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Determinants Of Gold Returns: An Austrian Perspective

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DETERMINANTS OF GOLD RETURNS: AN AUSTRIAN PERSPECTIVE

by

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This thesis, submitted by Justin Theriot in partial fulfillment of the requirements for the Degree of Master of Science in Applied Economics from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

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This thesis is being submitted by the appointed advisory committee as having met all the requirements of the School of Graduate Studies at the University of North Dakota and is hereby approved.

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Justin Theriot
April 23, 2014

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To my wife and children who say I read too much.

Thank you for your patience during the many long nights of reading.

Your love has supported me throughout graduate school.

ABSTRACT

In this article, I offer a comprehensive analysis on the factors that influence the gold market in relation to returns to demonstrate that gold moves as a currency. I employed a wide range of macroeconomic and commodity variables to investigate the underlying movements in the gold market. The methodology followed four simple steps; 1) correlation tests, 2) vector auto-regression model of two lags, 3) auto-regressive integrated moving average model and 4) generalized autoregressive conditional heoteroskedasticity. This methodology enabled me to convey that gold moves more as a currency and not as an investment. The main findings of this paper provided a solid foundation for Austrian economists to utilize an econometrics analysis in providing statistically significant variables which influence the gold market. Overall, financial theory does not provide an explanation for movements within the gold market, economists such as Ludwig von Mises argued throughout their career that gold is a true currency and moves according to those principles.

CHAPTER I

INTRODUCTION

The price of gold has grown steadily over the last few decades and took on exponential growth during the past 10 years. This increase coupled with a 30 percent downward correction since 2011 has caused debate throughout the financial spectrum on describing what influence move gold and what classification should gold fall under; an investment, commodity or currency. In this article, I offer a comprehensive analysis on the factors that influence the gold market in relation to returns to demonstrate that gold moves as a currency.

By employing a wide range of macroeconomic and commodity variables I was able to investigate the underlying movements in the gold market. My data includes explanatory variables that are well known in usefully accounting for the effects of the monetary environment and financial market sentiment on asset returns. The data spans the period between August 1971 and August 2013, for a total of 505 monthly observations taken at the end of month, for a total of 505 monthly observations.

The methodology followed four simple steps. I first ran various correlation tests to understand how the data worked with one another. Next I ran a vector auto-regression model (VAR) of two lags, which provided additional information on the explanatory variables in predicting the forecasted return on gold. Utilizing the statistically significant variables from these tests I worked towards an auto-regressive integrated moving average (ARIMA) model to establish the specific variables in which move the gold market. Lastly, after the model was

determined, I utilized a generalized autoregressive conditional heoteroskedasticity (GARCH (1, 1)) model in order to demonstrate the high level of volatility in gold returns and the gold returns with the statistical significant variables being 75 percent less volatile yet enabling me to convey that gold moves more as a currency and not as an investment.

The main findings of this paper have provided a solid foundation in determining that BASE, CPI, PPI and the dollar index are all economic indicators according which influence gold returns, which aligns with Austrian economic theory. Moreover, the volatility found within gold returns and gold returns against the statistically significant variables indicates that gold returns are immeasurably complex to forecast. On the other hand, based on the empirical results and literature, I have determined that gold acts a currency which maintains purchasing power over time. Overall, gold returns move in relation to the value of the dollar i.e., if the dollar's value goes down the price of gold will rise and vies versa. Gold is not an investment that moves according to financial theory, it is a currency that maintains purchasing power from one generation to the next.

CHAPTER II

LITERATURE REVIEW

In the literature, an analysis of gold price with co-movement with economic variables are complicated issue. It has been mentioned that "as civilization developed, the metals were discovered and their superior qualities as a medium of exchange became readily apparent. These qualities included portability, indestructibility, homogeneity, divisibility, cognoscibility and relative stability of value compared with other commodities" (Skousen, 2010 p. 9). Money—gold—has a life of its own and much literature has been written.

Consistent arguments have stated that gold is regarded as surrogate money, suggesting that variables such as inflation, interest rate and growth in the money supply are likely to be more important for the gold market. The main interest in the gold market though lies in its characteristic as a channel for hedging against inflation as suggested by Mutafoglu et al. (2012).

Despite the fact that gold is relatively safe in appearance and ideological inclinations, it is risky in terms of standard deviation and the spread between minimum and maximum values. The largest negative returns of gold are close to the one of financial markets and the maximum positive returns exceed the extremes of financial markets as explained by Baur and Lucey (2010).

Interestingly, Battan et al. (2010) clarified that changes in monetary policy and to a lesser extent oil shocks are shown to have a calming effect on gold. Furthermore, Cheung et al. (2001)

displayed that the reactions of gold to the foreign exchange and Treasury bond markets to be higher than the gold market's reaction to the release of U.S macroeconomic news. This is likely due to the fact that gold is the most watched metal by traders and policy makers in relation to the vast above-ground supply that acts as a buffer against changes in annual demand and production in the long run as explained by Hammoudeh et al. (2010).

In this regard, papers by Fledstien (1980), Chua and Woodward (1982), Tandon and Urich (1987), have provided empirical evidence demonstrating that gold acts as a hedge against both expected and unexpected inflation; a rise in inflation increases the price of gold. Additionally, Sjaastad and Scacciavillani (1996) reported that the floating exchange rates among major currencies have been a major source of price instability within the gold market. In particular the appreciation and depreciation of European currencies prior to the Euro being established, there noticeably higher volatility within the gold market however since the Euro inception gold has seen lower levels of volatility. .

Gold currently buys roughly the same amount of crude oil as it did in 1971 as stated by John Butler (2010). Butler (2010) goes on to explain the purchasing power of gold has remained the same while currencies, particularly the US dollar has plummeted in purchasing power. James Rickards (2011) states that since the Federal Reserve's creation in 1913, its most important mandate has been to maintain the purchasing power of the dollar; however since 1913 the dollar has lost over 95 percent of its value. Moreover, the Treasury's supply of gold has increased from $11 billion in 1971 to over $400 billion today.

CHAPTER III

DATA

I employed a wide range of macroeconomic variables to investigate the underlying movements in the gold market. My data includes variables that were found in the literature as being useful in accounting for the effects of the monetary environment and financial market sentiment on asset returns. Furthermore, I utilized a variety of commodity variables to test the effect of gold in maintaining purchasing power. The data spans the period between August 1971 and August 2013, for a total of 505 monthly observations taken at the end of month.

The financial variables that I utilize are the S&P 500 index, Dow Jones Industrial Average (DJIA), 1-month Treasury Bill Rate, the total amount of US dollars in circulation (BASE) and the Federal Funds Rate. I also include the US dollar to euro, British pound exchange rate and US Japanese yen exchange rates. The exchange rate is the value of one euro or pound to the US dollar and the value of one US dollar to Japanese yen.; a rise in the pound or euro implies a devaluation of the dollar with a rise in the US dollar to yen rate implying a strengthen of the dollar.

Additionally, I include the rate of inflation was measured in terms of Consumer Purchasing Index (CPI) and Producer Purchasing Index (PPI). In several macroeconomic variables such as industrial production, unemployment rate and the dollar index. Lastly, I utilize 26 commodity variables which includes, WTI oil spot price, platinum, silver, aluminum, copper,

iron, lead, nickel, tin, zinc, beef, chicken, lamb, timber, banana, cocoa, coffee Arabica, coffee robust, cotton, maize, orange, rice, soy, sugar, average price of tea, tobacco and wheat.

Table 1. Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
goldret	504	0.88	6.14	-21.37	29.24
sp500ret	504	0.66	4.46	-21.76	16.30
djiaret	504	0.66	4.44	-23.22	14.41
rfret	504	0.87	23.93	-84.21	333.33
effrret	504	-0.35	9.23	-59.79	46.67
baseret	354	0.86	2.54	-7.30	27.29
euroret	175	0.13	3.04	-9.94	9.65
yenret	504	-0.19	3.20	-14.74	10.92
ukret	504	-0.05	2.92	-12.17	14.55
cpiret	504	0.35	0.34	-1.77	1.81
ppiret	504	0.34	0.96	-5.33	5.79
ipret	504	0.20	0.74	-4.21	2.41
wtiret	504	1.05	9.55	-32.75	134.88
ueret	504	0.07	2.79	-8.51	12.50
dindexret	487	-0.05	2.10	-6.98	8.70
platret	504	0.67	5.90	-25.39	34.35
silverret	504	0.87	8.65	-39.55	73.16
alumret	504	0.36	5.42	-27.83	19.73
copperret	504	0.60	6.73	-29.54	28.30
ironret	504	0.69	6.24	-36.50	71.50
leadret	504	0.69	7.34	-25.57	36.23
nickelret	504	0.62	8.14	-31.78	78.80
tinret	504	0.52	5.63	-22.25	17.53
zincret	504	0.58	6.82	-24.97	39.72
beefret	504	0.31	4.46	-16.30	25.62
chickenret	504	0.35	2.10	-5.42	11.02
lambret	504	0.49	4.26	-16.84	24.81
timberret	504	0.41	3.93	-17.92	22.28
bananaret	504	1.63	16.59	-36.59	81.00
cocoaret	504	0.54	7.15	-20.18	75.62
cofararet	504	0.51	7.89	-29.71	52.61
cofrobustret	504	0.42	7.35	-22.10	45.93
cottonret	504	0.33	5.54	-23.59	22.22
maizeret	504	0.46	6.03	-21.72	34.65
orangeret	504	1.28	13.28	-50.51	72.35
riceret	504	0.51	7.13	-21.53	78.90
soyret	504	0.47	6.42	-29.79	37.69
sugarret	504	0.37	6.22	-26.08	47.60
tearet	504	0.46	7.00	-30.43	63.66
tobaccoret	504	0.32	1.74	-4.74	7.01
wheatret	504	0.52	6.63	-19.68	67.95

The descriptive statistics for the returns and/or percent changes are reported in Table 1. As stated

in the literature review, the returns for gold at their lowest equal the S&P 500 and Dow Jones yet exceed both at its highest. In terms of sample standard deviation, gold returns is slightly more volatile than the S&P 500 and DJIA returns Furthermore, we can see that BASE steadily increases with a mean equal to 0.86 demonstrating a possible correlation with the dollar index as it shows a negative mean of -0.05; as additional currency enters the market while holding demand steady the value of that currency will decline, in this case the US dollar. Among different commodities banana and oranges have the highest return but are accompanied by double digit standard deviations.

Table 2. Correlations and Spearman Correlations Against Gold Returns

	Corr	Corr 1-Lag	PW Corr		Corr	Corr 1-Lag	PW Corr
goldret	1.000	1.000	1.000	nickelret	0.147	0.016	0.069
sp500ret	0.010	-0.0031	0.002	tinret	0.169	-0.049	0.124
djiaret	-0.031	-0.0025	-0.032	zincret	0.193	0.029	0.112
rfret	0.090	0.0073	0.024	beefret	0.039	0.007	0.078
effrret	0.080	-0.2123	-0.025	chickenret	-0.101	-0.245	-0.033
baseret	0.053	0.1268	0.054	lambret	0.084	-0.064	0.037
euroret	0.376	-0.0485	0.376	timberret	0.184	0.011	0.167
yenret	-0.234	-0.1369	-0.229	bananaret	0.085	-0.031	0.007
ukret	0.302	-0.1045	0.273	cocoaret	0.219	-0.057	0.132
cpiret	0.122	-0.148	0.138	cofararet	0.171	-0.055	0.080
ppiret	0.112	-0.1687	0.164	cofrobustret	0.133	-0.089	0.078
ipret	-0.100	0.1285	-0.075	cottonret	0.084	-0.028	0.033
wtiret	0.152	-0.0406	0.191	maizeret	0.187	0.003	0.055
ueret	-0.011	0.0961	0.023	orangeret	-0.097	0.065	0.001
dindexret	-0.474	0.0332	-0.388	riceret	-0.050	-0.167	-0.018
platret	0.343	-0.144	0.440	soyret	0.224	0.082	0.196
silverret	0.467	-0.0475	0.535	sugarret	0.022	-0.001	0.185
alumret	0.110	-0.0394	0.074	tearet	0.099	-0.593	0.010
copperret	0.179	-0.1076	0.188	tobaccoret	-0.009	-0.049	-0.031
ironret	0.083	0.0543	0.059	wheatret	0.212	0.056	0.046
leadret	0.078	-0.012	0.082				

Contemporaneous correlations between gold and other 40 variable returns are provided in table 2. The table is broken down into two categories: gold and other variable returns through standard contemporaneous correlation, gold and other variable returns with one-lag on the variables, and gold returns and other variable returns through Pearson correlation. Certain

variables stand out within the first column. They include the Euro return, Yen return, British Pound return, dollar index, platinum return, silver return, cocoa return, soy return and wheat return as each variable has a greater than 20 percent correlation with gold return. However, when we compute correlation with gold returns using one lag, the Federal Funds Rate, chicken returns, and average price on tea returns all move above 20 percent.

CHAPTER IV

METHODOLOGY

Following the findings of prior work in the literature the expected (E) return on gold (G = gold) at time equals t, conditional on the information (I) available at the previous time interval (t-1).

$$E_t(r_t^G | I_{t-1}) \quad (1)$$

For the empirical implementation of equation (1), I use three separate methods to conduct alternative tests and establish the linkages between the various macroeconomic variables, commodities and returns of gold. Through an examination of correlations, previous literature, and theory, I first use a VAR model of two lags as denoted by equation (2), where y_t equals the vector of response time series variables at time *t;* y_t has *n* elements.

$$Y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + e_t. \quad (2)$$

After each VAR model, I test to see how well it fits data by running a Granger causality test to determine if the variables are useful in forecasting returns on gold. Since the test finds only predictive causality, I gather the most statistically significant variables along with those variables whose correlation was greater than 20 percent to fit an ARIMA model denoted by equation (3).

$$\hat{Y}(t) = \mu + Y(t-1) - \theta_1 e(t-1) - \theta_2 e(t-2) + \beta_1(X_1(t) - \phi X_1(t-1)) + \beta_2(X_2(t) - \phi X_2(t-1)) \ldots + \cdots \beta_n(X_n(t) - \phi X_n(t-1)) \quad (3)$$

This framework utilizes linear exponentional smoothing in the form of an ARIMA (0, 1, 2) as denoted by equation (3). After this first regression I save the selected variables who were statistically significant and perform an another ARIMA (0, 1, 2) model. Furthermore, I perform a model validation test via residual analysis of equation (3) and check for appropriateness, via the Ljung-Pierce portmanteau test for white noise as denoted by equation (4), where $\hat{p}_j$ is the sample autocorrelation at lag j.

$$Q = n(n+2)\sum_{j=1}^{m}\frac{1}{n-j}\hat{p}^2{}_{(j)} \twoheadrightarrow \chi_m^2 \quad (4)$$

Next, I utilize 4-plot graph to illustrate correlogram of the residuals. This includes a time-series graph of gold returns against the residuals, a histogram of the residuals, and probability distribution to determine the model's satisfactory fit.

Finally, after the appropriate model is determined, I utilized a GARCH (1, 1) model in order to examine the level of volatility in gold returns with and without the statistical significant variables as denoted by equation (5), where u_{t-1}^2 equals the lagged residual from model (2). This allows to see the next period's conditional variance as a weighted combination or the unconditional variance of returns, $E(\mu_{t^2})$, last period's squared residuals, u_{t-1}^2 , and last period's conditional variance, σ_{t-1}^2, with weights (1 - $\alpha_1 - \beta_1$) which is denoted in equation [a].

$$\sigma_t^2 = \alpha_0 + \alpha_1 u_{t-1}^2 + \beta_1 \sigma_{t-1}^2 \quad (5)$$

α_1, and β_1, which sum to one [a]

CHAPTER V

EMPIRICAL RESULTS

I first report the estimate results from equation (2) in Table 3 which were used in conjunction with the correlation tests to determine the appropriate variables to use within the ARIMA model. The results from equation (2) suggest that returns on BASE, platinum, lead, cocoa and frozen orange juice are statistically significant in effecting the returns on gold.

Table 3. VAR Granger Causility Against Gold Returns
2 degrees of freedom

Excluded	chi2	Prob > Chi2	Excluded	chi2	Prob > Chi2
sp500ret	0.1542	0.926	tinret	1.2636	0.532
djiaret	0.1360	0.934	zincret	4.5781	0.101
effrret	10.0950	0.006	beefret	2.7970	0.247
baseret	6.4323	0.04	chickenret	1.5409	0.463
euroret	0.2586	0.879	lambret	0.6350	0.728
yenret	0.2788	0.87	timberret	4.4795	0.106
ukret	0.0532	0.974	bananaret	0.7115	0.701
cpiret	1.8370	0.399	cocoaret	8.3006	0.016
ppiret	0.6914	0.708	cofararet	0.9535	0.621
ipret	1.3292	0.514	cofrobustret	0.9125	0.634
wtiret	8.9685	0.011	cottonret	0.8280	0.661
ueret	5.8673	0.053	maizeret	0.5087	0.775
dindexret	0.2705	0.873	orangeret	9.9034	0.007
platret	17.3620	0	riceret	5.1993	0.074
silverret	1.9162	0.384	soyret	0.6525	0.722
alumret	3.9943	0.136	sugarret	3.3818	0.184
copperret	4.5662	0.102	tearet	3.4069	0.182
ironret	8.9064	0.012	tobaccoret	3.2105	0.201
leadret	6.6718	0.036	wheatret	0.4613	0.794
nickelret	1.3745	0.503			

Additionally, the results from the correlation matrix suggest the returns on Federal Funds Rate, euro to dollar, yen to dollar, British pound to dollar exchange rates, dollar index,

unemployment rate, silver and iron should also be added to equation (3) as they indicate either a positive or negative 20 percent correlation. Furthermore, based on financial theory I added the returns on the S&P 500 as an additional explanatory variable. The the literature indicates that gold returns act as a hedge against the stock market as argued by Baur and Lucey (2010) and Hammoudeh, Yuan and McAleer (2010). Moreover, the literatures notes that inflation measurements (CPI and PPI), are statistically significant variables within the gold market. Lastly, since the euro was officially introduced in non-physical form on January 1, 1999 and this introduction causes the sample to be reduced by 330 observations, a 65 percent reduction, I decided to leave this variable out. Thus I use the following explanatory variables as a guideline in setting-up the ARIMA model: the one-month returns on BASE, platinum, lead, cocoa, frozen orange juice, Federal Funds Rate, yen to dollar, British pound to dollar, dollar index, unemployment rate, silver, iron, CPI, PPI and S&P 500.

I perform an ARIMA model to determine if the variables accurately fit and can provide a statistically significant model that controls for the effects that influence gold returns. Table 4 displays the regression of the variables described in the above paragraph run through an ARIMA (0, 1, 2) model. As argued by Austrian economic theory, the returns on S&P 500, BASE, CPI, PPI and dollar index are shown to be statistically significant in effecting the returns on gold. Furthermore, the returns on platinum and silver were shown to be statistically significant as well although these two precious metals act similar to gold. However, platinum does act slightly different as it behaves similar to a commodity as it is used in catalytic convertors. Aside from lead, the remaining variables were shown statistically insignificant which agrees with Austrian arguments for gold as a currency.

In the next step, I remove all statistically insignificant variables and once again run the ARIMA (0 1 2) model. Table 5 displays the regression results of that include the following variables: the returns on S&P 500, BASE, CPI, PPI, dollar index, platinum, silver and lead. We see that each variable is statistically significant at the 1 percent level aside from lead, which is significant at the 5 percent level. Subsequently, I perform a Portmanteau test as denoted in equation (4) which resulted in a p-value of 0.7829 indicating that we reject the null hypothesis, that suggests that the residuals are affected by the variable.

Table 4. ARIMA (0 1 2) Model

goldret	Coef.	OPG Std. Err.	z	P>z	[95% Conf.	Interval]
sp500ret	-0.1592**	0.0409	-3.9000	0.0000	-0.2393	-0.0791
effrret	0.0148	0.0208	0.7100	0.4770	-0.0260	0.0555
baseret	0.1858**	0.0739	2.5100	0.0120	0.0410	0.3306
cpiret	3.2043**	0.8862	3.6200	0.0000	1.4675	4.9412
ppiret	-1.0471**	0.2844	-3.6800	0.0000	-1.6045	-0.4897
yenret	0.0282	0.0789	0.3600	0.7210	-0.1264	0.1829
ukret	-0.1268	0.0882	-1.4400	0.1500	-0.2996	0.0460
dindexret	-0.894**	0.1681	-5.3200	0.0000	-1.2241	-0.5653
ueret	-0.0050	0.0779	-0.0600	0.9490	-0.1576	0.1477
platret	0.1730**	0.0404	4.2900	0.0000	0.0939	0.2522
silverret	0.2249**	0.0322	6.9800	0.0000	0.1618	0.2881
ironret	0.0349	0.0281	1.2400	0.2150	-0.0203	0.0900
leadret	-0.0530**	0.0249	-2.1300	0.0330	-0.1018	-0.0042
cocoaret	0.0148	0.0351	0.4200	0.6730	-0.0540	0.0836
orangeret	-0.0200	0.0165	-1.2100	0.2270	-0.0524	0.0124
_cons	0.0042**	0.0014	3.1000	0.0020	0.0015	0.0068
ARMA						
ma						
L1.	-1.3283	128.5938	-0.0100	0.9920	-253.3675	250.7109
L2.	0.3283	42.2281	0.0100	0.9940	-82.4373	83.0939
/sigma	3.3312	214.1508	0.0200	0.4940	0.0000	423.0590

Continuing with any standard non-linear least square fitting, the primary tool for model diagnostic checking is residual analysis. Graph 1 presents a correlogram of the residuals

displaying that they all fall inside the 95 percent confidence bound. Next, I display a time-series chart of gold returns from August 2008 to August 2013 against the residuals demonstrating a close match. Furthermore, histogram of the residuals illustrating a normal distribution is confirmed by the normal probability distribution chart. Lastly, the regression model displaya an Akaike information criterion (AIC) is equal to 1887.29.

Table 5. ARIMA (0 1 2) Model

goldret	Coef.	OPG Std. Err.	z	P>z	[95% Conf.	Interval]
sp500ret	-0.1482	0.0367	-4.04	0.00	-0.2202	-0.0763
baseret	0.1429	0.0544	2.62	0.01	0.0362	0.2495
cpiret	3.1642	0.8664	3.65	0.00	1.4660	4.8624
ppiret	-1.0042	0.2631	-3.82	0.00	-1.5199	-0.4885
dindexret	-0.7255	0.0877	-8.27	0.00	-0.8973	-0.5537
platret	0.1829	0.0377	4.85	0.00	0.1089	0.2568
silverret	0.2287	0.0310	7.37	0.00	0.1679	0.2895
leadret	-0.0559	0.0242	-2.31	0.02	-0.1034	-0.0085
_cons	0.0045	0.0013	3.35	0.00	0.0019	0.0071
ARMA						
ma						
L1.	-1.3337	264.5130	-0.01	1.00	-519.7698	517.1023
L2.	0.3337	88.2870	0.00	1.00	-172.7057	173.3731
/sigma	3.3652	445.0379	0.01	0.50	0.0000	875.6234

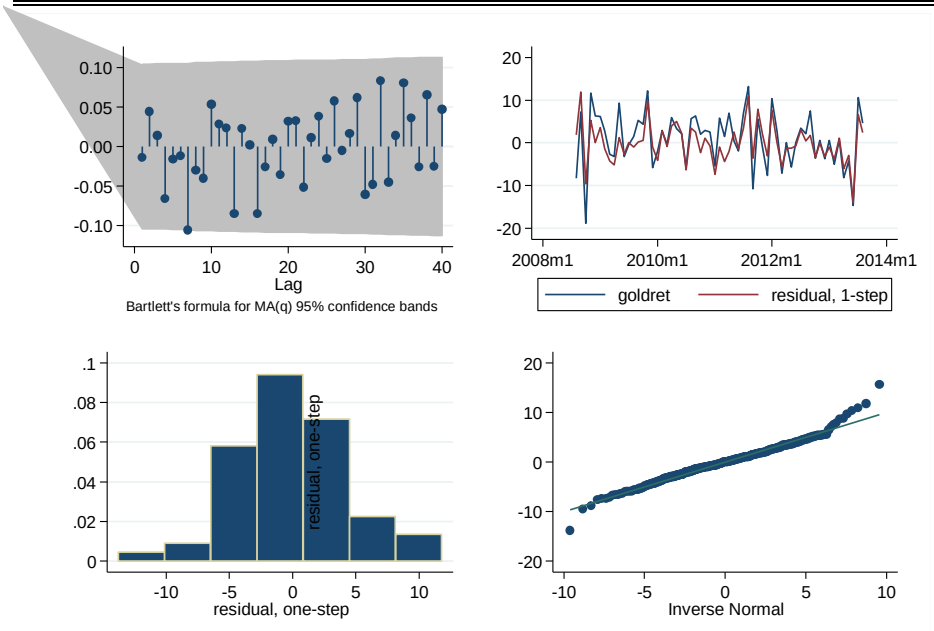


Figure 1. ARIMA (0 1 2) Model Residual Statistics

The empirical results have provided a solid foundation in determining the factors that move the

gold market. However, BASE, CPI, PPI and dollar index are all indicators to why the dollar has lost purchase power leading gold to maintain wealth based on Austrian economic theory. Moreover, I decided to implement a GARCH (1, 1) model, denoted by equation (5) determining how volatile gold return is month to month. I implemented the model on gold returns only and gold returns with the set of variables found through the ARIMA (0, 1, 2) model. Graph 2 demonstrates that the volatility found within gold returns on a month to basis with and without the statistically significant variables. Even though the second model is able to reduce volatility by 75 percent, it indicates that gold is immeasurably complex to predict on a month to month basis.

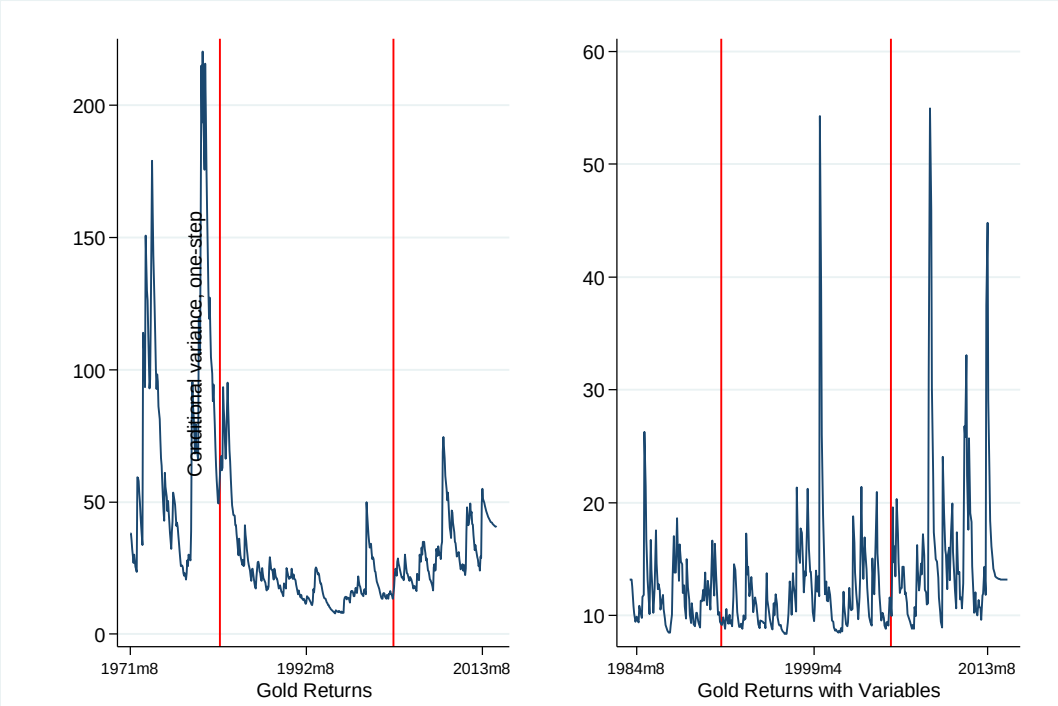
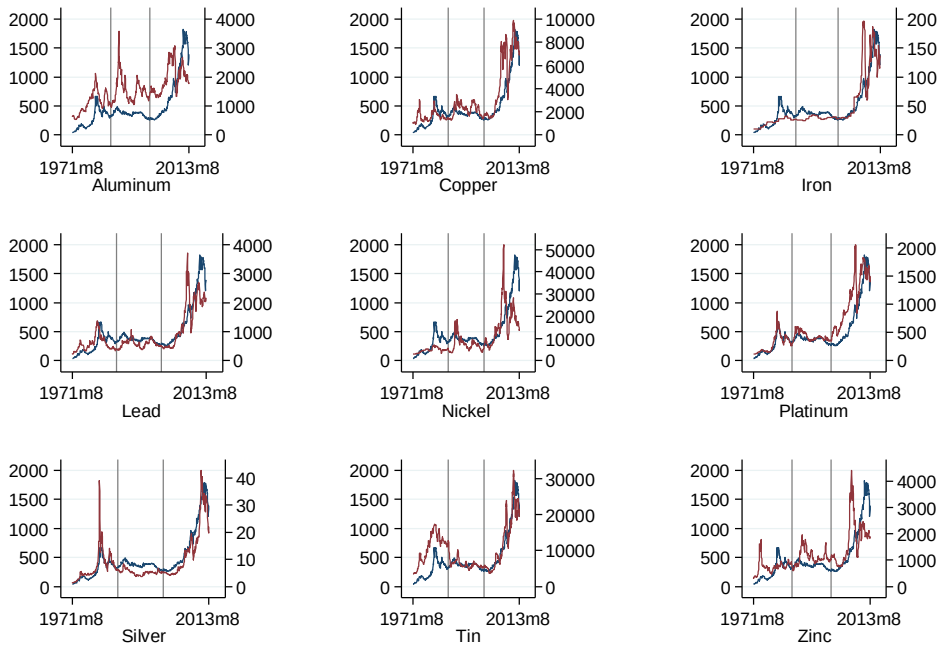


Figure 2. GARCH (1, 1) Model

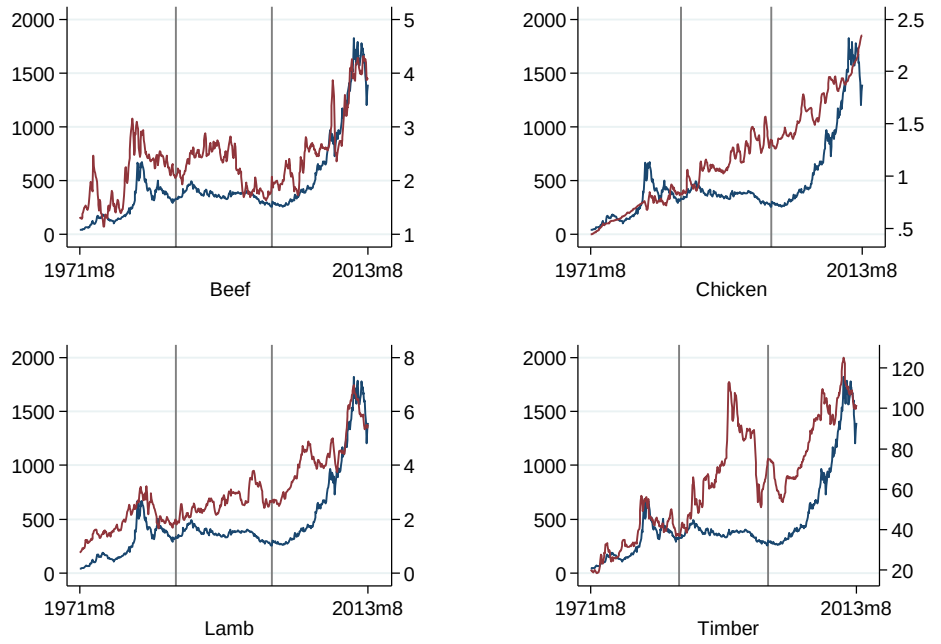
On the other hand, based on the empirical results and literature, I have determined that gold acts a currency, which maintains purchasing power over time. Graphs 3 through 5 portray the price of gold against 25 separate commodities from August 1971 through August 2013.

Graph 3 displays precious and industrial metals; graph 4 displays meats and timber; graph 5 displays soft and agricultural commodities; and graph 6 display currencies Aside from 1985 through 1999 in which gold prices remained flat and certain commodities experienced more volatility, one ounce of gold in 1971 can purchase the same amount of goods in 2013. Overall, this indicates that the market moves in relation to the value of the dollar i.e., if the dollar's value goes down the price of gold will rise and vies versa. Gold is not an investment that moves according to financial theory, it rather acts like a currency that maintains purchasing power from one generation to the next.



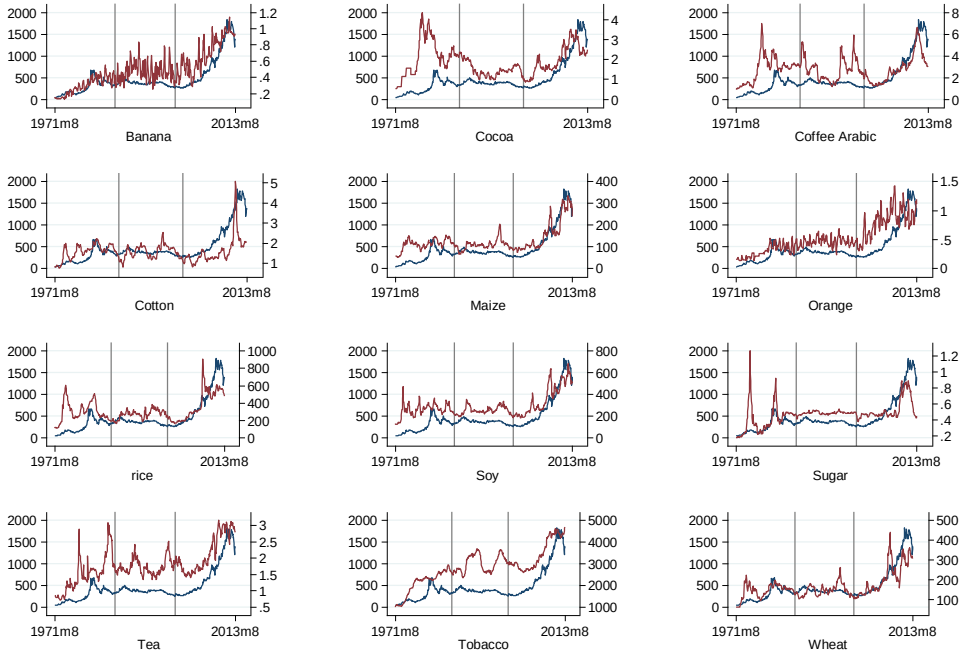
Gold: Blue, Price Left Side - Variable: Red, Price Right Side

Figure 3. Gold vs Precious & Industrial Metals



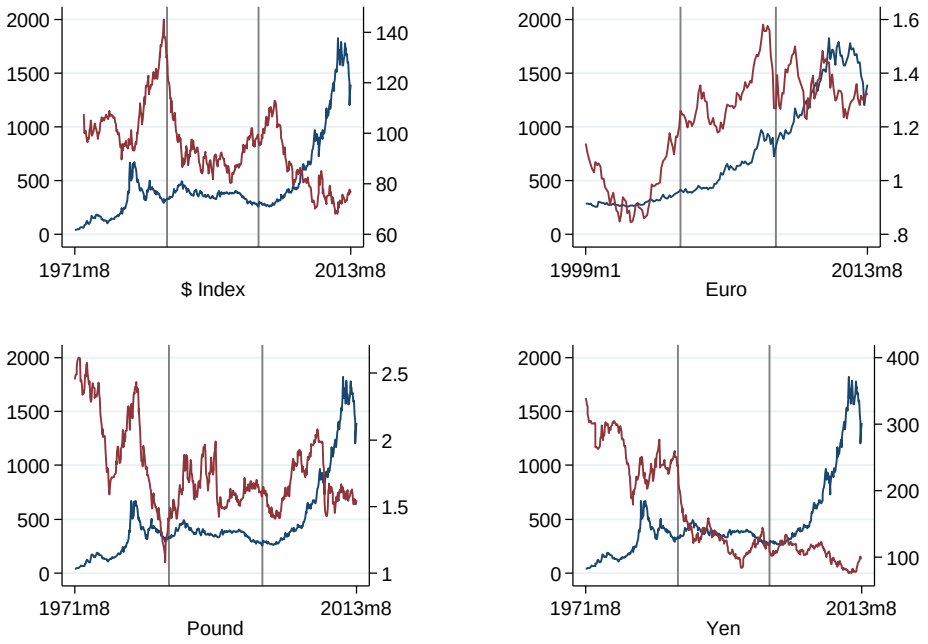
Gold: Blue, Price Left Side - Variable: Red, Price Right Side

Figure 4. Gold vs Agriculture & Timber



Gold: Blue, Price Left Side - Variable: Red, Price Right Side

Figure 5. Gold vs Soft Commodities



Gold: Blue, Price Left Side - Variable: Red, Price Right Side

Figure 6. Gold vs Currencies

CHAPTER VI

CONCLUDING REMARKS

This key objective of this paper was to empirically investigate and the variables that determine the returns on gold. The study contributes to an expanding body of research that assesses the gold market in relation to financial markets and the macroeconomy. There were 42 variables that were investigated against the returns on gold.

This study offers two important contributions: First, I provide counterevidence to the existing literature that investigates the variables which effect gold the most. My results provide limited evidence that the same macroeconomic factors as noted in the literature review influence the returns on gold. On the other hand, I find that *BASE* is a key factor in the gold market as argued through Austrian economic ideology. By expanding *BASE* the purchasing power of the US dollar declines providing further evidence towards Austrian economic ideology regarding monetary policy. Additional empirical research is necessary before these ideas begin to foster real discussion.

Second, my findings on factors that are directly correlated with inflation provides further evidence that gold acts not only as a hedge but also as currency that maintains purchasing power. Leading further support to Hillier et al. (2006) and Hood and Malik's (2013), assessment that including gold in a stock portfolio will provide a suitable hedge and a safe haven, particularly during periods of abnormal stock market volatility.

Finally, it is worth noting that two key factors were left out of this analysis based on difficulty of finding reliable data. The demand and supply factors of gold i.e., the gold demanded not only by the public but central banks to include the United States. Moreover, as noted by Skousen (2010), when gold becomes more valuable (either through a rise in the price of gold, or a decline in prices in general), there is a tendency for mining companies to reduce gold output temporarily as miners shift operations toward deeper shafts and less rich ore bodies that might have been previously cost-prohibitive. When reliable information is released regarding the true demand and supply factors of gold, additional research must be conducted as these two variables are sure to have a significant impact on the movement of gold price. Altogether, this thesis provides econometric evidence towards to the Austrian economic theory, which promotes gold as a true currency as it is difficult to be devalued overtime as argued by Austrian economists such as Ludwig von Mises who stated:

> "The gold standard has one tremendous virtue: the quantity of the money supply, under the gold standard, is independent of the policies of governments and political parties. This is its advantage. It is a form of protection against spendthrift governments."

REFERENCES

Economic Policy Uncertainty. *Economic Policy Uncertainty Index.* Retrieved November 18, 2013, from http://www.policyuncertainty.com/index.html

St. Louis Federal Reserve Economic Research. *Macroeconomic Data.* Retrieved October 15, 2013, from http://research.stlouisfed.org/fred2/.

Battan, Jonathan A., Ciner, Cetin and Lucey Brian. "The Macroeconomic Determinants of Volatility in Precious Metals Markets." Resources Policy, No. 35 (2010): 65-71.

Butler, John. *The Golden Revolution How To Prepare For the Coming Global Gold Standard.* New Jersey: John Wiley & Sons Inc. 2012.

Baur, Dirk G. and Lucey, Brian M. "Is Gold a Hedge or a Safe Haven? An Analysis of Stocks, Bonds and Gold." *The Financial Review*, No. 45 (2010): 217-229.

Cai, Jun. Cheung, Yan-Leung and Wong, Michael C.S. "What Moves the Gold Market?" *The Journal of Futures Markets*. Vol. 21 No.3 (2001): 257-278.

Chua, J., and Woodward R.S. " Gold as an Inflation Hedge: A Comparative Study of Six Major Industrial Counties." *Journal of Business Finance and Accounting*, Vol. 9 No. 2 (June 1982): 191-197

Feldstein, M.. "Inflation, tax rules, and the prices of land and gold," *Journal of Public Economics*, Elsevier, Vol. 14, No. 3 (December 1980), p. 309-317.

Hillier, David. Draper, Paul. and Faff, Robert. "Do Precious Metals Shine? An Investment Perspective." *Financial Analysts Journal*, Vol. 62, No. 62 (2006): CFA Institute.

Hammoudeh, S. Mm Yuan, Y., and McAleer, M. (2010). "Precious Metals-Exchange Rate Volatility Transmissions and Hedging Strategies." *International Review of Economics and Finance*, Vol. 19 (2010): 633-647.

Hood, M. and Malik, F. "Is Gold the Best Hedge and a Safe Haven Under Changing Stock Market Volatility?" *Review of Financial Economics.* Vol 22, Issue 2 (2013): p. 46-52.

Khalifa, Ahmed A.A., Mioa, Hong and Ramchander, Sanjay. "Return Distributions and Volatility Forecasting In Metal Futures Markets: Evidence From Gold, Silver and Copper." *The Journal of Futures Markets*, Vol. 31, No. 1 (2011): 55-80.

Mises, L.V. *Economic Policy: Though for Today and Tomorrow: Third Edition.* Auburn, Alabama: Bettina Bien Greaves. 2006

Mutafoglu, Takvor H., Tokat, Ekin and Tokat, Hakk A. "Forecasting Precious Metal Price Movements Using Trader Positions." *Resources Policy*, No. 37 (2012): 273-280.

Rickards, James. *Currency Wars The Making of the Next Global Crisis.* New York: Penguin Press. 2011.

Sjaastad, L.A and Scacciavillani, F., "The Price of Gold and the Exchange Rate." *Journal of International Money and Finance,* Vol. 16, No. 6 (December 1996): p. 879-897).

Skousen, Mark. *Economics of a Pure Gold Standard*. New York: The Foundation of Economic Education Inc. 2010.

Starr, Martha and Tran, Ky. "Determinants of the Physical Demand for Gold: Evidence from Panel Data." *The World Economy* (2008): 416-436.

Tandon, K., Urich, T. "International market response to announcements of US Macroeconomic Data." *Journal of International Money Finance,* Vol. 6, (1987): 71–84.

Urich, Thomas J. "Modes of Fluctuation in Metal Futures Prices." *The Journal of Futures Markets*, Vol. 20, No. 3 (2000): 219-241.

Feldstein, M.. "Inflation, tax rules, and the prices of land and gold," *Journal of Public Economics*, Elsevier, Vol. 14, No. 3 (December 1980), p. 309-317.