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UNEMPLOYMENT AS A DETERMINANT OF GOLD PRICES: EMPIRICAL EVIDENCE

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ABSTRACT

This objective of this econometrics study is to utilize Pesaran's (2001) Bounds Test to cointegration to study the relationship between gold prices and the US unemployment rate, using three different periods of monthly observation, Model I: 1978-2016, Model II: 1990-2016, and Model III: 2008-2016. Results reveal that there is a long run relationship between the price of gold and unemployment in Models II and III, with Model III representing the strongest and most significant relationship. During 2008-2016 the price of gold increases by 4.7% for every 1% change in the unemployment rate, ceteris paribus. The short run adjustment process however, is stronger between 1990-2016 than between 2008-2016. On the other hand, there is no observed no long run cointegrated relationship between the price of gold and unemployment during the 1978-2016 period. This direct relationship between gold price and unemployment has not been studied in the literature, so further work in this area may lead to greater insight into the impact of this macroeconomic variable on the price of gold.

JEL: E42, L7, N5

KEYWORDS: Cointegration, Gold, Unemployment, Exchange Rate, VIX

INTRODUCTION

Early in the 1800's gold was declared a legal tender. One gold coin equaled $10, and mostly used for large purchases abroad. In the 1900s gold prices were fixed to $35 an ounce under the Bretton Woods agreement. However, with the dissolution of the Bretton Woods agreement in 1973, gold lost its power as a medium of exchange and was no longer required to back up the value of money. Since then, even though central banks continue to hold gold as reserves, it is considered a precious metal whose value is determined by demand and supply forces. The demand for gold arises from consumers, the private sector and government domestically and internationally and the rise for it has been subject to economic cycles, but with an upward trend. The supply of gold however, has stayed relatively flat over time. Since gold is a fixed asset, past gold inventories are still in circulation and increasing in value over time. For example, the cumulative stock of gold in 1974 stood at around 98,000 tons but grew to 175,000 tons by 2015, reflecting roughly a 1.9% growth over the period (World Gold Council, 2016).

Gold Miners and central banks are the most prominent suppliers of gold, with the latter leasing their gold reserves for interest rate since the 1980s (O'Callaghan 1991). Miner's will borrow gold from central banks and sell it on the open market on the assumption that their future extractions would allow them to repay the gold to central banks (Elwell, 2011). There are three major categories for research in gold: its economic and financial prospects, its role as a currency, and the nature and impact of gold mining on the environment and on society (Lucey, 2011; World Gold Council, 2016). From an economic perspective, research has focused on the short-run and long-run determinants of gold prices. Studies have found evidence that U.S Inflation, world inflation volatility, U.S-world exchange rate index, the beta of gold and credit risk default premium all significantly impacted gold prices (Baur & McDermott, 2010). No study however, attempts to analyze the impact of unemployment on the price of gold. This research aims to close this loophole by investigating the impact of unemployment on the price of gold. We proceed in the next section with a review of the literature on gold prices and its determinants. Thereafter we specify our models and variables and explain the data used in estimating our models. The penultimate section explains and discuss our empirical results, while the final section concludes the paper with suggestions for future studies.

LITERATURE REVIEW

One of the most renowned characteristics of gold is the illusion of safety in volatile markets. Baur and McDermot (2009) define gold as a safety asset in short term market turmoil contend that the role of gold in a developed financial system is that of a safe haven asset, but only in the short-run, and only in the presence of extreme volatility. Their study suggests that investors react to short-term, day-to-day volatility, thereby seeking out the safe haven of gold in the short run. An analysis of weekly and monthly stock market losses does not produce the same safe haven refuge response from investors. A study by Mulyadi and Anwar (2012) supports the conclusion of Baur and McDermont (2009) that gold performs as a safe haven asset in short term market turmoil. Mulyadi and Anwar (2012) compare the returns of a stock investment in Indonesian financial markets and an investment in gold. They conclude that when one gets a depreciating return in a stock investment, the return in gold increases. Their results support gold as a diversification instrument and as a safe haven for investors to hedge against stock market risk.

Gold functions as a store of value against inflation. Anssi (2007) examined the short-run and long run determinants of gold prices using Johansen's (1988, 1991) cointegration method. Anssi (2007) found evidence that U.S Inflation, world inflation volatility, U.S-world exchange rate index, beta of gold and credit risk default premium were all statistically significant variables that impact gold prices. A study by Faugere and Erlach (2006) further supports this theory. The authors construct an asset valuation model for gold, dependent on required yield theory, introducing a new exchange rate parity rule. Their model specified that gold prices vary with per capita GDP growth. Real gold prices respond to changes in foreign exchange rates. When the domestic required yield is constant and when foreign exchange rates are constant and there are no major catastrophes, real domestic gold prices increases with domestic inflation. When these factors hold then the real domestic price of gold is determined by the domestic required yield and is impacted by inflation as well as the exchange rate at home. Faugere and Erlach (2006) clearly demonstrate that when exchange rates depreciate gold prices increase, holding everything else constant. In more recent work, Baur (2011) reviewed the relationship of gold with major economic and financial variables and examined whether gold serves as a store of value, influenced by commodity prices, consumer prices, and the value of the U.S. dollar, stock market returns, stock market uncertainty and short and long-term interest rates. The study concludes that gold has evolved as a hedge against financial losses rather than a hedge on inflation. Inferring that when financial instruments deliver depreciating returns, gold takes on a negative correlation allowing one to maintain one's financial wealth.

Qadan & Yagil (2012) observe an interesting connection between gold and the VIX. Their study concludes that variation in investors' sentiment, measured by the VIX, triggers change in the price of gold between January 1995 and May 2010. Their conclusion is significant and opens the door for physiological exams studying the relationship between the mind of investors and how gold prices react. Aggarwal & Lucey (2007) follow this logic and find strong evidence of volatility to returns in the presence of psychological price barriers in gold markets. They conclude that the presence or absence of barriers in gold returns could be a reflection of investor's reactions to changes in interest, inflation and currency markets.

A regression analysis by Fei & Adibe (2010) find a statistically significant relationship between the price movement of gold, real interest rates and the exchange rate, suggesting a close relationship between gold prices and the value of the U.S. dollar. A multiple linear regression study verifies the findings as statistically significant. Furthermore, a study by Başari & Bayramoğlu (2011) yield a negative and statistically significant relationship between the return of gold and the return of the U.S. Dollar. The study also find evidence of a high negative correlation between gold prices and U.S. exchange rates, and a positive correlation between gold prices and oil prices. While GDP has been theorized to have an inverse relationship with gold, empirical studies have yielded mixed results. Lawrence (2003) discovered that gold appeared to be independent of regular business cycles in contrast to other commodities and GDP was uncorrelated with the real rate of return of gold.

On the other hand, an article in the WSJ (December 21, 2012) by Cui & Day, suggested that a drop in gold prices was triggered by an upwards revision by the Commerce Department's of U.S. gross domestic product for the third quarter to 3.1% from 2.7% on December 2012. To date no study has attempted to study the relationship between unemployment and Gold. Unemployment and GDP are related, but it is conventional wisdom that the former is a more commonly accepted indicator of the health of the economy. This was especially true of the financial crises, during which time, unemployment kept rising even though GDP was rising. (The Heritage Foundation, 2010) Unemployment is also a strong indicator of consumer confidence and is often used by politicians to make their case for or against a candidate or political party. Given this, it is important to study the effects of unemployment on gold prices, which is the objective of this paper.

Method, Model Specification, and Data Sources

In order to estimate the price of gold over time, we first specify a general double-log Model I for the period 1978-2016 in Equation (1).

$$lnPG_t = \beta_0 + \beta_2 lnCPI_t + \beta_3 lnSP_t + \beta_4 lnDollar_t + \beta_5 lnUn_t + \varepsilon_t \quad (1)$$

Since 1990, the Chicago Board Options Exchange constructed the VIX, also referred to as the stock market fear index, to quantify stock market volatility over a 30-day period. Qadan & Yagil (2012) observe that variation in investors' sentiment, measured by the VIX, triggers change in the price of gold. However, no further study has been done on this relationship, so this study will integrate VIX into a second general double-log Models II and III for the periods 1990-2016 and 2008-2016 as in Equation (2).

$$lnPG_t = \Psi_0 + \Psi_1 lnVIX_t + \Psi_2 lnCPI_t + \Psi_3 lnSP_t + \Psi_4 lnDollar_t + \Psi_5 lnUn_t + \varepsilon_t \quad (2)$$

In Equations (1) and (2) , PG_t is defined as the monthly London Pm Fix price of an ounce of Gold obtained from the Gold Council and is measured in U.S dollars. The value employed is nominal prices following findings by several studies (Ghazali, Lean, & Bahari, 2015; Naidoo, & Peerbhai, 2015; Ghosh, Levin and Wright, 2004) that the price of gold moves with inflation. SP_t, is the S&P 500, a market value weighted index that measures 500 of the most actively traded stocks in the US financial markets. Empirical evidence of the relationship between PG_t and SP_t is mixed, so we hypothesize that the coefficient for β_2 and Ψ_2 will be indeterminate. $Dollar_t$, is defined as the Nominal Major Currencies Dollar Index with base year 1973. It captures the value of the U.S dollar against major trading partners.

Data are found on the Federal Reserve's database. Empirical evidence of the relationship between PG_t and $Dollar_t$ is mixed (Zheng; Wang & Zheng, 2016), so we expect the coefficient for β_3 and Ψ_3 will be indeterminate. Un_t, The unemployment levels in the economy are measured by the monthly unemployment rate from the Bureau of Labor Statistics. Since no studies have been done to capture the relationship between unemployment and the price of gold, we have no a priori expectations of the sign of its coefficient, so β_5 and Ψ_5 will be considered indeterminate. VIX_t is defined as the volatility index from the Chicago Board Options Exchange. It quantifies the market's expectation of 30-day volatility and is constructed using the implied volatility of a wide range of S&P 500 options. The *VIX* is a widely used measure of market risk and is often referred to as the 'investor fear gauge'. Commensurate with findings in other studies, the relationship between PG_t and VIX_t is negative, so we expect Ψ_1 in Equation (2) to be negative.

We employ the Bounds test model developed by Pesaran, Shin, and Smith (2001) for our cointegration analysis because of its advantages over other models: It does not assume stationarity, or constant means and/or variances of data; it may be applied whether determinants in the model are purely I(0), I(1), or mutually cointegrated; it is able to test the existence of a level relationship between two variables without need to first determine the order of integration of the underlying variables; and it is robust for small and finite samples (Pesaran, *et al.*, 2001; Hendry and Juselius, 2000). The basis of cointegration is that while the response variable and its determinants may be individually non-stationary, they will 'walk' (Murray, 1994) together over time in a cointegrated manner (Engle and Granger, 1987). Furthermore, as other studies have shown, among them, Fama (1965), employing a co-integration model in this study is logical as gold prices, interest rates, and stock markets theoretically follow a random walk and in turn are non-stationary. (Fama, 1965). In estimating the long-run model outlined by Equations (1) and (2), the model will distinguish the short-run effects from the model's long-run dynamics. For this purpose, Equation (1) must be specified in an error-correction model (ECM) format following Pesaran, et al. (2001). Using the Bounds testing approach to cointegration analysis, we rewrite Equation (1) in an ECM format in Equation (3) below.

$$\begin{aligned}\Delta lnPG_t = \alpha_0 &+ \sum_{i=1}^{n} \delta_i \Delta lnPG + \sum_{i=0}^{n} \vartheta lnCPI_{t-i} + \sum_{i=0}^{n} \pi lnSP_{t-i} + \sum_{i=0}^{n} \tau lnDollar_{t-i} \\ &+ \sum_{i=0}^{n} \sigma lnUn_{t-i} + \sum_{i=0}^{n} \varphi lnVIX + \alpha_1 D_{1t} + \lambda_1 lnPG_{i-1} + \lambda_2 lnCPI_{t-1} \\ &+ \lambda_3 lnSP_{t-1} + \lambda_4 lnDollar_{t-1} + \lambda_5 lnUn_{t-1} + \lambda_6 lnVIX_{t-1} + \omega_t \end{aligned} \qquad (3)$$

We process two steps in Equation (3) for both Models II and III. The first step utilizes the Wald test to determine the joint significance of the no-cointegration hypothesis H_0: $\lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = \lambda_5$ ($= \lambda_6$ in Model III)=0 against an alternative hypothesis of cointegration H_a: $\lambda_1 \neq 0$, $\lambda_2 \neq 0$, $\lambda_3 \neq 0$, $\lambda_4 \neq 0$, $\lambda_4 \neq 0$ (and $\lambda_6 \neq 0$ in Model III). If the calculated Wald F-value exceeds the upper critical bound value indicating a cointegrated relationship among the explanatory variables, H_0 is rejected; otherwise, H_0 cannot be rejected. The long-run elasticities are the negative of the ECM coefficient of one lagged determinant, for example, Un_{t-1} divided by the coefficient of the lagged response variable, PG_{t-1} to yield the long-run Un elasticity of PG *is* (λ_5/λ_1). The short-run effects are captured by the coefficients ($\delta, \vartheta, \pi, \tau, \sigma, and\ \varphi$ of the first-differenced variables in Equation (3). To estimate Models I, II, and III, monthly data from January 1978 to June 2016 are used. The data series on gold prices are taken from the Gold Council; data on the S&P 500 and the VIX are taken from the Chicago Board Of Exchange found on http://finance.yahoo.com. Data on the CPI and unemployment rate are taken from the Bureau of Labor and Statistics (http://data.bls.gov

EMPIRICAL RESULTS

Cointegration among Variables

Commensurate with Pesaran et al. (2001), Equation (3) goes through two steps. The first step utilizes the Wald test to determine the joint significance of the no-cointegration hypothesis H_0: $\lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = 0$ against an alternative hypothesis of cointegration H_a: $\lambda_1 \neq 0$, $\lambda_2 \neq 0$, $\lambda_3 \neq 0$, and $\lambda_4 \neq 0$. If the calculated Wald F-value exceeds the upper critical bound value indicating a cointegrated relationship among the explanatory variables, H_0 is rejected; otherwise, H_0 cannot be rejected. As can be seen in Table 1, the calculated Wald F-statistic in Model I is below its critical lower bound values (2.003) at the ten percent level, indicating no cointegration between the price of gold and its determinants for the period 1978-2016, leading us to not reject the H_0. Since the relationship between the predictor and response variables are stationary, we drop Model I from our analysis. For diagnostic purposes however, we run the double-log model in Equation 1, and reveals that the unemployment elasticity of *PG* is significant at the 1% level, indicating a strong relationship between the variables when they are not lagged over time.

Table1: Cointegration Results–Gold Price Function, Models I, II &III

Critical Value Bounds of the F-Statistic: Intercept and No Trend						
	10 Percent Level		**5 Percent Level**		**1 Percent Level**	
k	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
4	2.45	3.52	2.86	4.01	3.74	5.06
5	2.26	3.35	2.62	3.79	3.41	4.68

Calculated F-statistic			
Model I (1978-2016);	k =4:	F_{Gold}(PG| SP, Dollar, CPI, U)	2.003
Model II (1990-2016);	k =5:	F_{Gold}(PG| VIX,SP, Dollar, CPI, U)	4.331*
Model III (2008-2016);	k =5:	F_{Gold}(PG| VIX,SP, Dollar, CPI, U)	32.275**

*Note: This table shows the results of the ARDL bounds test for cointegration for different models. Model 1 ranges from 1978-2016 does not include VIX as a regressor, whereas Model 1I ranging from 1990-2016 does include VIX as a determinant of gold. So does Model III, ranging from 2008-2016. Critical values are taken from Pesaran, Shin, & Smith (2001, Table CI(iii) Case III, p. 300). k = # determinants. *, ** indicates statistical significance at the 5% and 1 % level, respectively.*

Models II and III, do however, indicate that cointegration exists between the price of gold and its determinants. The calculated Wald F-statistic for Model II, F=4.331 is above its critical upper bound values at the five percent level, whereas Model III, F = 32.275 is above its critical upper bound value at the one percent level. We therefore reject H_0 in Models II and III, opening the way to estimate the long-run and short-run elasticities of each predictor variable with *PG* for each model.

Long-Run and Short-Run Elasticities, Models II and III

Having established cointegration in Models II and III, we estimate the long-run partial elasticities of the price of gold with respect to each independent variable (Table 2). In addition, we determine the short-run dynamics in Table 3, using the Error Correction Model (ECM). In ECM the movement of any one determinant in time *t,* is related to the gap in time *t-1* from its long-run equilibrium. This step essentially recognizes that economic forces are in constant flux so that the market for gold is seldom in equilibrium. After a shock to the system, ECM facilitates the adjustment back to long-run equilibrium.

Table 2: Gold Price Long-Run Elasticities, Model II: 1990-2016 and Model III: 2008-2016

Independent Variables	**Model II: 1990-2016**		**Model III: 2008-2016**	
	Coefficient	**t-statistic**	**Coefficient**	**t-statistic**
Constant)	-8.439	-2.998***	46.170	3.169***
lVIX	0.141	1.356	-1.798	-6.995***
lSP	0.627	-2.560**	2.241	3.049***
lDollar	-1.354	-2.144**	6.743	8.259***
lCPI	4.910	4.514***	-12.937	-3.872***
lU	0.216	0.862	4.688	5.876***
Adjusted R-squared (R^2)	0.33		0.86	

*Note: This table shows the long-run elasticities of the estimated gold price function for the periods 1990-2016 and 2008-2016. Here the dependent variable is the natural log of the price of gold, PG. Independent variables are listed in the table. *** and ** indicate statistical significance at the 1% and 5% level, respectively.*

Table 2 shows the long-run elasticities between the price of gold and its determinants for Model II: 1990-2016, and Model III: 2008-2016. The signs of the coefficients of all independent variables in Model II, VIX, SP, Dollar, CPI, and Unemployment, meet our research expectations. SP and Dollar are significant at the 5% level, whereas CPI, whose partial elasticity to PG is 4.9, is significant at the 1% level. However, VIX, which is positive and inelastic, is not significant, which is supported by recent studies. Of special interest here is the partial elasticity of unemployment with respect to PG. It is positive and inelastic with a 10% increase leading to an increase in PG by 2.16% , holding other variables in the model constant. However, this occurs at the 30% significance level only, which renders weak results. The S&P 500 is significant and yields a positive sign, signifying that an increase in the value of the stock market by 10% should increase the price of gold by 6.27%, *ceteris paribus*. Adjusted R^2 is 0.33.

Model III, unlike Model II, yields excellent results. All independent variables are significant at the 1% level. We note in particular, that since the financial crisis period is heavily represented in Model III, the coefficients of all the determinants of PG are highly elastic. In the case of unemployment in particular, its partial elasticity with respect to PG is positive and highly elastic with a 1% change in Un positively affecting PG by 4.87%, *ceteris paribus*. Similarly, in the case of VIX, an increase of 1% leads to a decrease in PG of 1.8% indicating that volatility in the stock market leads to purchasing more gold and therefore, driving up its prices, *ceteris paribus.* Adjusted R^2 is 0.86, indicating the PG is very well explained by its determinants.

We present the estimated short-run elasticities between the price of gold and its determinants for Model II: 1990-2016, and Model III: 2008-2016 in Table 3. Results suggest that the short run partial elasticities of all the determinants with respect to their response variable, PG, are statistically significant, mostly at the 1% level for both Models II and III. Model II produces a negative sign for the VIX indicating that a decrease of 1% in the change in VIX leads to an increase to a change in PG of 0.03%, and it is significant at the 1% level. In contrast, in Model III, which encompasses the 2008 financial crisis, an increase of 1% in the change in VIX leads to an increase to the change in PG of 0.17%, and it is significant at the 1% level. Since the VIX measures volatility in financial markets, but does not differentiate between positive and negative volatility, a lot of volume in financial markets can lead to higher or lower stock prices; hence our results can be expected. Our variable of interest, Unemployment, in both models are statistically

Table 3: P Error-Correction Model and Short-Run Elasticities, Model II: 1990-2016 and Model III: 2008-2016

Model II: 1990-2016			**Model III 2008-2016**		
Independent Variable	**Coefficient**	**t-statistic**	**Independent Variable**	**Coefficient**	**t-statistic**
Constant	0.000	0.000	Constant	0.000	0.000
$\Delta\ln PG_{t-11}$	0.144	2.873***	$\Delta\ln PG_{t-9}$	0.165	2.803**
$\Delta\ln VIX_{t-12}$	-0.027	2.048**	$\Delta\ln VIX_{t-6}$	0.367	13.493***
$\Delta\ln SP_{t-2}$	0.102	2.363**	$\Delta\ln SP_{t-7}$	0.288	3.148***
$\Delta\ln Dollar_{t}$	-1.168	-7.124***	$\Delta\ln Dollar_{t-2}$	-0.790	-2.678**
$\Delta\ln CPI_{t}$	2.545	3.568***	$\Delta\ln CP_{t-12}$	5.412	4.298***
$\Delta\ln U_{t-11}$	-0.179	-2.623***	$\Delta\ln U_{t-6}$	0.426	3.509***
ecm1	-0.061	-5.148***	ecm1	-0.201	-15.730***
Adjusted R-squared (R^2)			Adjusted R-squared (R^2)		

*Note: This table shows the results of the short-run partial elasticities of the estimated gold price function for the periods 1990-2016 and 2008-2016. Here the dependent variable is the change in the natural log of the price of gold, PG. *** and ** indicate statistical significance at the 1% and 5% level, respectively.*

significant at the 1% level. In Model II, the $\Delta\ln U_{t-11}$ takes on a negative relationship with $\Delta\ln PG$, with a 10% decrease in $\Delta\ln U_{t-11}$ leading to a 1.7% increase in $\Delta\ln PG$. However, Model III capturing their relationship during the financial crisis, supports our hypothesis, that unemployment is a determinant of PG. The error correction term, ECM_{t-1}, gauges the rate at which PG adjusts to short-run deviations in its determinants, VIX, PG, U, SP and Dollar, before returning to its long run equilibrium level. The coefficient for ECM_{t-1} in both models is negative as is theoretically expected, signifying that the system is converging to equilibrium. Values of -0.061 in Model II and -0.201 in Model III, indicate that once the model in Equation (2) is shocked, convergence to equilibrium is 6% and 20% respectively, of the adjustment occurring within the first month. Clearly, Model III has a far more rapid response rate than Model II, although both models are adjusting quite slowly. Although it is assumed that the ECM complies with the classical normal linear regression model specifications, including no serial correlation and no perfect multi-colinearity, and that the model is correctly specified, we perform the following diagnostic tests, namely, the Durbin-Watson, Breusch-Godfrey (Basak, et al., 2012), RESET and the Augmented Dickey-Fuller, to test these hypotheses. Results for both Model II and Model III are shown in Table 4.

Table 4: Results of the Diagnostic Tests

Diagnostics	**Model II: 1990-2016**		**Model III: 2008-2016**	
	Coefficient	**p-value**	**Coefficient**	**p-value**
R-squared	0.38	--	0.97	--
Adjusted R-squared	0.34	--	0.91	--
Durbin Watson Test	1.902	0.154	2.514	0.910
Breusch-Godfrey Test	0.6	0.663	0.983	0.440
RESET Test	3.6069	0.03	0.004	0.99
Augmented Dickey-Fuller	-2.153	0.51	-2.4138	0.405

Note: This table shows the diagnostic tests for Models II and III to determine the presence of serial correlation, multi-colinearity, and correct model specification.

In Table 4, the Durbin-Watson (D-W) test is used to test autocorrelation in the residuals, yields a p-value of 0.154 in Model II and 0.910 in Model III, so we do not reject the null hypothesis of no autocorrelation in both models. The Breusch-Godfrey test is appropriate in the presence of stochastic regressors such as lagged values of the dependent variable for higher order autocorrelation, and is asymptotically equivalent to the Durbin-Watson test for first order autocorrelation (Rois, Basak, Rahman, Majumder 2012). The test results in a p-value of 0.663 in Model II and 0.440 in Model III, reinforcing the D-W test results of no serial correlation in the errors of the model. The RESET test, used to determine if the model is correctly specified, produces non-significant values in Model III,, leading to a non-rejection of the null hypothesis. The Augmented Dickey-Fuller Test in both models yield non-significant results leading to a non-rejection of the null Hypothesis of the absence of a unit root; that is, both models are non-stationary.

Conclusions, Limitations, and Suggestions for Future Research

This study attempted to model gold prices as a function of the unemployment rate using Pesaran's (2001) cointegration model. Three models were created under different conditions: Model I encompassed the period 1978-2016, in which the price of gold was regressed against unemployment, the dollar exchange rate, the Consumer Price Index, and the S&P 500. Model II covering the period 1990-2016 included the VIX as a determinant of the price of gold. Model III replicated Model II but for the period 2008-2016 to capture the effects of the global financial crisis of 2008-2010. Results from Models II and III indicate that cointegration exists between the price of gold and its determinants. This is not so for Model I, leading to us dropping the model. In the long run, in both models, the estimates of the partial elasticity of unemployment is positive; however, Model II renders non-significant results, whereas Model III indicates a strong positive and elastic relationship between unemployment and the price of gold. Short-run elasticities in Model II are negative, inelastic, and significant at the 1% level, whereas in Model III it is positive, inelastic, and significant at the 1% level. It is Clear that the 2008 financial crisis, strongly represented in Model III, reflects a strong relationship between unemployment and the price of gold.

Diagnostic test results indicate that models are neither serially correlated, nor stationary. Model III is correctly specified and displays correct functional form. Adjusted R^2 in Model III in the short and long runs indicate that variation in the price of gold is explained by its determinants. This is, however, not the case for Model II, implying that that the 2008-2016 Model is a better indicator of the relationship between unemployment and the price of gold.

To our knowledge, this is the only study to date that estimates the link between the price of gold and the unemployment rate in the US. As indicated above, our results are mixed, with Model III showing robustness. Future studies may revisit the unemployment-price of gold relationship by using quarterly rather than monthly data and by including real GDP as a determinant of the price of gold. Since the price of gold has been linked to consumer confidence, it may be helpful for future studies to incorporate the Consumer Confidence Index, which quantifies the degree of consumer optimism in the economy, into the models. Furthermore, Model I could include a dummy variable to capture the various business cycle downturns and troughs between 1978 and 2016.

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