duller (2012).

Due to the uncertainty of the development of key currencies such as the US dollar and the euro, which have historically been key reserve assets held by central banks, central banks have held an ever-increasing portion of their reserves in gold and an ever-decreasing portion in US dollars during the last crisis.

According to Bhatia (2012), between 2000 and 2012, central banks globally shifted from holding 62% to 54% of reserves in US dollars. Furthermore, during this same period, the typical emerging market central bank reduced its reserves in US dollars and euros from 78% in 2000 to 74% in 2012. Assuming this trend continues, reserves held in these two currencies will amount to just 65% of total reserves (47% held in US dollars and 18% held in euros). This will leave 35% of reserves to be allocated freely among alternative currencies such as the British pound, the yen, other most popular reserve currencies such as the Canadian dollar and the Swiss franc and finally, gold according to the World Gold Council.

### **1.3 Gold as a Diversification Instrument**

Gold’s third key investment motive is to act as a diversifier within a portfolio or as a risk management tool. Asset managers and some individual investors are concerned with the composition of well-diversified portfolios that achieve the respective fund’s risk-return objectives. Based on their risk averseness level, they would hold more or less assets in a portfolio in gold, but almost in all cases, gold or an alternative to gold is held in a typical portfolio with an allocation of around 10%. Most recent studies conclude that 8% seems to be the ideal amount held in gold in a well-diversified portfolio (Bhatia, 2012).

For a simple preview of correlations between selected indices and the gold price, refer to Figure 4. Correlations of above 0.40 are shown in bold. Of all the correlations between gold returns and returns of bond and equity, emerging and developed market indices below, only the correlation with the S&P GSCI Commodity Index is worth noting. Similarly, according to research by Duller (2012): “compared to key indices such as the U.S. large-cap stocks (the S&P 500 Index), the broad U.S. bond market (the Barclays U.S. Aggregate Bond Index and developed foreign stocks (the MSCI EAFE Index), gold has shown relatively low correlation,” supporting numerous other studies on correlation between stock market and bond market returns versus gold price returns.

However, during crisis periods, the correlation between stock market and bond market returns tends to increase while the correlation with gold stays largely comparable, which requires further diversification of portfolios. This is why gold investments prove to be most valued as diversification instruments in times of economic distress. The most recent case of this phenomenon is the 2008 US stock market crash of 37% which was followed by gold appreciation of 5.8% according to Merk (2012). This reverse return correlation makes gold a dependable portfolio diversifier. It is important to identify the factors that are behind driving the price of gold today.

## **2. Factors that Drive the Gold Price Today**

### **2.1 Systemic Risk, Business Sentiment and Market Volatility**

Historically, a high level of systemic risk in the markets has encouraged holding gold as a safe haven asset in the midst of uncertain markets and deteriorating economies. Systemic risk, in particular in relation to US and eurozone economies, was a key driver of the gold price in the past five years. Post-2008, gold maintained its steady climb in prices due to ongoing concerns surrounding the eurozone sovereign debt crisis and the US debt ceiling. With high level private sector debt built up by 2007, especially in the most affected eurozone countries, governments had to take action, but in the process transformed a significant amount of private sector debt into public sector debt. This resulted in escalating levels of sovereign debt in most countries. According to Boeckh (2013), the level of public sector debt is currently around 80% to 220% of GDP for countries such as Japan, France, US, UK and Spain. However, as discussed above, total debt including private sector debt is key to determining the level of systemic risk with respect to a particular economy.

As shown in Figure 5, changes in the VIX index, which tracks the volatility of the S&P 500 index, mirror changes in the gold price. This means that volatility dynamics in the equity markets influence gold price dynamics. Volatility of the equity index, correlated with volatility of the bond markets, approximately indicates the level of systemic risk in the markets. According to Figure 5, incremental monthly increases in the VIX index are lagged by incremental monthly increases in the gold price.

### **2.2 Real Interest Rates, Money Stock and Markets Velocity**

The increasing rate of money creation in the form of Quantitative Easing coupled with low markets velocity led to currency debasement/inflation and pushed negative real interest rates close to -2% for the first time since the 1970s according to Artigas (2013), which further drove gold demand. Another characteristic of gold as an asset that made it such an attractive alternative to investors during the past decade is the fact that it has no yield. The fact that real interest rates were negative made a zero yield investment more attractive than a negative yield investment (stocks that did not pay out dividends or bonds that did not pay out yield). However, as nominal interest rates increased through 2013, inflation remained manageable and equity markets picked up, the cost of holding gold became less attractive with respect to other investments.

According to studies cited in Sindhu (2013), the gold price has a significant positive relationship with expected inflation, but no relationship with unexpected inflation. When it comes to macroeconomic drivers such as inflation and interest rates, it is expectations that matter, not actual levels since it is expectations that drive consumer sentiment and gold prices (Oxford Economics, 2011). Therefore, as expectation shifted towards an increase in real interest rates, the gold price collapsed. When identifying the real drivers of gold prices, the expectation of inflation is more important than whether inflation eventually occurs or not and regressing actual changes in the CPI against gold prices might not provide an accurate picture. Hence, to note, this is a shortcoming of using regressions to determine the real drivers of gold prices.

Figure 7 shows US inflation-adjusted gold price (right y-axis) versus US, EU, Chinese and UK inflation indices (left y-axis). Adjusting gold for inflation allows for clearer identification of gold price bubble peaks – 1974, 1979, 1987 and 2011. It is interesting to note that inflation-adjusted gold price had already been in decline since September 2011 before the gold price collapses starting in April 2013.

Recently, investors have switched from fears of central bank-induced inflation to a fear of general economy slowdown. Again, it is also the fear of deflation that counts for driving gold investment rather than actual deflation. Given there is unlikely to be another round of Quantitative Easing, although the current round is to be in place until the end of 2014, and that the phase of expansionary global monetary policy is at its end, the publicly-induced fear of deflation has entered the picture. Although actual extreme deflation supported gold prices in the 1930s, the situation today is radically different given elastic money supply. Ness (2012) explains that currently, “the banking system is being ‘threatened’ by unsustainable debt levels; however, the banking system was built on the creation of debt and its existence is predicated on the sustenance of that debt. Those who control the money supply (e.g. central banks, IMF, etc.) do not want to lose that power under any circumstance. Being that money is the crucial aspect of retaining this power, inflation is the only viable solution to retaining and perpetuating a system that they intend to preserve. We will not experience deflation in the long term, we will however be ‘threatened’ by it through deflationary events which serve to sway public sentiment and market participants’ psychology.” This threat is sufficient to uphold gold prices.

To conclude, according to research by Ventura Commodities (2013) and Oxford Economics (2011), gold performs well in both inflationary and deflationary periods as long as market uncertainty is high and as soon as markets stabilize again and both the threat of inflation and deflation subsides, a fall in the gold price is to be expected. This driver of gold prices – expected inflation or expected deflation, therefore works collectively with systemic risk and uncertainty to drive the gold price.

Although the tapering off of Quantitative Easing will keep the gold price down in the short-term, according to Merrill Lynch Wealth Management Chief Investment Team (2013) as the US economic recovery picks up and the output gap narrows, it is likely that inflation will once again enter the picture in 2014. This will again tip the inflation and interest rates balance and cause real rates to fall – a positive for the gold price. Inflation will also be supported by policymakers as the only solution to achieving deficit reduction in Japan, the U.S. and periphery Europe according to MacLean (2013).

On the other hand, according to Artigas (2013), as gold demand continues to expand in emerging markets, the US dollar and US interests rates will become less significant for driving the gold price as domestic inflation rates and currencies will become more important. In this case, if domestic inflation in the Southeast Asia is controlled, the gold price will not be as driven by the inflation factor, but will remain to be significantly driven by private demand.

In Figure 7, the gold price labels are shown on the left y-axis and the M2 Money Stock labels are shown on the right y-axis. Over time, there seems to be a general increase in the gold price with the increase in M2 Money Stock; however, from the graph alone it is not possible to determine whether M2 expansion is indeed driving gold or both factors are driven by a third factor. It is likely that a combination of factors – inflation, money stock, etc. is responsible for driving the gold price simultaneously.

### **2.3 US Dollar, Crude Oil and Other Potential Drivers**

Various statistical studies point to additional drivers of gold prices. Many of these factors are interdependent and therefore causality is an issue when analyzing regression results.

Firstly, the US dollar has historically been linked to driving the gold price. Also, the fact that gold is priced in US dollars in the markets makes it furthermore negatively correlated to the gold price as mentioned earlier. Consequently, numerous studies point to the US dollar driving the gold price, for example, Sindhu (2013) cites the study Capie et. al (2005) in his research on gold price drivers in India, which concludes that the US dollar moves with negative correlation to the gold price and that a weekly movement in the US dollar would generate an opposite movement in the gold price. The period under study for the research done by Capie et. al (2005) was 1971 to 2002 (this is roughly equivalent to the first three periods of my quantitative analysis in Section 3). According to Sindhu (2013)'s own research on gold price drivers for the 5-year period from November 2006 to December 2011, 22% of the variations in gold prices are due to the US dollar while the R-squared is 0.227, clearly indicating significant correlation. Similarly, 27% of gold price variations can be explained by crude oil prices with an R-squared of 0.27. Finally, the rate of inflation accounts for 21% of variation in gold prices. However, given the interdependence of the US dollar and inflation, it is important to look at a longer time period in identifying the prime driver. In Section 3, various periods are looked at to identify the real driver in this case. Furthermore, according to Bapna (2012) study of gold drivers in India, "exchange rate, fiscal deficit, forex reserves, inflation rate and interest rate have P values lesser than 0.05 which means that these independent variables strongly influence the dependent variable and effect the gold prices at large." This study was based on quarterly data collected for the period from 2002 to 2011. Bapna (2012) concludes that gold affects and is affected by the growth rate and GDP in India. It seems that consumer gold demand in India is even more correlated with Indian growth rate and GDP than consumer gold demand in the West. Furthermore, according to the study, gold influences the interest rate and inflation and vice versa at varying lags of 1 to 12 quarters, while all other macroeconomic variables such as the exchange rate, Indian sentiment indices, forex reserves and the fiscal deficit are not driven by the gold price. Therefore, it is important to also look at the direction of the causality when examining the real drivers of the gold price.

Finally, oil has also been linked to driving gold. Bapna (2012)'s study concludes that gold and oil spot and futures markets are co-integrated, which means that gold is used as an inflation hedge and that the oil market can be used to predict the gold market and vice versa. Therefore, the causality between oil and gold prices also works in both directions as with interest rates and inflation.

### 3. Quantitative Analysis – Identification of Real Drivers of Gold Prices

This chapter deals with the quantitative aspect of identifying gold price drivers. The study is done over the course of the last 42 years, since the current monetary system was put in place in August 1971, to determine whether certain drivers were more critical during different time periods and different gold price bubbles. Ultimately, the real drivers of gold prices during the current crisis and gold price bubble will be determined.

Similarly, a regression analysis will be conducted for gold mining stocks, gold futures and gold ETFs. I believe this enhances the analysis of gold price drivers since two main investor groups – asset managers and individual investors, when interested in gold investments have numerous options to consider – physical gold, gold mining stocks, gold futures or gold ETFs. Ultimately, their choice of instrument will be largely based on the development of many of the macroeconomic drivers analyzed below. For example, when picking an ETF, investors will consider factors such as macroeconomics, the US dollar, geopolitical risks and the relative valuation of gold mining stocks and this is why it is useful to know to what extent gold ETFs are driven by these factors.

#### 3.1 Data and Methodology

Thomson Reuters was used to collect monthly data for the gold price, an aggregate of gold mining stocks, Comex gold futures and the SPDR Gold Shares ETF in addition to a wide variety of macroeconomic factors – potential real drivers of gold, for the last 42 years (from August 1971 to August 2013). The periods for the individual regressions were constructed based on the business cycle.

Data-permitting the regressions for gold investment real drivers were done not done for all four periods. For example, the SPDR Gold Shares fund was only established in November 2004; therefore, the regression is only based on the period December 2004 to August 2013, once again split into two periods: December 2004 – October 2008 and November 2008 – August 2013. Similarly, for gold futures, data was only available from May 1995, so it was split into the following three periods: May 1995 – March 2000, April 2000 – October 2008 and November 2008 – August 2013. And finally, for gold mining stocks, the periods were set up as follows: January 1973 – October 1987, November 1987 – March 2000, April 2000 – October 2008 and November 2008 – August 2013.

Since a larger number of these factors drive the gold price than vice versa, it was more appropriate to divide the data according to the business cycle and not the appreciation and depreciation cycles of gold. Additionally, this means that each business cycle should have a slightly different interplay of economic factors most significant in driving the gold price during each time period assuming that each business cycle was characterized by the appreciation of a different group of assets.

*Regression-based drivers* were calculated using Stata for correlograms as well as for the polynomial regressions. First, *correlation analysis* was performed between wide ranges of factors to determine which drivers move in tandem. Then, a number of mostly independent factors was selected: M2 as a measure of money supply, US federal funds target rate and inflation to calculate the real interest rate, the S&P 500 and its VIX index, Brent crude oil, S&P GSCI Commodity Index, US consumer sentiment indicator and the US trade-weighted value of US dollar against major currencies. For the other gold instrument regressions, the gold price was also included as a potential driver. After constructing the correlograms, the drivers with the most interesting X-Y graphs or most significant r-correlation coefficients based on a 95% confidence level were selected for polynomial regressions.

The purpose of obtaining the correlation and regression results is to be able to answer the following key questions from the perspective of both different time periods and different price levels of gold and gold instruments:

1. Which factors most significantly drove the price of gold and the gold instruments during each time period?
2. Have the real drivers of the gold price gone through a major change over the last 42 years?
3. Are different factors more significant at different price levels of gold and gold instruments? Which real drivers exhibit linear and which factors exhibit non-linear relationships?

#### 3.2 Results of Analysis

The statistical analysis that follows aims to specifically identify the real drivers in each period and the correlogram (Figure 8) provide a clearer picture of the relationship of these drivers to the gold price – **linear, parabolic, scattered or asymmetric**. R-correlation coefficients are given only in cases where the p-value of the r-correlation coefficient was significant at the 95% confidence level (p-value > 0.05), indicating a significant linear relationship with the driver.

A summary of the results of the analysis in Stata is shown in Figure 9 for the last period of the study: November 2008 – August 2013. Figure 8 includes the X-Y graphs of the gold monthly prices in US dollar versus chosen drivers with the line of best fit and the corresponding value of the r-correlation coefficient if linearly significant. From Figure 9, it is clear that in some cases the real price driver has a very different relationship with gold (column 2) than with the other three gold investments (columns 3-5) while in other cases the relationship is almost identical. Gold and gold ETFs seem to be driven by the same general factors, while gold mining stocks are the least driven by the above selection of factors which is understandable given the number of corporate and industry related factors that influence mining and stock prices. A number of these factors is highly correlated with Comex gold futures; however, most of the relationships of gold with gold futures are unidentifiable via a correlogram in Figure 8 since they appear as scattered and would need to be regressed with lags to be defined clearly although they are still linearly significant according to the r-correlation coefficients. Likewise, their regression coefficients would also be significant as a rule. Therefore, whenever a driver has a significant r-correlation coefficient (r-correlation coefficient > 0.05) with gold, a regression coefficient would also be significant, meaning that the driver does drive the gold price.

Gold is linearly significant according to the r-correlation coefficients, but has a non-linear relationship with most of the drivers. With US CPI, the S&P 500 and with M2, it has a negative parabolic relationship. Furthermore, gold has a positive linear relationship with Brent crude oil and with the S&P GSCI Commodity Index and a negative linear relationship with the US dollar. These results agree with background theory on these drivers. Meaning that US CPI, the VIX, M2, S&P 500, the US sentiment indicator and Brent crude oil are correlated with and drive the gold price. However, the null hypothesis that gold is not driven by US real interest rates has not been rejected, since according to the correlogram in Figure 8 under gold and US real interest rates, there is an insignificant linear relationship between these two factors in the period from November 2008 to August 2013. This does not however mean that there is no significant non-linear relationship, which goes along with the expectation of a parabolic relationship of US real interest rates and gold. However, this was needed to be tested for additionally with result that these factors are significantly linearly correlated with and drive the gold price.

Gold mining stocks are only correlated with the price of gold with an r-correlation coefficient of 0.43, which is rather small compared to the other gold instruments. Furthermore, the selection of drivers above would not be sufficient to conduct an analysis on the drivers of gold mining stock prices, but the focus here was to compare drivers of gold to those of gold mining stocks, not solely to identify the drivers of gold mining stocks. Unsurprisingly, gold mining stocks have a negative r-correlation coefficient of -0.39 with US CPI, which is in contrast with the positive r-correlation coefficients the US CPI has with gold, gold futures and the gold ETF.

Concerning Comex gold futures, the drivers are more in line with those of gold although the r-correlation coefficients are not as high for gold futures as for the SPDR Gold Shares ETF. SPDR Gold Shares are correlated with gold by a factor of 0.9995 and most of their drivers exhibit the same relationships as with gold. The only exception here is US real interest rates. SPDR Gold Shares have a negative r-correlation coefficient of -0.31 with gold, while gold has no significant linear relationship with US real interest rates as discussed above.

The analysis above concerns itself with identifying significant drivers that drive gold linearly. However, many of these drivers have parabolic relationships with the gold and gold investments despite also being significant linearly. For example, as discussed in Section 2.3, the gold price rises most in times of extreme inflation or extreme deflation; therefore, this relationship is clearly not linear.

### **3.3 Latest Development of Gold Market**

The global financial crisis, global recession and global indebtedness led to a significant volatility of gold price. Based on the latest data published by the World Gold Council (June 2014) have been some changes in comparison with the previous period.

Despite the expectation at the end of the last year that the gold price will reduce, since the beginning of this year the gold price has increased by almost 10 percent. In comparison with the other financial assets, the gold has performed relatively very well for the first 6 months of this year and reached higher return in comparison with silver, other commodities, including fixed income securities and equities. To the upward trend of gold prices contributed also the purchase of central banks (180 tonnes), including the jewelry demand that was the highest since the first quarter of 2005.

At the beginning of 2014 both market risk and volatility were relatively low. Relatively low interest rates since the second half of 2008, including an excess of lower quality bonds led to partially increase risk in the financial system. During the latest period volatility in the international financial market was relatively low and this creates favorable conditions for investors to diversify their portfolio. There is always important to assess the demand and supply during the latest period.

The total supply of gold in 2013, in comparison with 2012, decreased by 5 percentage points and reached 4,254 tonnes. Although, net producer hedging did not record any significant changes between 2012 and 2013, mine production during this period increased by 6% and reached a total of 3,022 tonnes. In 2013, total mine supply increased by 5%. The most significant change has been a reduction in recycled gold of 22 percentage points.

The total demand in 2013 in comparison with 2012 has decreased by 5 percentage points. Demand for bar & coin increased significantly by 31 percentage points. Jewelry fabrication's demand increased by 18 percentage points. Demand for technology reduced by 2 percentage points. In addition, central bank demand for net purchases for gold in 2013 decreased by 25 percentage points a demand for gold within the over-the-counter investment & stock flows slowly increased in 2013.

Gold is very stable asset and is considered as a reserve of all reserves. In this area, there have been some changes although not significant. Regarding the side of gold holdings, in the first half of 2014 in comparison with the previous period have been changes on both sides both upwards and downwards. Some countries such as the USA, Russian Federation, France, Netherlands and India have reduced official gold holdings. There are some countries such as China, Japan, including the International Monetary Fund that have not changed official gold holdings. ECB, Germany, Italy, Portugal, Taiwan and Turkey have increased official gold holdings.

From an analytical point of view, it is always important what the level of foreign exchange reserves is and what the share of gold in these reserves is. Some countries, especially those that historically might have had an approach in their assets' portfolio towards holding foreign currencies rather than gold show very big differences in terms of the share of official gold holdings within the overall foreign reserves portfolio. On one side, China has the lowest of gold reserves (with 1.3% of total reserves), Japan (2.6%), Taiwan (4.4%), the Russian Federation (8.3%) and India (8.4%) belong to countries with the lowest ratio between gold reserves and the total level of assets. On the other side, Portugal (84.4%), the USA (71.7%), Germany (69.8%), Italy (67.1%), France (65.5%) and Netherlands (54.2%) belong to countries with the highest share of official gold holding reserves within the overall assets portfolio of their respective central banks. Here, it is important to note a particular key issue. Those countries that adopted the single currency such as Germany, France, Italy, Netherlands, including Portugal, have a relatively very high level of official gold holdings within the total assets of the central banks' balance sheets. During the first half of 2014 those countries have increased gold holding in their portfolio.

China, South Africa and the Russian Federation belong to the main producers of gold. Although, these countries are not members of any monetary union, but at the same time, they did not significantly increase their share of official gold holdings, although they recorded a current account surplus and excessive foreign exchange reserves from their exports.

It might be a very interesting subject matter for further analytical research to determine what is behind the relatively very high proportion of official gold holdings in the central banks' balance sheet in most developed countries in comparison with the emerging market economies with relatively very low proportion of official gold holdings.

### **Conclusion**

The changing compositions of global gold demand in combination with macroeconomic developments in the West and the East have resulted in continuously evolving drivers of the gold price. Although it is easy to identify factors that have significant linear and non-linear relationships with gold in retrospect, it is more difficult to select those that actually drive the gold price given the number of macroeconomic factors that are interdependent. Particularly, inflation, interest rates, money stock, the value of a currency as well as crude oil and the stock market are all significantly correlated. Furthermore, it is even more complex to quantify the effects that general uncertainty in the markets and monetary policy and politics have on the gold price. It is this uncertainty combined with a multitude of these drivers that drives gold demand today.



Based on the analysis in this thesis, the following conclusions can be made. In the majority of the 20<sup>th</sup> century, gold has been driven by the US dollar and it is often misunderstood that this is still a key driver in the current monetary system. However, it has been established by economists and also proven through polynomial regressions of gold versus US CPI and M2 that it is rather the increase in money stock in combination with systemic risk that have driven gold prices in the 21<sup>st</sup> century. Historically, high systemic risk in the form of elevated total debt to GDP figures has coincided with an appreciation in the gold price.

Furthermore, the increase in the percentage of gold demand coming from gold investment products such as gold-backed ETFs since mid-2010s has resulted in increased volatility of the gold price as it became easier to enter in and out of gold investments. The April price collapse was significantly exacerbated by the liquidation of gold ETFs. Therefore, speculation also drives the gold price as it increases its volatility considerably.

Currently, there are widely differing forecasts for the gold price published and many theories surround the topic of where gold prices will evolve from current price levels. The pronounced shift in consumer as well as private investor demand from the US and Europe to Southeast Asia and the Middle East will have implications for future gold price drivers. A number of scenarios can be proposed concerning future gold price development.

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**Figure 1: Correlation of Gold and Other Commodity Returns (1993-2003)**

	GOLD	BRENT CRUDE OIL	PALLADIUM	COPPER	NATURAL GAS	SILVER	ALUMINIUM	PLATINUM	S&P GSCI COMMODITY	GSCI PRECIOUS METALS
<b>Gold</b>	1.00									
<b>Brent Crude Oil</b>	0.18	1.00								
<b>Palladium</b>	0.34	0.31	1.00							
<b>Copper</b>	0.27	0.36	0.37	1.00						
<b>Natural Gas</b>	0.09	0.15	0.03	0.00	1.00					
<b>Silver</b>	0.70	0.23	0.43	0.34	0.04	1.00				
<b>Aluminium</b>	0.27	0.38	0.44	0.65	0.11	0.38	1.00			
<b>Platinum</b>	0.51	0.33	0.67	0.48	0.11	0.53	0.44	1.00		
<b>S&amp;P Gsci Commodity</b>	0.22	0.87	0.34	0.43	0.35	0.28	0.49	0.38	1.00	
<b>Gsci Precious Metals</b>	0.98	0.21	0.41	0.30	0.10	0.78	0.30	0.57	0.26	1.00

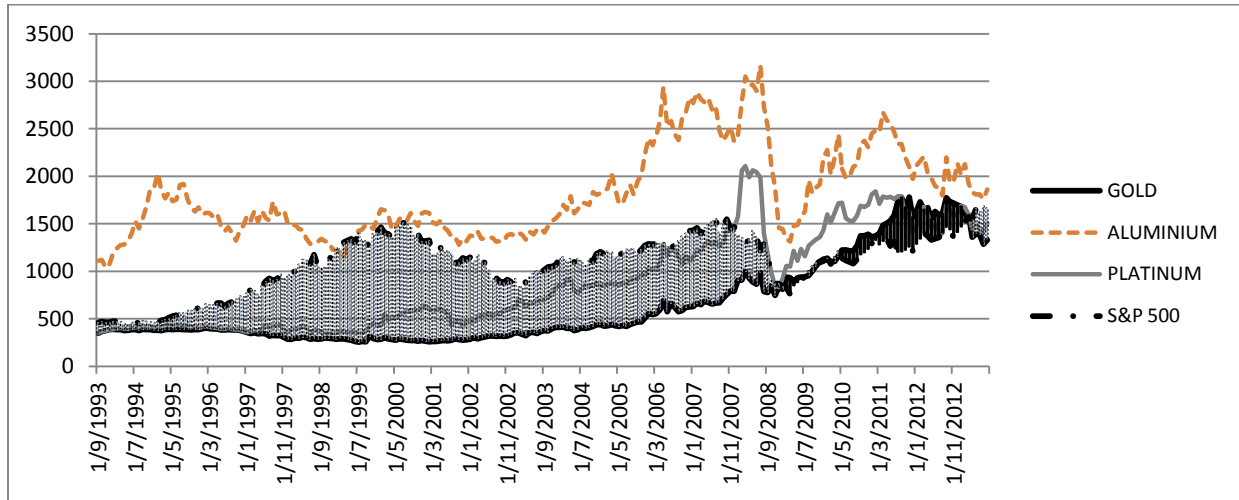
Source: Author's table based on data from Thomson Reuters (2013).

**Figure 2: Correlation of Gold and Other Commodity Returns (2003-2013)**

	GOLD	BRENT CRUDE OIL	PALLADIUM	COPPER	NATURAL GAS	SILVER	ALUMINIUM	PLATINUM	S&P GSCI COMMODITY	GSCI PRECIOUS METALS
<b>Gold</b>	1.00									
<b>Brent Crude Oil</b>	0.25	1.00								
<b>Palladium</b>	0.43	0.36	1.00							
<b>Copper</b>	0.33	0.55	0.59	1.00						
<b>Natural Gas</b>	0.10	0.16	0.02	-0.02	1.00					
<b>Silver</b>	0.79	0.39	0.66	0.46	0.10	1.00				
<b>Aluminium</b>	0.32	0.51	0.60	0.70	0.11	0.48	1.00			
<b>Platinum</b>	0.55	0.45	0.74	0.65	0.08	0.66	0.58	1.00		
<b>S&amp;P Gsci Commodity</b>	0.25	0.92	0.43	0.58	0.29	0.42	0.58	0.48	1.00	
<b>Gsci Precious Metals</b>	0.98	0.28	0.50	0.37	0.09	0.86	0.36	0.59	0.29	1.00

Source: Author's table based on data from Thomson Reuters (2013).

Figure 3: Price Developments of Gold, Aluminum, Platinum and the S&P 500 (1993-2013)



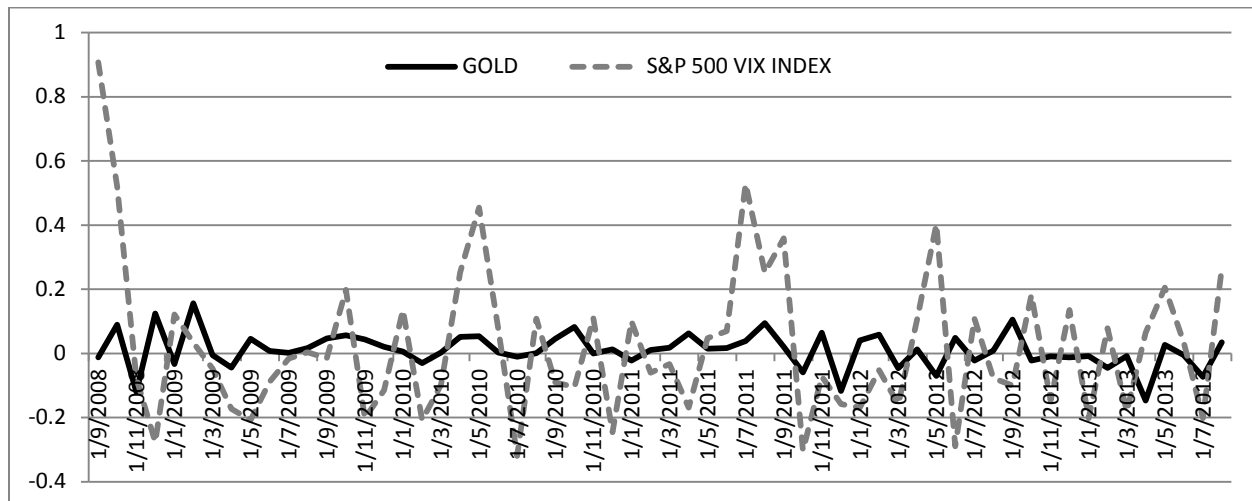
Source: Author’s graph based on data from Thomson Reuters (2013). Units as follows: gold – USD per Troy ounce, aluminium: USD per Metric tonne, platinum: USD per Troy ounce.

Figure 4: Correlation Matrix of Gold Price versus Major Indices and the US Dollar

	Gold	S&P Commodity	Gsci Metals	Gsci Precious Metals	Msci Index	World Index	Dj Industrial Index	S&P 500	Jpm Embi	Eu Embi
<b>Gold</b>	1,00									
<b>S&amp;P Commodity</b>	0,09	1,00								
<b>Gsci Precious Metals</b>	<b>0,97</b>	0,15	1,00							
<b>Msci World Index</b>	0,04	<b>0,72</b>	0,12	1,00						
<b>Dj Industrial Index</b>	-0,08	<b>0,65</b>	-0,01	<b>0,95</b>	1,00					
<b>S&amp;P 500</b>	-0,04	<b>0,70</b>	0,05	<b>0,97</b>	<b>0,98</b>	1,00				
<b>Jpm Embi</b>	0,00	<b>0,46</b>	0,07	<b>0,67</b>	<b>0,63</b>	<b>0,66</b>	1,00			

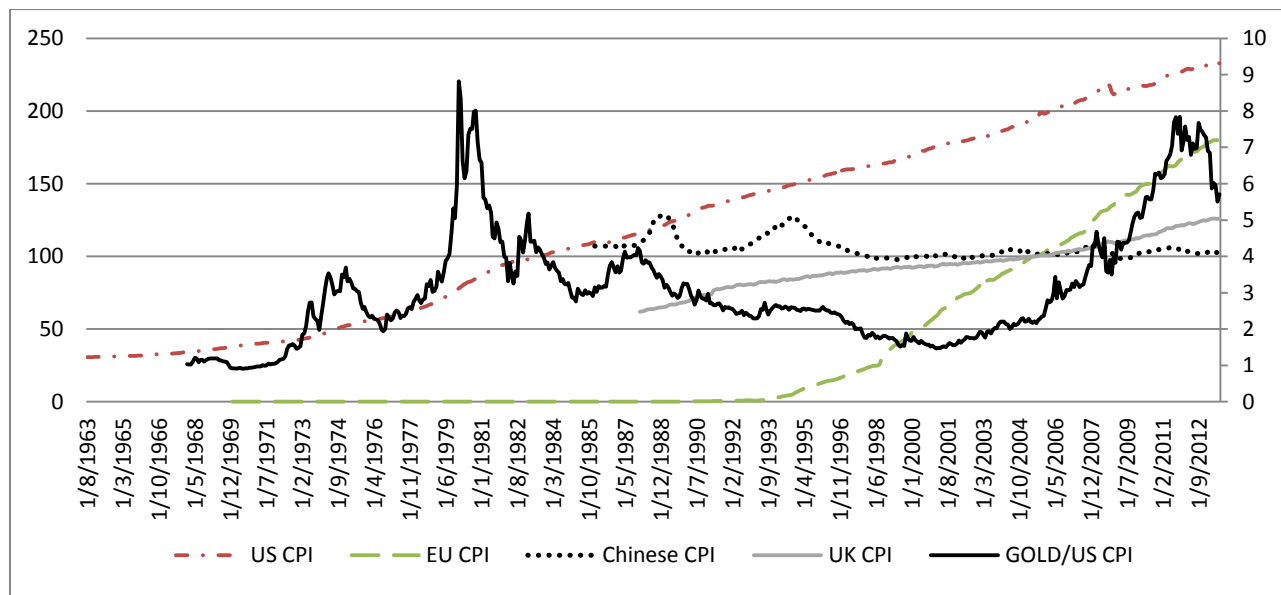
Source: Author’s table based on data from Thomson Reuters (2013).

**Figure 5: Changes in the S&P 500 VIX Index Versus Changes in the Gold Price**



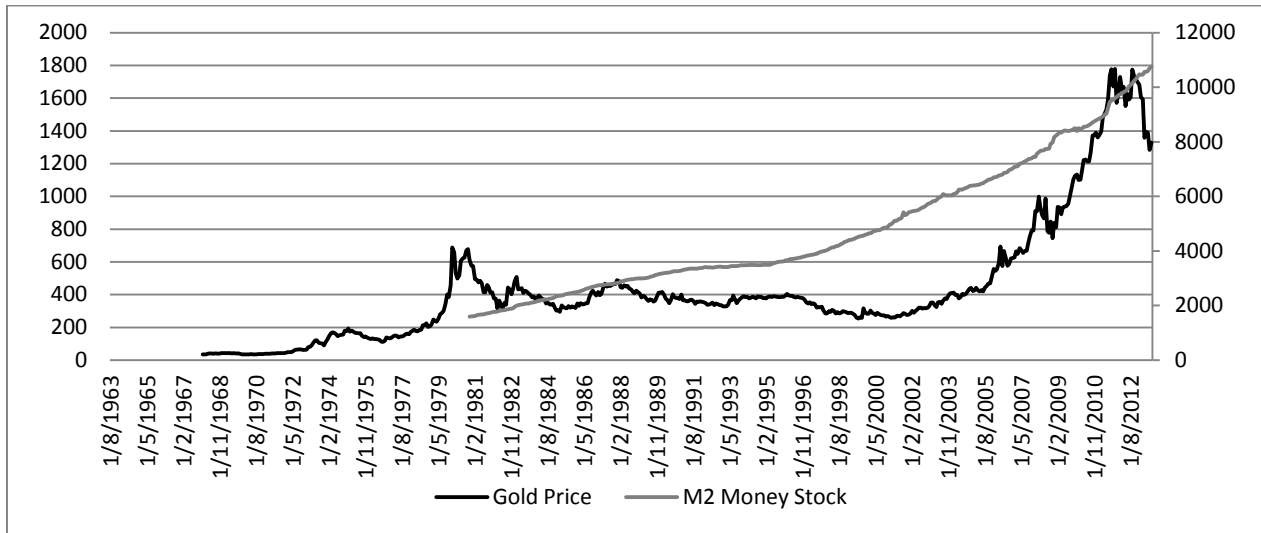
Source: Author’s graph based on data from Thomson Reuters (2013)

**Figure 5: Gold-price deflated by US CPI compared to global CPI indices (August 1963 – August 2013)**



Source: Author’s graph based on data from Thomson Reuters (2013).

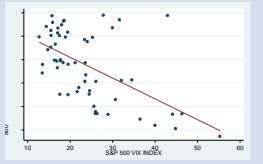
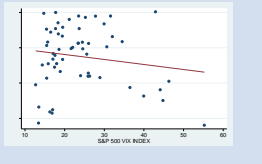
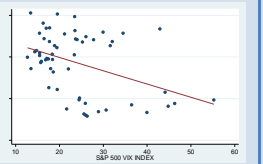
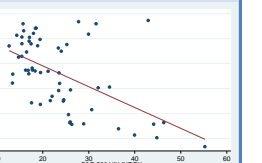
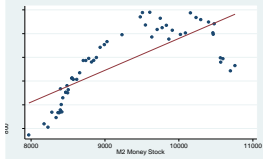
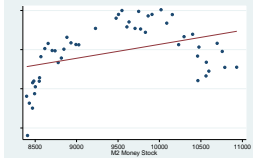

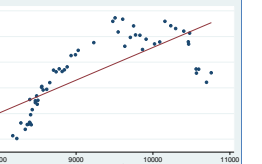
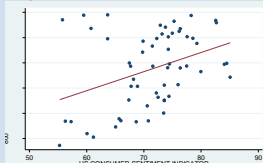
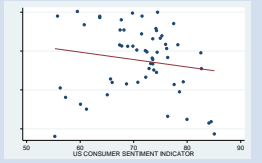
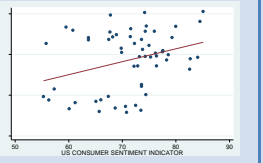
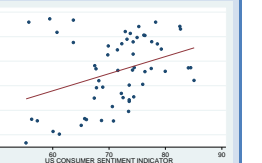
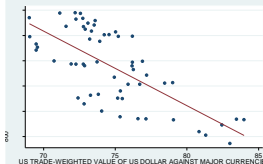
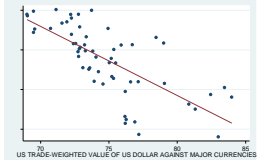
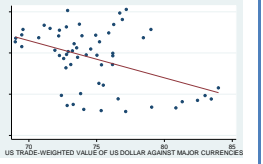
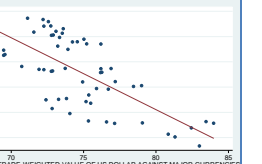
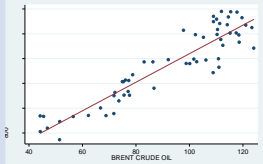
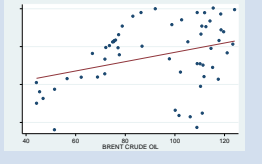
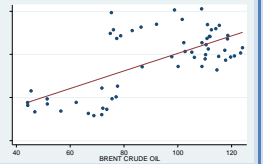
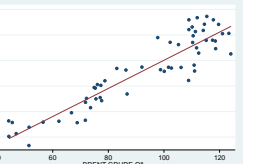
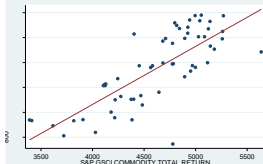
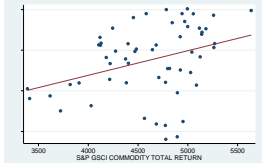
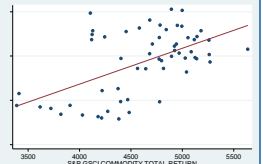
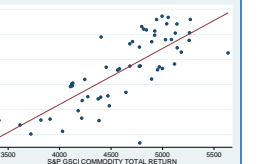
Figure 6: US M2 Money Stock Versus the Gold Price



Source: Author’s graph based on data from Thomson Reuters (2013).

Figure 7: Correlograms of Real Drivers of Gold and Gold Investments (November 2008 - August 2013)

Key driver	Gold	Gold mining stocks	Comex gold futures	SPDR Gold Shares
<b>Gold</b>	-	R = 0.4349 Parabolic	R = 0.6513 Asymmetric	R = 0.9995 Linear
<b>US Real interest rate</b>	Insignificant linear Scattered	Insignificant linear Scattered	Insignificant linear Scattered	R = -0.3109 Scattered
<b>US CPI</b>	R = 0.85 Parabolic	R = -0.3874 Parabolic	R = 0.5810 Parabolic	R = 0.8532 Parabolic
<b>S&amp;P 500</b>	R = 0.73 Parabolic	Insignificant linear Parabolic	R = 0.6225 Asymmetric	R = 0.7250 Parabolic

<p><b>S&amp;P 500 VIX</b></p>	<p>R = -0.5619 Parabolic</p> 	<p>Insignificant linear Scattered</p> 	<p>R = -0.4086 Parabolic</p> 	<p>R = -0.5507 Parabolic</p> 
<p><b>M2</b></p>	<p>R = 0.7564 Parabolic</p> 	<p>R = 0.3976 Parabolic</p> 	<p>R = 0.4884 Parabolic</p> 	<p>R = 0.7490 Parabolic</p> 
<p><b>US Consumer Sentiment Indicator</b></p>	<p>R = 0.3688 Asymmetric</p> 	<p>Insignificant linear Scattered</p> 	<p>R = 0.3143 Scattered</p> 	<p>R = 0.3554 Scattered</p> 
<p><b>US Trade-weighted value of US dollar against major currencies</b></p>	<p>R = -0.7044 Linear</p> 	<p>R = -0.7155 Linear</p> 	<p>R = -0.4368 Scattered</p> 	<p>R = -0.7077 Linear</p> 
<p><b>Brent crude oil</b></p>	<p>R = 0.9236 Linear</p> 	<p>R = 0.3395 Scattered &amp; parabolic</p> 	<p>R = 0.6611 Asymmetric</p> 	<p>R = 0.9212 Linear</p> 
<p><b>S&amp;P GSCI Commodity Index</b></p>	<p>R = 0.7759 Linear</p> 	<p>R = 0.3458 Scattered</p> 	<p>R = 0.5469 Scattered</p> 	<p>R = 0.7747 Linear</p> 

Source: Author's analysis in STATA version 12. Data source: Thomson Reuters (2013).

**Figure 9: The Real Drivers of the Gold Price**

Period	<i>r</i>	<i>p</i>	<i>n</i>
<b>US Real interest rate</b>			
All periods	-0.4562	0.0000	505
January 1973 – October 1987	0.6267	0.0000	195
November 1987 – March 2000	0.3370	0.0000	149
April 2000 – October 2008	0.0919	0.3559	103
November 2008 – August 2013	-0.0160	0.9069	56 (2 extremes excluded: 1.82, 2.77)
<b>US CPI</b>			
All periods	0.7004	0.0000	505
January 1973 – October 1987	0.7876	0.0000	195
November 1987 – March 2000	-0.7375	0.0000	149
April 2000 – October 2008	0.9596	0.0000	103
November 2008 – August 2013	0.8593	0.0000	58
<b>S&amp;P 500</b>			
All periods	0.5661	0.0000	505
January 1973 – October 1987	0.4955	0.0000	195
November 1987 – March 2000	-0.8110	0.0000	149
April 2000 – October 2008	0.4448	0.0000	103
November 2008 – August 2013	0.7319	0.0000	58
<b>S&amp;P 500 VIX</b>			
All periods	0.0951	0.1099	284
January 1973 – October 1987	-	-	-
November 1987 – March 2000	-0.5316	0.0000	123
April 2000 – October 2008	-0.0721	0.4694	103
November 2008 – August 2013	-0.5619	0.0000	58
<b>M2</b>			
All periods	0.8034	0.0000	394
January 1973 – October 1987	-0.3405	0.0015	84
November 1987 – March 2000	-0.8344	0.0000	149
April 2000 – October 2008	0.9315	0.0000	103
November 2008 – August 2013	0.7564	0.0000	58
<b>US Consumer Sentiment Indicator</b>			
All periods	-0.4163	0.0000	454
January 1973 – October 1987	-0.1493	0.0740	144
November 1987 – March 2000	-0.4275	0.0000	149
April 2000 – October 2008	-0.6986	0.0000	103
November 2008 – August 2013	0.3688	0.0000	58
<b>US Trade-weighted value of the dollar against major currencies</b>			
All periods	-0.6160	0.0000	488
January 1973 – October 1987	0.0988	0.1987	178
November 1987 – March 2000	-0.5757	0.0000	149
April 2000 – October 2008	-0.8694	0.0000	103
November 2008 – August 2013	-0.7044	0.0000	58
<b>Brent crude oil</b>			
All periods	-0.9128	0.0000	505
January 1973 – October 1987	0.8560	0.0000	195
November 1987 – March 2000	0.0125	0.8799	149
April 2000 – October 2008	0.9445	0.0000	103
November 2008 – August 2013	0.9236	0.0000	58
<b>S&amp;P GSCI Commodity Total Return</b>			
All periods	0.5843	0.0000	505
January 1973 – October 1987	0.8490	0.0000	195
November 1987 – March 2000	-0.5030	0.0000	149
April 2000 – October 2008	-0.8787	0.0000	103
November 2008 – August 2013	0.7759	0.0000	58

Source: Author's analysis in STATA version 12. Source of data: Thomson Reuters (2013).