The Value of Gold:
Hedge, Haven, or Hell for the U.S. Economy?

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Abstract:

Does gold act as a hedge, safe haven, or neither to the U.S. Economy? Two separate regression models are used in order to draw the conclusions found in this essay. For the purposes of this essay, a hedge will be defined as an asset that moves inversely to another asset on average, whereas a safe-haven is an asset that moves to another asset during times of economic stress alone. This essay concludes that gold acts as a weak hedge towards the U.S. economy as a whole.

Keywords: Gold, Safe-Haven, Hedge

JEL Classification: G12, G11, G10

Introduction:

Almost everyone has that one elderly relative that insists on purchasing as much gold as possible, and shoving it beneath their mattress. They insist on this form of investing, because gold is a trusted asset that holds an intrinsic value that no other asset can match. It cannot be printed, manufactured, nor issued, making it an almost finite resource.

The United States of America officially left the gold standard in 1971. At this time, the Federal Reserve reneged on their promise to exchange a dollar bill for a dollar's worth of gold. Since the amount of gold is limited, there was no way for the central bank to increase the amount of currency during periods of economic expansion in order to properly support economic growth. Leaving the gold standard made the value of the U.S. dollar, as well as the strength of the U.S. economy increasingly dependent on the Federal Reserve, since they now control the supply of U.S. dollars. Gold is the most trusted, and time-tested asset in existence. When people panic, they no doubt invest in gold. The purpose of this paper is not to determine why people might invest in gold during a panic, but to determine if they do. However, it does not seem unreasonable to assume that since gold has been around for far longer than any currency existing today, that it is viewed as nearly risk-free asset.

In an increasingly volatile market, it could be helpful to have an almost risk-free asset that does not rely on the Federal Reserve or the U.S. government. In an age when people are increasingly interested in cryptocurrencies because of its lack of ties to governing bodies, it would be interesting to analyze the value of gold.

There are several names for the types of relationships between two assets. The first being a safe-haven. In order for an asset to be considered as such, its value must move inversely to

another asset, but only when the economy is in a time of stress. A time of stress can be anything from a recession to a full-blown depression. Examples of such are 2001, 2008 and 2020. The second term for this type of asset is called a hedge. For an asset to be considered a hedge, it must move inversely to another asset on average, no matter the state of the economy. The value of gold acts as a hedge to the U.S. economy, because as a whole, the value of gold moves inversely to the U.S. economy on average, rather than during times of stress alone.

The following essay will be divided into several sections, including a literature review, methodology, main results, and a conclusion. The literature review looks at other works that compare gold to bitcoin, currencies, and a handful of stock markets. The methodology examines the regression analysis conducted on the variables. There are two separate regression equations used. The first of which has gold in troy oz, priced in USD (XAU), as the dependent variable, and the S&P 500 (SPX), the Bloomberg Dollar Spot Index (BBDXY), the VIX index (VIX), 10-year U.S. treasury bond yields (GOVT), and the TIPS index (TIP) as the independent variables. The second regression equation is the same as the first, but with the SPDR Gold Shares ETF (GLD) as the dependent variable. The methodology section will also have a table with the regression results. The main results section will consist of summary statistics. The concluding remarks section will consist of a summary of the results, as well as mention any future research for this project.

Literature Review:

In order to determine the nature of the relationship between gold and the U.S. economy, it is necessary to consider work already done on the topic, as well as various regression equations that have been utilized. Cai et al. (2001) focuses on the value of gold on the New York Mercantile Exchange (NYMEX). Their research focuses on the NYMEX intraday return

volatility using 5-min returns from 1994-1997. The purpose of studying gold on the COMEX division of the NYMEX, is because it allows for the study of intraday patterns, intraday ARCH effects, and major economic announcement effects (Cai et al., 2001). The research focuses on twenty-five foreign exchanges with the largest 5-min absolute returns during the sample time period, and twenty-three U.S. macroeconomics announcements. Cai et al. (2001) conclude that there is a pronounced U-shaped pattern in the intraday volatility of gold. Volatility for gold opens high, lowers in the middle of the day, then goes back up again at market close. Out of those twenty-five absolute returns, six were associated with the Central Bank's sale of gold reserves. Out of those twenty-three announcements Cai et al. (2001) only found four that have significant effect on the volatility of the gold market. The four announcements are employment reports, Gross Domestic Product (GDP) and the Consumer Price Index (CPI), and personal income (Cai et al., 2001). Although the time period is prior to that of my own data, I found the research of Cai et al. (2001) rather helpful to my own. Their research allowed me to better determine which macroeconomic indicators would be most relevant to the changes in USD gold prices per troy ounce, even though their research took place on the NYMEX.

Baur and McDermott (2010) state that gold acts as a strong safe-haven during times of stress for most developed stock markets, including Germany, France, Italy, Switzerland, the U.K., and the U.S. There are two types of safe-havens and hedges, strong and weak. A strong safe-haven or hedge can make up for money lost, whereas a weak safe-haven or hedge can only prevent the loss of more money (Baur and McDermott, 2010). A weak safe-haven or hedge can be thought of as a store of value, but not something that will gain additional value. Baur and McDermott (2010) use daily, weekly, and even monthly compounded returns of the seven largest stock markets in the world, the G7. The G7 stock markets are made up of Canada, France,

Germany, Japan, Italy, the United Kingdom, and the United States. The largest emerging markets (BRIC countries, including Brazil, Russia, India, and China), Australia, and Switzerland are included to represent small developed countries with a larger commodity market. Regional indices denominated in U.S. dollars were also included. The sample of data spans from March 2, 1979 to March 2, 2009. My research focuses on assets that pertain to the U.S. economy. Therefore, the regression analysis in this essay will not include other non-U.S. stock markets, but will include other U.S. economic indicators.

Joy (2011) analyzes the value of gold, and compares it to that of the U.S. dollar. The data spans twenty-three years of weekly data for sixteen major U.S. dollar-paired exchange rates. The value of gold was measured in the price per troy oz in USD, measured in the same intervals. The research used a GARCH model in order to look at the conditional correlation between the value of the two assets. GARCH is a model for volatility that incorporates a long-term volatility estimate. GARCH stands for General Autoregressive Conditional Heteroskedasticity. It is the most up-to date tool for analyzing volatility. However, due to technological restraints, my own paper focuses on a multi-variate regression model. The paper by Joy (2011) looks at gold's effectiveness as a hedge or safe-haven to the U.S. dollar. For the twenty-three years in which the data was sampled from, it is concluded that gold acts as an effective hedge to the U.S. dollar, but does not act as an effective safe-haven. This means that there is a strong negative correlation between gold and the U.S. dollar on average during the sample time period, and not a consistent negative correlation between the two assets during times of stress on the U.S. economy alone. Gold moves inversely to the U.S. dollar on average, rather than during times of stress alone (Joy, 2011).

Reboredo and Rivera-Castro (2014) conducted research that analyze gold's ability the hedge and preserve value against U.S. dollar depreciation. Gold is determined to be a weak safe-haven for when the U.S. dollar depreciates (Reboredo and Rivera-Castro, 2014). Since the nature of the correlation is a weak one, gold can preserve value, but not make up for losses. Gold could act as a good asset to diversify a currency portfolio (Reboredo and Rivera-Castro, 2014). The conclusions are drawn from the outcome of a likelihood ratio test between gold and the U.S. dollar. The test exploits the average and tail dependence found in the dependence structure (Reboredo and Rivera-Castro, 2014). Reboredo and Rivera-Castro (2014) expressed gold in USD per troy ounce, and the USD exchange rate was expressed in USD per unit of foreign currency. The USD was compared to the Australian dollar (AUD), Canadian dollar (CAD), euro (EUR), pound sterling (GBP), Japanese yen (JPY), Norwegian krone (NOK) and Swiss franc (CHF), Australian dollar (AUD), Canadian dollar (CAD), euro (EUR), pound sterling (GBP), Japanese yen (JPY), Norwegian krone (NOK) and the Swiss franc (CHF) (Reboredo and Rivera-Castro, 2014). The conclusions of Robredo and Rivera-Castro (2014) are similar to those of Joy (2011). The research by the two groups both point towards the direction of having gold as a diversification tool when it comes to currency portfolios.

Bouri et al. (2019) took a different approach to analyzing the characteristics of gold. Not only did they look at its relationship with the G7 stock markets, but they also compared gold's relationship to the G7 stock markets to that of bitcoin's. The only other work I read that analyzed the G7 was that of Baur and McDermott (2010). Gold is found to be a hedge and safe-haven to the U.S. stock market, as well as other G7 markets. For this paper, Bouri et al. (2019) define the terms hedge and safe-haven differently from the other authors prior. To Bouri et al. (2019), the two terms are not mutually exclusive. Essentially, gold moves inversely to the U.S. stock market

on average, but has larger inverse movements in times of stress on the economy (Bouri et al., 2019). Bitcoin is determined to have a lesser correlation then that of gold (Bouri et al., 2019). The work of Bouri et al. (2019) is interesting, because it holds a much larger focus on the U.S. stock market, which is relevant to my research.

Soja (2019) discuss the optimal portfolio combination of the Eurozone bond index with the investment grade rating from 1 to 10 years (EG05), the stock market index Euro Stoxx50 and gold using the Markowitz methodology. The data sample was from January 200 to December 2017. They used monthly data. The used the EG05 index for investment grade gov. bon maturity from 1 to 10 years. The Euro index Stoxx50, representing top 50 shares of best performing companies from eleven Eurozone Countries, and gold priced in dollars. They conducted an expected return on the formula with all the mentioned variables (Soja, 2019). Soja (2019) concluded that the optimal portfolio should include between 1% to 9% gold, depending on the investor's risk tolerance. This paper does not deal with the US economy, however I have yet to see a paper run examples of incorporating gold into portfolios.

Methodology:

The empirical research between gold and the U.S. economy involves two different regression equations. The first of which uses the value of gold in U.S. dollars per troy ounce as the dependent variable. The second equation uses the SPDR Gold Shares ETF (GLD). Both regressions use the same five independent variables; BBDXY, SPX, VIX, TIP, and GOVT. The first independent variable is the Bloomberg Dollar Spot Index, which compares the value of the U.S. dollar to that of other major currencies. The S&P 500 (SPX) is comprised of the 500 largest companies listed on U.S. stock exchanges. VIX is the Chicago Board Options Exchange’s CBOE

volatility index for the stock market. The index is based on S&P 500 options. TIP is an exchange traded fund, or ETF, that measures the TIPS index. The TIPS index provides protection against inflation in the U.S. economy. GOVT is comprised of 10-year U.S. treasury bond yields. Both regressions have 4027 degrees of freedom.

$$XAU_t = \beta_0 + \beta_1 BBDXY_t + \beta_2 SPX_t + \beta_3 VIX_t + \beta_4 TIP_t + \beta_5 GOVT_t + \epsilon_t$$

$$GLD_t = \beta_0 + \beta_1 BBDXY_t + \beta_2 SPX_t + \beta_3 VIX_t + \beta_4 TIP_t + \beta_5 GOVT_t + \epsilon_t$$

The dataset is a daily time series that spans the years 2005 to 2021. All of the data, except BBDXY starts before 2005. Unfortunately, the limited data on the value of the U.S. dollar greatly lowers the number of observations in the data set. It is necessary to have two different regression equations, because buying physical gold has higher costs to the individual investor compared to buying an ETF. ETF's do have fees, but they are miniscule compared to owning a safe, and getting gold bars or coins appraised and certified.

Main Results:

The regression results can be seen in Table 1. The adjusted R-squared for both regressions are close in value. The regression with XAU as the dependent variable has an adjusted R-squared of 0.22, which means that only 22% of the variation in the price of gold per troy oz, measured in U.S. dollars (XAU) is explained by the model. The regression with GLD as the dependent variable has an adjusted R-squared of 0.19, which shows that only 19% of the variation in the SPDR Gold Shares ETF (GLD) is explained by the model.

[Table 1 Here]

In Table 1, the asterisks next to the coefficients show the level of significance of those variables. All the dependent variables, for both regressions, except VIX, which has a p-value greater than 0.05 (for both regressions). The p-value of the VIX variable indicates that there was no effect observed on either XAU or GLD. All other independent variables are statistically significant. All the independent variables in the XAU regression fall in the same significance level as their GLD regression counterpart, they only vary slightly in p-value.

TIP is vital to the accuracy of both equations. TIP measures inflation, which is paramount when analyzing the value of the U.S. dollar throughout time. There are two ways to account for inflation. The first is to put all of the data points in terms of a single year's dollar value, or to incorporate the TIPS index, which measures inflation. When either regression is run without TIP, the VIX is then no longer statistically significant. Therefore, from an economic standpoint, TIP must remain in both regression equations.

[Table 2 Here]

Table 2 gives a rundown of the summary statistics. All of the data was pulled from the same time frame spanning from 1/3/05 through 12/31/2021.

Concluding Remarks:

Although it is statistically significant, XAU does not show hedging characteristics to SPX, rather safe-haven characteristics. Gold is a safe-haven to the S&P 500 rather than a hedge, because the relationship between the VIX and gold is not statistically significant. In order for gold to act as a at least a safe-haven to the S&P 500, the coefficient of SPX must be negative. A negative coefficient shows that the independent variable moves inversely to the dependent

variable. For example, with the XAU regression, when SPX goes up by one, XAU goes down by 0.05.

On the other hand, with the same regression, when BBDXY goes up by one-point, the gold goes down by 1.15. GOVT also has a negative coefficient of -0.04, which means that for every one-point increase in GOVT, there is a 0.04-point decrease in gold per troy oz in U.S. dollars. Now, this does not sound very good for the price of gold, but this correlation works both ways. In relation to GOVT, if the yield were to go down by one point, gold per troy oz in U.S. dollars would increase by 0.04.

The VIX however should have a positive coefficient. The VIX measures the amount of volatility in the market, so when the VIX is high, volatility and the price of gold should be high to match it. For every one-point increase in the price of the VIX, the model shows a 0.04 point decrease in gold per troy oz, measured in U.S. dollars. However, the data is not significant.

The variable TIP is statistically significant, showing a successful control for inflation, however, the relationship between TIP and XAU is positive. This adheres to the hypothesis that gold is a hedge towards inflation, because if inflation increases, the TIP ETF increases in value, therefore, during times of increased inflation, investors flee to safer assets such as gold. For every one-point increase in the TIP ETF, there is a 0.25 increase in gold per troy oz in U.S. dollars.

The GLD regression shows very similar results to that of the XAU regression. Like the XAU regression, all the variables in the GLD regression are statistically significant, except VIX. As a reminder, GLD is a gold ETF. With the GLD regression, for every one dollar increase in the value of SPX, there is a 0.04 decrease in GLD. Nevertheless, even with the ETF, gold does not

show an inverse correlation to the S&P 500. SPDR Gold Shares ETF (GLD) shows a positive correlation with the S&P 500, failing to show any hedging characteristics, based on the model.

The GLD regression also shows a negative correlation with BBDXY. For every one-point increase in the value of BBDXY, there is a 1.20-point decrease in the SPDR Gold Shares ETF (GLD). GOVT also shows a negative correlation, similar to that in the XAU regression. For every one-point increase in the yield of GOVT, there is a 0.03-point decrease in the SPDR Gold Shares ETF. The VIX once again lends itself towards a negative correlation, which indicates a hedging relationship. However, the data is not statistically significant.

Both the XAU and GLD regressions show gold has a weak hedge relationship towards the U.S. economy, based on the models. The strength of the relationship is based on a few different factors. First and foremost, the levels of significance are very strong for all the variables. Although, the adjusted R squares are low. The variable that sticks out the most however, is SPX. In both models, SPX shows an inverse relationship between gold and the value of the S&P 500. However, the VIX, which measure volatility in the market shows something different. The VIX variable was not statistically significant. The value of the VIX directly correlates to the level of volatility in the U.S. stock market. When the VIX is high, so is volatility. Therefore, since the data shows a negative correlation with the S&P 500, but no significant correlation with the VIX, gold acts as a safe haven to the S&P 500 rather than a hedge.

However, in both models, gold moves inversely to both the value of the U.S. dollar (BBDXY), and 10-year U.S. treasury bond yields (GOVT). The models also show that gold move inversely to the TIPs Inflationary ETF (TIP). A hedge is defined as an asset that moves

inversely to another asset on average, not during times of stress alone. Therefore, gold acts as a hedge towards the value of the U.S. dollar, 10- year U.S. treasury bond yields, and the TIPs inflationary ETF, but a safe-haven towards the U.S. stock market.

Although according to the model, gold is a hedge towards TIP, GOVT, BBDXY, and a safe-haven towards SPX. The model does not show any statistically significant relationship to the VIX. Gold does not seem to be a very effective hedge. Gold has a weak inverse correlation to the U.S. economy. Therefore, if one were to use gold as a hedge or safe haven, it may be best to do so in the form of a derivative, such as a future or option contract. However, the first quarter of 2022 has seen gold skyrocket in value while the U.S. stock and bond markets continue to suffer.

Future research will consist of adding other variables for analysis, as well as increasing the time span and frequency of the data. Looking forward, I would like to add the entirety of 2022 into the data. For more types of data, it seems beneficial to try another method to account for inflation. As mentioned earlier in the paper, it would be interesting to put everything into one year's dollar value, and remove TIP from both models. Adding other gold ETF's into my research could also be interesting to see if some are more effective than others. It seems that it would be beneficial to run an analysis between the relationship between SPX and VIX in order to better understand the relationship between those two indices in order to better determine gold's safe-haven characteristics towards the S&P 500. Considering that the rise of cryptocurrencies is ever-present, it may be interesting to run two more regressions. One with Bitcoin as the dependent variable, and another with Ethereum. These two additional regressions may help to explain gold's declining capacities of being an effective hedge or safe-haven. Since the models use financial heavy indicators, it seems beneficial to add other economic indicators such as GDP,

unemployment, or CPI. Additionally, it could be interesting to run a third regression using gold futures to see if the return profile associated with futures improves gold's hedge and safe haven abilities. However, I think the most beneficial adjustment to future research would be the implementation of a GARCH model.

References:

Baur, D., & McDermott, T. (2010). Is gold a safe haven? International evidence. *Journal of Banking and Finance, 34 (*8), 1886-1898.

Bouri, Elie et al. (2019). Safe haven, hedge and diversification for G7 stock markets: Gold versus bitcoin. *Economic Modeling, 212-224.*

Bloomberg. (2005-2020). BBDXY Index. In Bloomberg (Ed.): Bloomberg.

Bloomberg. (2005-2020). XAU Currency. In Bloomberg (Ed.): Bloomberg.

Bloomberg. (2005-2020). GLD US Equity. In Bloomberg (Ed.): Bloomberg.

Bloomberg. (2005-2020). SPX Index. In Bloomberg (Ed.): Bloomberg.

Bloomberg. (2005-2020). VIX Index. In Bloomberg (Ed.): Bloomberg.

Bloomberg. (2005-2020). TIP US Equity. In Bloomberg (Ed.): Bloomberg.

Bloomberg. (2005-2020). GT10 GOVT. In Bloomberg (Ed.): Bloomberg.

Cai, J., Cheung, Y.-L., & Wong, M. (2001). What Moves the Gold Market? *The Journal of Futures Markets*, 257-278.

Reboredo, J., & Rivera-Castro, M. (2014). Can gold hedge and preserve value when the US dollar depreciates? *Economic Modeling, 39* 168-173.

Soja, T. (2019). Gold in Investment Portfolio From Perspective of European Investor. The European Journal of Applied Economics. (16)1: 41-58.

Joy, M. (2011). Gold and the US dollar: Hedge or haven? *Finance Research Letters, 8*, 120-13.

Tables:

Table 1

Variables	XAU	GLD
BBDXY (X_1)	-1.15****	-1.20*
SPX (X_2)	-0.05*	-0.04*
VIX (X_3)	-0.004 ns	-0.005 ns
TIP (X_4)	0.25****	0.27****
GOVT (X_5)	-0.04****	-0.03****
Intercept	2,650.84***	264.33****
Adj. R^2	0.22	0.19
n	4,238	4,238

ns means the variable has P-value > 0.05
* means the variable has P-value ≤ 0.05
** means the variable has P-value ≤ 0.01
*** means the variable has P-value ≤ 0.001
**** means the variable has P-value ≤ 0.0001

Table 2

Summary Statistics					
Variable	Obs	Mean	Std. Dev.	Min	Max
BBDXY	4239	1083.88	96.01	905.27	1297.08
SPX	4239	1964.88	891.03	676.53	4793.06
VIX	4239	19.17	9.24	9.14	82.69
TIP	4239	111.67	7.93	90.73	130.86
GOVT	4239	2.74	1.11	0.51	5.30
GLD	4239	117.42	35.92	41.26	193.89
XAU	4239	122.05	386.68	413.35	2063.54