

Deterministic Elements of 1990s Gold Prices

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Abstract

This study examines recent deterministic elements of gold prices. Financial, economic, and political conditions have changed the role of gold. Following recent major financial crises, the volume of transactions have increased. These phenomena, from 1990 to 2015, included a breaking point at 2008Q3 in gold prices for macroeconomic variables. In the first half of this period, exchange rates, inflation, and stock prices influenced gold prices; for the latter part of this period, exchange rates, interest rates, and inflation more greatly impacted gold prices. A large difference and change in deterministic elements of stock prices occurred around the time of the Lehman shock. Hedging the role of gold against inflation is a recent phenomenon; however, it played no significant role at the time of Lehman shock. Currency depreciation caused past demand for gold; however, appreciation of currency may have increased the recent demand for gold in some countries.

Keywords: exchange rate, gold price, inflation, interest rate, stock price.

Introduction

The trading volume of gold has been increasing, and prices have risen greatly since the 1990s. In the 2000s, increases in gold prices have accelerated except during the period of the Lehman shock. In the commodity markets of both developed and newly industrializing economies, gold is traded in large volumes every day. With the development of ICT (Information, Communication, and Technology), gold has been trading across the world at any moments. The volume and prices of gold have large roles not only for manufacturers but also for global financial markets and financial/economic authorities in every country. It is natural to think that the role of gold in global financial and commodity markets has been changing for financial, economic, and political reasons. Recently, large financial crises repeatedly hit the world economy. In addition, deflation and recession have been prevailing all over the world. Zero, low, or even negative interest rates increase the focus of market participants on gold. Commodity markets allow many institutions to participate in trading all over the world.

This study examines the deterministic elements of gold prices in the 1990s. Traditional economic theory states that interest rates negatively influence gold (and stock) prices. Increases in expected interest rates cause a negative impact on gold prices. However, other determinants, such as exchange rates, for example, may be considered. The large trading volume in global financial markets and the development of financial instruments are the reasons. There is some possibility that the deterministic elements of gold prices increase and change over time. An examination of deterministic elements of gold prices would be difficult but necessary not only for investors but also for financial authorities/policymakers to achieve financial stability. Section 2 reviews existing studies on gold price determination. Section 3 provides a theoretical view for the empirical analyses. Section 4 shows the empirical analyses and examines the results. Finally, this study concludes with a brief summary.

2. Existing Studies

Many empirical studies have addressed gold price determination for the past, including the era of the so-called *gold standard*; this study focuses on recent times; however, the empirical results seem inconclusive. Of course, there is no rigid theory for the determination of gold prices. There also is some possibility that changes in the deterministic elements of gold prices occur continuously.

This fact should be taken into account. This study considers this problem from macroeconomic view and supports it with empirical analysis. Few studies have examined how and what macroeconomic variables influence gold prices regardless of the importance. Sherman (1983) showed that the price of gold is affected by inflation and inflationary expectations that are reflected by growth in monetary aggregates. Beckman and Czudaj (2013) found that gold-oil spread is positively related to US consumer prices. Subhashini and Poornima (2014) showed that gold is a safe investment for those who hold capital for speculative purpose. Jones and Saekley (2016) showed that gold is a hedge against inflation. In general, these studies found that increased inflation is expected to cause rises in gold prices. However, Blose (2010) showed that gold prices do not change as a result of inflation expectations. Ghosh, Levin, MacMillan, and Wright (2004), Joy (2011), and Scacciavillani (1996) suggested that an increase in the dollar evaluated prices make gold prices more expensive for foreigners and thus decrease the gold prices. Sjaastad and Scacciavillani (1996) found that European currencies impact gold prices in those currencies. Toraman, Basarir, and Bayramoglu (2011) showed that the relationship between gold price and the US exchange rate is negative. Tully and Lucy (2007) showed that the US dollar has a significant impact on the price of gold. Most studies seem to show a negative relationship between gold prices and exchange rates; however, recent large fluctuations in exchange rates and financial turmoil all over the world should be taken into account. Tully and Lucy (2007) found that fluctuations in US dollar/Euro exchange rate impacts gold prices. Papadamou and Markopoulos (2014) showed that for the case of the British pound and the Japanese yen, a volatility shock has a greater impact on silver prices than on gold.

Fortune (1987) found that increases in expected interest rates cause a negative impact on gold prices as expected theoretically; however, Tully and Lucy (2007) found that few macroeconomic variables influence gold prices. For the relationship between gold and stocks, Twite (2002) found that average gold-mining stock moves 0.76% for each 1% change in gold prices. Baur and Lucey (2007) showed that gold is an effective hedge against changes in stock prices. Phoong, Ismail and Sek (2013) showed that gold and oil prices affect the Asian stock market. Hira, Ghulam, Qayyum, and Hussain (2014) showed that there is no long-term relationship among gold prices, stock prices, and oil prices in Pakistan. Joshi and Giri (2015) found that gold prices impact stock prices. Baur and Tran (2015) showed a cointegration relationship between gold and silver prices. Jones and Saekley (2016) indicated that increases in policy uncertainty causes increases gold prices. However, Blose (2010) examined policy anticipation of the Federal Reserve and found that the empirical results are mixed. Bahmani-Oskooee (1984) showed that gold prices have a negative impact on demand for reserves. Gold prices seem to be determined not only by economic factors but also by political and other reasons. Moreover, the deterministic elements change over time and empirical studies to date seem to be inconclusive. Precise and detailed analyses are necessary.

3. Theoretical Aspects

First, most studies have shown that gold can be an effective hedge instrument and a safe haven against inflation and financial crisis. Inflation encourages investors to shift to gold as gold values have been thought to be stable. However, another view may have been prevalent during the low inflation and no-crisis era. The stability of gold prices may be evaluated highly under recession. They remain high. In addition, recently gold prices have increased greatly. Ghazali, Lean, and Bahari (2013) showed that gold is a weak safe haven for stockholders during times of financial crisis. For other candidate elements, there is a strong possibility that traditional economic theory does not fit well for gold price determination and some other macroeconomic variables may have to be considered. In response, the present study not only considers interest rates and inflation, which are both thought to be deterministic elements of gold prices, but also other factors, including exchange rates and stock prices. Sopipan, Sattaytham, and Bhusana (2012) showed that the MRS-GARCH is the best performance model for gold price volatility. Pala (2014) found that for the Hausman test, the fixed effect model is the best. Hua and Jiang (2015) employed an empirical mode decomposition model. The present study uses OLS, error correction model (ECM), and vector autoregressions (VARs). In addition, whether or not the possibility of breaking points exists in the sample period is taken into account.

4. Empirical Analyses

Data are quarterly and from IFS (International Financial Statistics; IMF). Available panel data were used for estimation. Countries include Argentina, Belgium, Brazil, Canada, Chile, China (mainland), Hong Kong (China), Croatia, Czech, Denmark, Estonia, Fiji, Finland, France, Hungary, Iceland, India, Iran, Italy, Japan, Korea, Latvia,

Lithuania, Luxembourg, Malaysia, Mexico, New Zealand, Norway, Papua New Guinea, Philippines, Poland, Russia, Serbia, Singapore, Slovak, South Africa, Thailand, Turkey, United Kingdom, and the United States. The sample period is from 1990Q1 to 2015Q4. The reason that the sample period is divided into two is explained below.

Regression results, with gold prices regressed on macroeconomic variables, are shown in Tables 1 and 2. Table 2 uses LS and ECM for estimation. ECM is one category of multipletime series models that is often used for data when the variables used for estimation have a long-term trend. ECM is useful for estimating both short-term and long-term effects of one time series on another. The term *error correction* belongs to the past period's deviation from a long-run equilibrium and influences short-term movements. Thus, ECM estimates the speed at which a dependent variable comes to equilibrium after a change in other variables.

Table 1: Regression Analysis (LS)

Period	1990–2015	1990Q1–2008Q3	2008Q4–2015Q4
Price (inflation)	1.976*** (6.223)	-0.296** (-2.361)	1.383** (2.405)
Change in Exchange (logarithm)	-0.156*** (-3.201)	0.031* (1.989)	-0.266*** (-3.425)
Change in Stock price (logarithm)	0.013 (0.082)	0.140** (2.026)	-0.142 (-0.867)
Interest rate	1.977 (1.035)	-0.311 (-0.488)	-15.092*** (-4.925)
C	-19.672 (-0.864)	26.128*** (3.131)	199.982*** (4.734)
Adj.R2	0.640	0.108	0.756
F-statistic	46.816	3.034	28.184

Note. ***, **, and * denote significance at 1%, 5%, and 10%. Figures in parentheses are t-values.

Table 2: Regression Analysis (LS & ECM)

Period	1990Q1–2008Q3		2008Q4–2015Q4	
Price (inflation)	-0.280** (-2.329)	-0.873*** (-3.173)	1.550*** (2.870)	-6.293*** (-14.538)
Change in Exchange (logarithm)	0.034** (2.322)	0.202*** (4.962)	-0.308*** (-5.134)	0.382*** (5.919)
Change in Stock price (logarithm)	0.138** (2.011)	-0.077 (-0.547)	-	1.267*** (7.884)
Interest rate	-	3.202* (1.936)	-14.949*** (-4.905)	-3.720 (-1.535)
C	22.281*** (8.107)	-74.464	194.748*** (4.676)	154.956
Adj.R2	0.118	0.035	0.758	-0.089
F-statistic	4.014	1.329	37.617	0.731
Method	LS	ECM	LS	ECM

Note. ***, **, and * denote significant at 1%, 5%, and 10%. Figures in parentheses are t-values.

A Chow breakpoint test was conducted for the overall sample period to determine whether or not a breakpoint exists. The null hypothesis is that there were no breaks at specified breakpoints. The point is 2008Q3 when Lehman shock occurred. The F-statistic is 101.201 and the Wald statistic is 506.006. Both probabilities are 0.000. So setting that time as a breaking point is reasonable.

In the first half of the sample period, the coefficient of inflation on gold prices is significantly negative. The interpretation is difficult; however, the stability of gold prices may be evaluated highly under recession. On the other hand, in the latter half, financial crises and political instability occurred repeatedly, so gold can be considered an effective hedge instrument, and safe haven against financial crisis as expected theoretically. The Lehman shock (2008Q3) and the Greek debt crisis may have influenced gold prices. Both problems have had widespread repercussions.

The coefficients of the exchange rates show different results (+ and -) between the first half and the second half of the period. The coefficient is positive for the case of first half. It is difficult to interpret this; however, compared to the second half, the exchange rate had been stable. For the latter period, an increase in the dollar evaluated prices made gold prices more expensive for foreigners and thus made the gold prices decrease as expected theoretically.

For the first part, gold is an effective hedge instrument against stock as expected theoretically. At that time, the Asian currency crises and the Iraq war occurred and a lot of capital may have flowed into gold markets. On the other hand, the coefficient is negative and insignificant for the latter part. For interest rates, in both periods, the coefficients were negative for gold prices as expected theoretically. Increases in interest rates cause strong demand for interest-based commodities instead of gold. These results coincide with economic theory. However, for the first part, the coefficient is not significant.

Recently, VARs have been used for estimation in many cases. The method is used to forecast systems of interrelated time series and to analyze the dynamic impact of random disturbances on the used variables. Empirical estimation and inference are complicated by the fact that endogenous variables may appear on both the left and right sides of equations. The simultaneous use of VAR can avoid these problems. The macroeconomic variables are usually structurally correlated with different possible lags. Therefore, a VAR model is used to examine the data to avoid this problem. The results are shown in Figure 1a (first part) and Figure 1b (latter part). Time lag is set at 2 according to Akaike criteria.

Figure 1a. Impulse response functions (1990Q1–2008Q3).

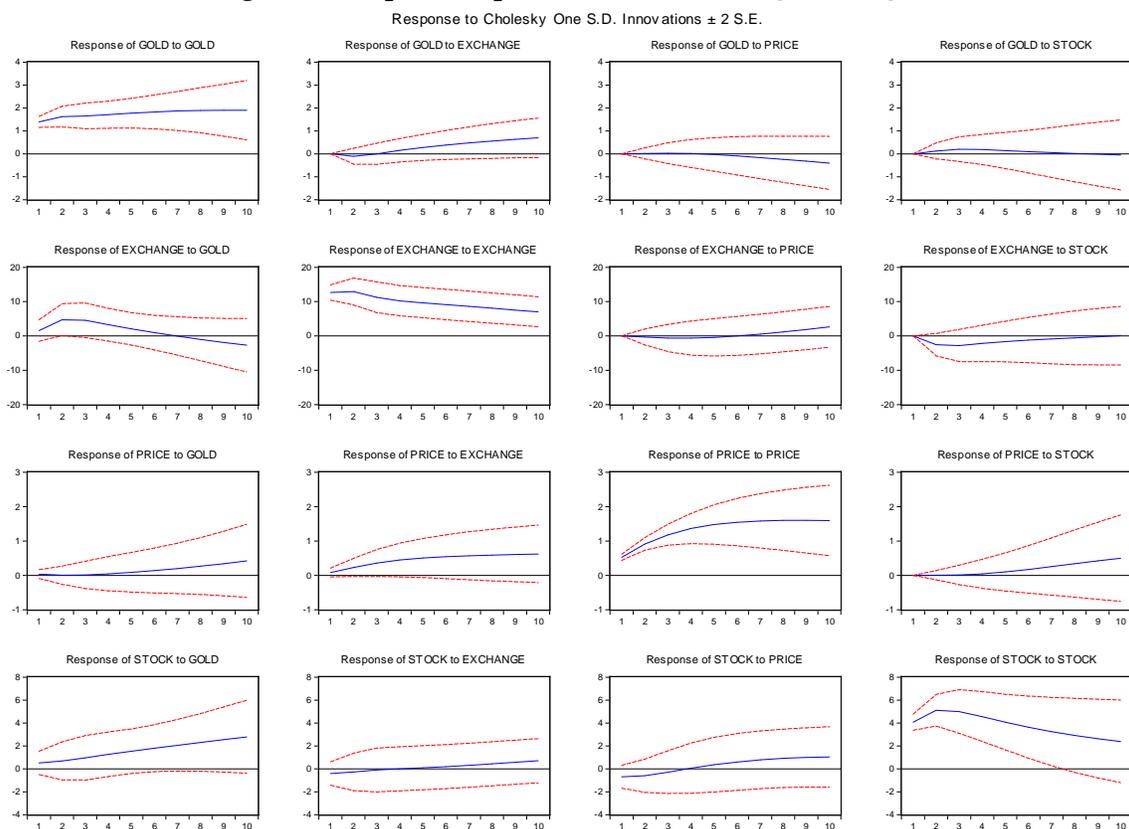
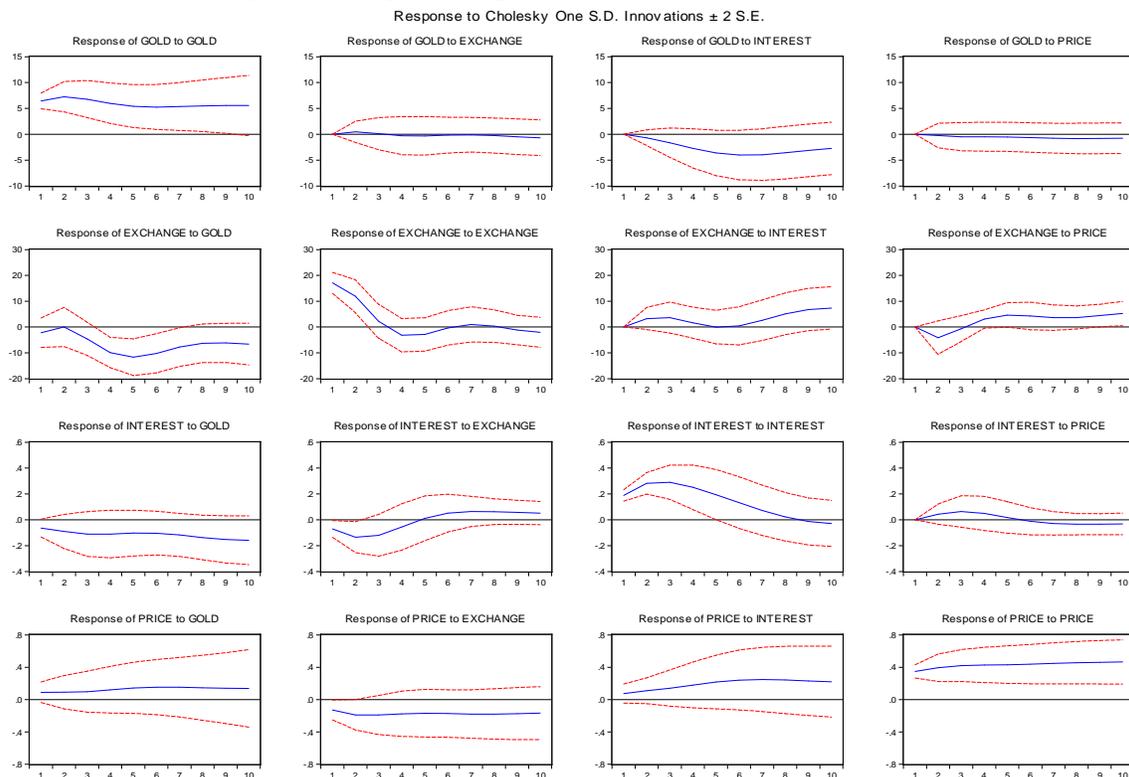


Figure 1b. Impulse response functions (2008Q4–2015Q4).

It should be noted that the shock continues for some time. So analysis of gold prices is complex and difficult to understand.

5. Conclusions

This study examined the deterministic elements of gold prices for the 1990s. The role of gold has been changing for financial, economic, and political reasons. Recently, serious financial crises hit the world economy and huge gold transactions occurred. Considering such phenomena, from 1990 to the present, there is a breaking point at 2008Q4. In the first half the studied period, exchange rate, inflation, and stock prices influenced gold prices; on the other hand, exchange rate, interest rate, and inflation impacted gold prices in the second half. There is a large difference and change in deterministic elements for stock prices around the time of Lehman shock. For inflation rate, hedging role of gold appeared recently; however, there was no such role at the time of the Lehman shock. Depreciation of each currency caused demand for gold in the past; however, appreciation has caused the demand recently.

Some important matters merit consideration in further analysis. Ivanov (2013) found that the price of ETFs (Exchange Traded Funds) impacts gold and silver. Similarly, other variables have to be considered. Levin and Wright (2006) showed that the real price of gold is stable over the long-term but unstable for the short-term. The distinction between long- and short-term seems important. Gwilym, Clare, Seaton, and Thomas (2011) showed that investor timing decisions reduced average returns for gold 1.5% annually between 2005 and 2009. Kumar and Arora (2011) found that gold futures market in India is playing the role of gold price discovery. Recently, gold futures markets have been expanding. Hassani, Silva, Gupta, and Segnon (2015) used 17 methods to forecast gold prices. Miles (2015) stated that the gold standard does not cause price level comovement. The use of other empirical methods may improve the findings.

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