

## **Chow Test to Compare Impact of Dollar Value in Euros on Gold Price Prior to and During Subprime Crisis.**

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### **Abstract**

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*It is widely believed that the value of the dollar in International currency exchanges is negatively correlated with the price of gold, but there is not ample significant quantitative research to prove it until the study of the World Gold Council in 2004. Forest Capic, Terrrence Mills and Geoffrey Wood from the Gold Council published in 2004 some evidence showing the negative relationship between dollar exchange rates in Europe and Gold price in dollars. With their developed models using the weekly data from 1971 to 2002, they argued that gold is a good hedge against the US dollar. Using non-linear models, one with the weekly data of years 2006-2007 prior to the subprime crisis and the other with the weekly data of years 2008-2009 during the subprime crisis, the analysis here shows that until 2007, the dollar exchange rate in euros has a significant major impact on gold price. The current research is also interested in investigating whether the parameters of the regression models relating gold price and dollar value in Euros have changed during the subprime mortgage crisis of the United States during 2008-2009. The Chow test is used to compare the regression model developed using the data from 2006 and 2007 before the subprime crisis and the regression model developed using the data from 2008 and 2009 during the subprime crisis. The dollar value was a major factor in influencing gold price prior to the subprime crisis, but the dollar value fluctuations played only a minor but still significant role in influencing the gold price during the subprime crisis of 2008 and 2009.*

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**Keywords:** Subprime Crisis, Dollar Exchange Rate, Chow Test, Gold Price, Non-Linear Model

### **Introduction**

Gold price has been climbing steadily during the past few years, and there is very little published research with detailed investigation and search for its reasons. It has been widely accepted for many years that holding gold is a good hedge against inflation. Even in ancient times, Gold was perceived as a valuable commodity with a lasting value giving it's holder unshakable sense of security and comfort in the times of personal, national economic and political crises. It is possible that the special place of gold as a source of wealth is due to its unusual luster, chemical properties, scarcity, high liquidity, and marketability. Gold is held not only by individuals but also by the national governments as a backup for the currencies issued for circulation. It is also true that there is a great demand for gold jewelry in countries like India, and naturally, when there is more demand than supply, the commodity's value and price increase.

A new source of demand for gold arose after 1971 when the major countries of the world allowed their currencies to float after the collapse of the Breton Woods system in 1971, and it offered some great new investment opportunities for the International traders.

The fluctuations in major currencies increased the probabilities for large gains and losses in the currency trading. The tremendous increase in risks due to volatility in currency exchange rates made the investors look for means to reduce the inherent risks that are involved. The currency traders discovered that one way of hedging is to invest simultaneously in gold contracts.

At least until now, the dollar is perceived as the main trading currency in the world, and therefore, it appears to be reasonable to assume that the gold investments and the dollar value fluctuations could somehow be related because the traders attempt to protect themselves from the anticipated dollar value erosions by simultaneous investments in gold. Despite the logical intuitive presumption of a close association between the world's premium currency and the dollar gold price, the published research about their relationship did not materialize until the release of a report of the World Gold Council in 2004. The Gold Council released the results of a statistical research conducted by three academic professionals in the United Kingdom which might have been supported by the World Gold Council.

### **Previous Research**

In 2004, the World Gold council released the results of research conducted by Forest Capic, Terence Mills and Geoffrey Wood(2005). Their research established a quantitative relationship between gold prices and the currency exchange rates of a few currencies against the US dollar. The end of week US dollar prices of the currencies such as the German Mark, British pound, and Japanese yen were analyzed along with the end of the week gold prices from 1971 to 2002. Their key finding is that the US dollar gold price moves in opposition to the US dollar price of the major currencies. They argued that gold is a reasonable hedge against the exchange rate risks. Ismail, Yahya and Shabri(2009) published regression models showing the causal influence of factors such as USD/Euro foreign exchange rate, US dollar index and US money supply on gold price. They used one or more lags for the independent variables.

Juan Carlos Artigas(2010) attempted to link money supply to gold price. One of his key conclusions is that a 1% increase in US money supply may result in 0.9% increase in gold price.

Tim Congdon(2010) shows concern about accumulating US trade deficits and their impact on US dollar value and gold prices.

### **Current Research**

The objective of the current research is to study the weekly fluctuations in the dollar value in Euro currency and Gold price from 2006 to 2009. The current investigation is different from the research released by the World Gold Council. The previous research considered data only up to 2002. There were dramatic changes in the U.S Economy, global technology, politics, and gold prices after 2002, and therefore, the current investigation is interested in analyzing the data of most recent years. Instead of targeting major currencies of Europe as in the previous study, we target Euro currency only in the Europe. Moreover, United States had to go through one of the very painful economic crises in 2008 and 2009 with the Subprime mortgage crisis, and the present study deals with its impact on gold price.

Therefore, the purpose of the current study is to establish whether there is a significant impact of dollar exchange rate in euro on gold price in dollars both before and during subprime crisis. The study is also interested in establishing whether there is significant difference between the parameter estimates of the regression model of subprime crisis period and the regression model of normal period of 2006 -2007. An attempt would be made to determine whether the dollar value is the dominant factor that is responsible for most of the fluctuations in the gold price in both periods. The current type of analysis has not been reported before, and the results could be very relevant for the investment industry.

### **Data**

The end of week London afternoon gold price, and the Euro exchange rate history from the US Federal Reserve Bank releases were collected for two time periods. For the pre-subprime crisis period, the data collected was from January 2006 to December 2007. On the other hand, for the sub-prime crisis period, the data considered is from January 2008 to December 2009.

## ANALYSIS

A scatter diagram between gold dollar price and value of a dollar in Euros revealed visually that an exponential functional relationship between variables may be appropriate. The following nonlinear functional relationship between gold price in dollars and the dollar's value in terms of Euros is assumed.

$$Y = AB^X$$

Y = Dollar price of one ounce of gold.

X = Value of a dollar in Euros.

The nonlinear equation was linearized as follows:

$$\ln Y = \ln A + (\ln B)X$$

Two models were fitted using least squares technique, one for each chosen time period. The regression models are compared to establish whether there is a significant change in the magnitude of the impact of the dollar's value on gold price during the subprime crisis. The Chow test is used to compare the regression models of the two periods of interest.

## RESULTS

<b>Model 1</b>				
Using Weekly Data during 2006 and 2007 (prior to Subprime Crisis)				
Variable	Coefficient	SE of Coefficient	T	P
Constant	8.1992	0.0735	111.61	0
Dollar In Euro	-2.2616	0.0962	-23.5	0

Model:  $\ln$  of Gold Price = 8.1992 - 2.2616 (dollar in Euro)

$N_1$  = number of observations = 100

$R^2$  = 84.93

Adjusted  $R^2$  = 84.78

$E_1$  = Sum of Squared residuals = 0.1607

<b>Model 2</b>				
Using Weekly Data during 2008 and 2009 (During Subprime Crisis)				
Variable	Coefficient	SE of Coefficient	T	P
Constant	7.382	0.135	54.79	0
Dollar In Euro	-0.799	0.191	-4.18	0

Model:  $\ln$  of Gold Price = 7.382 - 0.799 (dollar in Euro)

$N_2$  = number of observations = 99

$R^2$  = 15.24

Adjusted  $R^2$  = 14.36

$E_2$  = Sum of Squared residuals = 0.8274

<b>Pooled Model 3</b>				
Using Weekly Data during 2006-2009				
Variable	Coefficient	SE of Coefficient	T	P
Constant	8.660	0.128	67.61	0
Dollar in Euro	-2.748	0.174	-15.76	0

Model:  $\ln$  of Gold Price = 8.660 - 2.748 (dollar in Euro)

$N = N_1 + N_2$  = number of observations = 199

$R^2$  = 55.76

Adjusted  $R^2$  = 55.53

$E_3$  = Sum of Squared residuals = 3.5327

$E_4 = E_1 + E_2 = 0.1607 + 0.8274 = 0.9881$

$E_5 = E_3 - E_4 = 3.5327 - 0.9881 = 2.5446$

Chow Test:

Null Hypothesis: Regression Model Prior to Subprime Crisis is same as Regression model during Subprime Crisis.

Alternative Hypothesis: The two regression models are different.

$F = (2.5446/2)/(0.9881/195) = 249.47$  which

is greater than the critical F value at 2 and 195 degrees of freedom. Therefore, the conclusion is that the two regression models are different.

### Conclusions

- The negative signs of the slopes in the regression models indicate that the dollar exchange rate in Euros and gold price in dollars move in opposite directions. The high T values with close to zero P values shows that the negative correlation between the two variables is highly significant during the study periods.
- The impact of dollar value in Euros on Gold Price has declined significantly during the Subprime crisis. 84.7% of gold price variation was explained by dollar value fluctuations before the subprime crisis while only 14.4% of gold price variation was explained by the dollar value fluctuations during subprime crisis. This shows that model parameters are sensitive to the global economic conditions.
- There may be other factors that are relevant to explaining the behavior of gold price, and to predict the gold price with higher confidence.

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