

Factors that Influence the Price of Gold - Inflation and Hedging Against the Dollar

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This article looks at past gold price trends and introduces existing discussions about what factors determine the gold price. The studies on investing in gold for inflation hedging do not prove the general beliefs. Other studies show that gold investments effectively hedge the change in the dollar value, but the result largely depends on the outbreak of political events and thus is uncertain. For Korean investors, there have not been enough studies about the relationship between the gold price and other factors, i.e., Korea inflation, the won rate changes, and other asset prices to address the uncertainties.

I. Introduction

Gold has been resilient even after massive corrections in 2011. Some point out that the gold price, which began to rise from 1999, is a bubble, while others forecast that it could increase further due to dollar depreciation and excessive government debts in the US and Europe. For now, it is hard to tell which judgment is right, but everyone acknowledges that gold is an important alternative investment vehicle amid the increasing uncertainty in the global financial markets. This article discusses the factors that determine the gold price.

* All opinions expressed in this paper represent the author's personal views and thus should not be interpreted as the Korea Capital Market Institute's official position.

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II. Gold Price

1. Spot and futures price

The spot price or spot rate of a commodity is the price that is quoted for immediate (spot) settlement (payment and delivery). Spot settlement is normally done one or two business days from the trade date. It is, however, difficult to find the spot price of gold because there is no official exchange or institution that ensures immediate payment and delivery of gold trade. Then, how can we find out gold spot prices? Generally, there are two prices that are considered as gold spot prices.

The price of gold was stable for the twenty years after the mid-1980s. But it has been rising since the Washington Agreement on Gold in 1999 which restricted sales by the central bank. The gold price surged until 2011.

First, the fixing price is most commonly used. It is used as the settlement price for mini gold futures on the Korea Exchange (KRX). Five members of the London Bullion Market Association (LBMA) announce the fixing price for gold at 10:30 am and 3:00 pm (London local time) every day. The fixing price is determined through transactions among the members of LMBA and is used as a base price not for transactions among investors, but for the gold derivatives and gold related financial products.

The second most commonly used price is the spot price calculated from gold futures traded on the Commodity Exchange (COMEX),¹⁾ which defines an active month (or spot month) as the month that spot trading occurs the most. Then, it regards the gold futures price in a spot month as the gold spot price. The gold spot close is calculated as the average of the highest and lowest price during the last two minutes of the market close, which is between 1:28 pm and 1:30 pm in New York.

1) Gold futures are traded on the CME as of 2011 after COMEX merged with NYMEX (New York Mercantile Exchange). Then NYMEX merged with CME.

2. Gold price trends

The price of gold has fluctuated since the gold exchange standard was abolished in August 1971.²⁾ The price fluctuations can be categorized into three periods: First, the volatile period from 1971 to the early 1980s; second, the stable period from the mid-1980s to 1999; and third, the price hikes from 1999 to the present.

The first period refers to the decade after the US unpegged the dollar from gold, during which the gold price skyrocketed and plunged repeatedly whenever there was international tension, e.g., two oil shocks and the Soviet Union's invasion of Afghanistan. Right after the Soviet Union attacked Afghanistan, gold soared to \$875 per ounce from \$400 per ounce before the attack. Another possible reason behind the volatility was the increasing demand for gold to hedge against inflation which was more than 10% in some economies. However, it is widely understood that the high volatility in the gold price, denominated in US dollars, stemmed from the timing: The US dollar had then just begun to build credibility and stability as a key international currency after the gold exchange standard was abolished.

During the next two decades after the mid-1980s, gold was relatively stable. When it began to decline in the late 1980s, central banks in Europe, which adopted the gold standard before the Great Depression and accumulated huge gold reserves, started to sell off their reserves. Furthermore, the development of financing markets helped gold mines increase their output and this brought down the gold price further. To make matters worse, major developed nations had inflation rates below 5% per year. This diminished the demand for gold for inflation hedging and pushed down the gold price. Aside from shrinking demand and increasing supplies, some cast doubt on artificial price manipulation in the US gold market. The gold price often declined during the NYMEX trading hours, and there were suspicions about market intervention by the FRB and the US Treasury Department, but this has never been proven.

Gold turned around after a decline only after the Washington Agreement on Gold

2) When the IMF was founded after the World War II, each member was required to peg their currency to the US dollar, and the US dollar was pegged to gold. Under the scheme, the US promised to fix the price of gold at approximately \$35 per ounce. This was sustained until the Bretton Woods Agreement collapsed in 1968.

was signed in 1999. This was a voluntary control, in which European central banks agreed to limit the sales of their gold reserves to 400 tons per year.³⁾ The purpose of this measure was to prevent the gold price from declining further, amid the outlook that the weak gold price would continue and that European central banks might continue to sell off their gold reserves. Ultimately, this effectively resolved the gold market's anxiety about oversupply, and partly helped the gold price to increase.

Figure 1. Gold spot prices, 1980~2011



III. The Factors that Determine the Gold Price

A natural question arises: What are the factors that determine the price of gold? Just like other commodities, the price of gold is determined by supply, demand, and speculative transactions. The difference between gold and other commodities is that the holding and selling of gold plays a larger part in its price than consumption. For the past centuries, gold has been held by central

The studies on investing in gold for inflation hedging failed to prove the general beliefs. Other studies showed that gold investments are effective to hedge the change in the dollar value, but the results largely depend on the outbreak of political events and thus is uncertain.

3) In 2009, the Washington Agreement on Gold was extended for another five years, and the annual sales limit was adjusted to 500 tons per year.

banks as reserves, and by individual investors as a part of investments or jewelry, rather than consumed by industrial demand. These gold holdings can come to the market for sale any time. Taking into account the inventory of gold, it is safe to conclude that the gold price is primarily determined by the demand and changes in gold reserves, rather than the supply from gold mines.

1. Central banks' gold reserves

The IMF and central banks around the world play a leading role in pricing gold. As of 2010, they held 18.4% of the world's gold inventory. In particular, central banks in Western Europe, although they have been selling their gold reserves since the 1990s, currently hold 70% of their foreign reserves as gold.⁴⁾ The large sell off by central banks in the 1990s brought down the gold price, while the limit on the sales of gold reserves after the Washington Agreement on Gold caused the price to go up. Also, the recent gold price hikes are attributable to the fact that emerging economies such as Russia and China have increased their gold reserves since 2000. Currently, gold reserves in these nations are only 2%-10% their foreign reserves. However, it is highly likely that if a weak dollar continues, they will change the portfolio of their foreign reserves from dollars to gold, and this may help maintain the uptrend of the gold price.

Table 1. World official gold holdings (As of December 2011)

Rank	Country	Tons	% of reserves*	Rank	Country	Tons	% of reserves*
1	US	8,133.5	76.6%	8	Russia	871.0	9.2%
2	Germany	3,396.3	73.7%	9	Japan	765.2	3.5%
3	IMF	2,814.0		11	India	557.7	9.6%
4	Italy	2,451.8	73.4%	12	ECB	502.1	35.0%
5	France	2,435.4	71.8%	46	Korea	39.4	0.7%
6	China	1,054.1	1.8%		Euro Zone	10,788.0	65.4%
7	Switzerland	1,040.1	15.3%		World	30,744.3	

Notes: * The percentage share held in gold of total foreign reserves is calculated by the World Gold Council. The value of gold holdings is calculated using the end of month London pm fix gold price published daily by the LBMA.

Source: World Gold Council

4) The UK is an exception to this trend, selling a large stock of gold after the 2000s, and now holding only 15%

2. Inflation

A. Previous studies

Gold has been widely used as currency for a long time and thus been thought to effectively hedge inflation and deflation. Contrary to this belief, however, studies have failed to prove the exact relationship between gold price changes and inflation.

Sherman (1983) and Moore (1990) concluded that the gold price and inflation have a positive correlation, and inflation can be used as a leading indicator to predict the price of gold. In addition, Christie-David et al. (2000) studied intraday gold futures trading data and found that it takes 15 minutes for the price of gold futures to respond to the announcement of inflation, proving that unexpected inflation helps predict future gold prices at least for the short term.

On the other hand, Jaffe (1989), Garner (1995), Larson and McQueen (1995), Cecchetti et al. (2000) conclude that the gold price is not affected by inflation. Some others also show that inflation in countries other than the US does not accurately predict the gold price⁵⁾ and proves that gold cannot hedge against inflation in many countries. Studies using data including the post-1999 period of gold price hikes also failed to prove the relationship between inflation and the gold price.⁶⁾ Hence, it is uncertain whether gold can hedge against inflation.

of its foreign reserves as gold. However, other major European nations, such as Germany, France, and Italy hold over 70% of foreign reserves as gold.

5) Chua and Woodward (1982), Tkacz (2007).

6) L. Blose (2010).

Table 2. Research about the impact of inflation on gold price

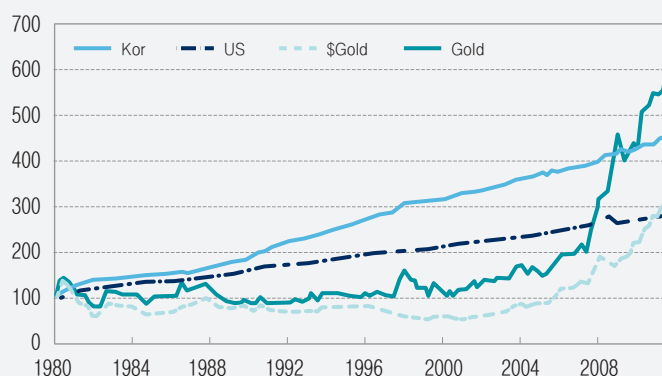
Authors (date)	Study period	Holding period	Research result
Sherman (1983)	1970~1980	Annual	Gold price has a significant positive relationship with unexpected inflation.
Jaffe (1989)	1971~1987	Monthly	Gold price movements are not predictive of future changes in CPI.
Moore (1990)	1970~1988	Monthly	Gold prices are predicted by a leading indicator of inflation.
Garner (1995)	1973~1994	Monthly	Gold price and inflation leading indicator have not been successful in predicting the magnitude of CPI inflation.
Larson & McQueen (1995)	1972~1992	Monthly	Coefficient of unexpected inflation for gold price is significant and positive but F-statistic is not significant.
Mahdavi & Zhou (1997)	1970~1994	Quarterly	No evidence of a cointegrating relationship between the CPI and gold price.
Cecchetti et al. (2000)	1975~1984	Quarterly	Gold prices do not provide accurate signals of inflation.
Christe-David et al. (2000)	1992~1995	Intra-day	Gold Futures reaction to unexpected changes in CPI is significant in the 15-min time period following the announcement.
Lawrence (2003)	1975~2001	Quarterly	Gold does not react to changes in the Producer Price Index.
Adrangi et al. (2003)	1968~1999	Monthly	Gold has a positive relationship with expected inflation, but no relationship with unexpected inflation.
Tkacz (2007)	1994~2005	Monthly	Examines gold as a leading indicator of inflation in 14 countries, and finds out that gold signals inflation in some countries that have adopted formal inflation targets.
Blose (2010)	1988~2008	Monthly	Unexpected changes in CPI do not affect gold spot prices and investors cannot determine market inflation expectations by examining the price of gold.

B. Inflation and the gold price in Korea

After 1980, the quarterly gold price and the inflation rate from the consumer price index show a different relationship depending on comparing periods. While the inflation rate linearly increased in Korea and the US after 1980, the gold price was stable before the gold price hike in 1999. After 2000, the gold price increased more than the US inflation rate, but not as much as Korea's inflation rate. But considering the won/dollar exchange rate fluctuation, the gold price in Korean won soared to a level higher than Korea's inflation rate because of won depreciation during the financial crisis.

The 20-quarter (5-year) correlation trend clearly shows the time-varying relationship between gold and inflation. The US CPI and gold price showed a negative correlation between 1980 and 1991, but showed a positive correlation between 1992 and 2004 during which the inflation rate was low. This is why previous research using the data from 1980 to 1995 does not show a clear relationship between gold and inflation.

Figure 2. Gold price and CPI in Korea and the US (1980=100)



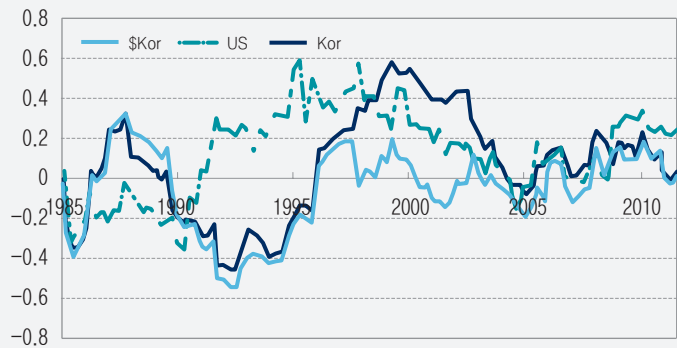
Notes: This is based on quarterly data. \$Gold refers to gold spot prices in the US dollar. Gold means gold spot prices in Korean won.

Source: Bloomberg, Statistics Korea, Census Bureau

The fluctuation of CPI and gold price in Korea and the US are different. The CPI in Korea and the dollar-denominated gold price showed a large negative/positive correlation before 1995, but the correlation is not much different from 0 afterwards. This means that the relationship between gold prices and inflation is not clear. The

correlation between the CPI in Korea and the won-denominated gold price fluctuated between -0.6 and +0.6 before 2005, but a small positive correlation below 0.2 is observed after 2005. However, even after considering the won/dollar exchange rate, the correlation between Korea's CPI and gold prices shows a different trend from that between the US CPI and gold prices. This means that it is hard for Korean investors to apply the research results based on US data.

Figure 3. The 20-quarter correlation between gold prices and CPI



Notes: The 20-quarter (5-year) rolling correlation. \$Kor indicates the correlation between CPI changes in Korea and gold returns in the US dollar. Kor refers to the correlation between CPI changes in Korea and gold returns in the Korean won.

Source: Bloomberg, Statistics Korea, Census Bureau

Similar results can be found in the correlation between CPI and commodity indices other than gold. This is a phenomenon where the fluctuations in commodity prices determined in international markets do not reflect the price changes in local markets. Hence, the gold price can predict US inflation, but this does not suggest that the gold price can predict inflation in Korea.

Table 3 shows correlation coefficients between monthly changes in CPI and monthly returns on commodity indices. The correlation coefficient between return on gold in the US dollar and the inflation rate in Korea was -0.04. But this went up to 0.28 when considering the won/dollar exchange rate. The correlation coefficient of return on the Reuters Commodity Research Bureau Futures Price Index (CRB) and the inflation rate in Korea became 0.4 from 0.02 after taking into account the exchange rate changes.

Table 3. Correlation between Korea's CPI and commodity indices

	\$GSCI	\$CRB	\$GOLD	GSCI	CRB	GOLD
CPI	0.05	0.02	-0.04	0.18	0.40	0.28

Notes: \$GSCI, \$CRB, and \$GOLD are correlation coefficients of returns on commodity indices in the US dollar and the inflation rate. GSCI, CRB, and GOLD are correlation coefficients of returns on commodity indices in Korean won and the inflation rate.

Source: Thomson Reuters, central banks of each country. % from last month, January 1991 ~ May 2010.

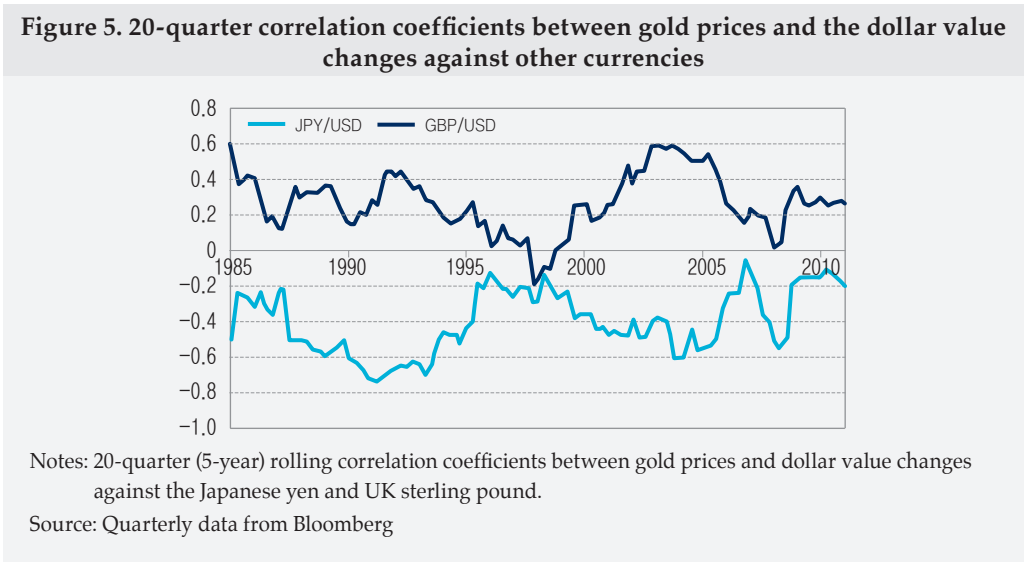
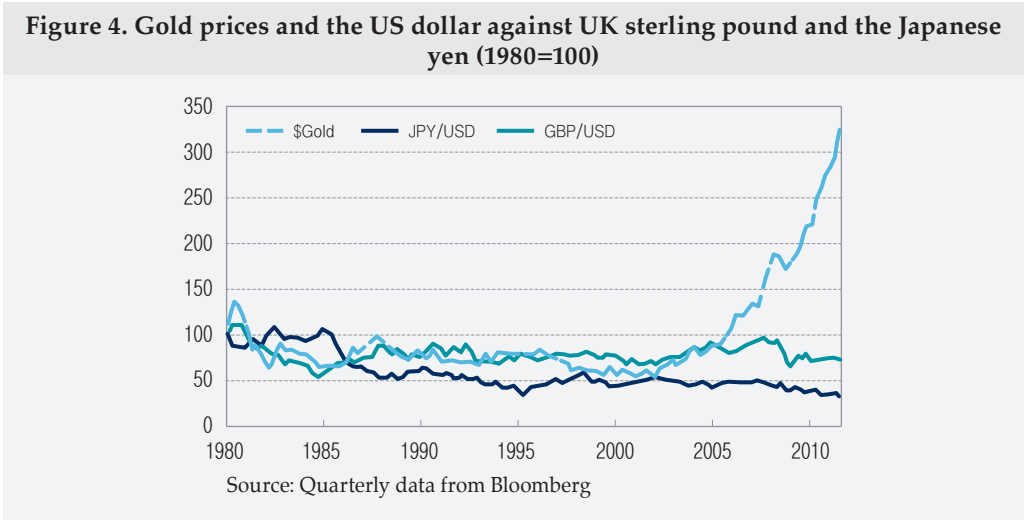
3. Hedge against the dollar value

It is generally accepted that the dollar and gold have an inverse correlation since the gold exchange standard was abolished. There are two ways to measure changes in the dollar value: First, measure the quantity a dollar can buy or produce (price fluctuations), and second, measure the change of the relative dollar value against another currency (the change in the exchange rate). If the value of the US dollar against major currencies and the change in the gold price show an inverse correlation, then it would be wise to use gold to hedge against the US dollar.

The inverse correlation between the dollar value and the gold price was confirmed by a few events. When the dollar hit a record high against the German mark in 1985, the price of gold plunged to \$281 per ounce. When measures to depreciate the US dollar were announced in the Plaza Accord, the gold price soared to \$500 per ounce. However, the change of the dollar value does not always show a preview of future price levels of gold. Capie et al. (2005) successfully proved that the gold price climbs when the US dollar depreciates against the UK sterling pound and the Japanese yen, and thus gold is a better hedging tool against dollar-pound and dollar-yen rate changes than against inflation. However, they also found that the result is highly dependent on political events around the world.

Empirically, the quarterly data from 1980 and September 2011 show the correlations between dollar-denominated gold prices and the dollar value against the Japanese yen and UK sterling pound stand at -0.4 and 0.32, respectively. Moreover, the 20-quarter (5-year) correlation shows a time-varying relationship, and therefore it is not clear that

gold hedges against dollar value fluctuations, just as in the relationship between gold and inflation.



IV. Conclusion

Gold price fluctuations have become a hot issue in the global financial markets. Against the backdrop, the Bank of Korea's decision to increase its gold reserves raised attention from individual investors toward gold investments. Central banks hold gold reserves for different reasons than individual investors. Before rushing to invest in gold, individual investors should carefully weigh the factors that determine the gold price from the perspective of Korean investors, rather than be swayed by conventional wisdom.

This article looked at past gold price trends and introduced existing discussions about what factors determine the gold price. The studies on investing in gold for inflation hedging failed to prove the general belief. Other studies showed that gold investments effectively hedge the change in the dollar value, but the result largely depends on the outbreak of political events and thus is uncertain. The biggest uncertainty for domestic investors, however, is that there have not been enough studies about the relationship between gold and other factors, i.e., Korea inflation, the won rate changes, and other asset prices. It is too risky to apply research results on the US and insist that gold investments are appropriate for Korean investors. Before encouraging Korean investors to flock to gold investments, we need more research on the outcome and risk that may arise from gold investments in Korea.

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