

Research & Strategy

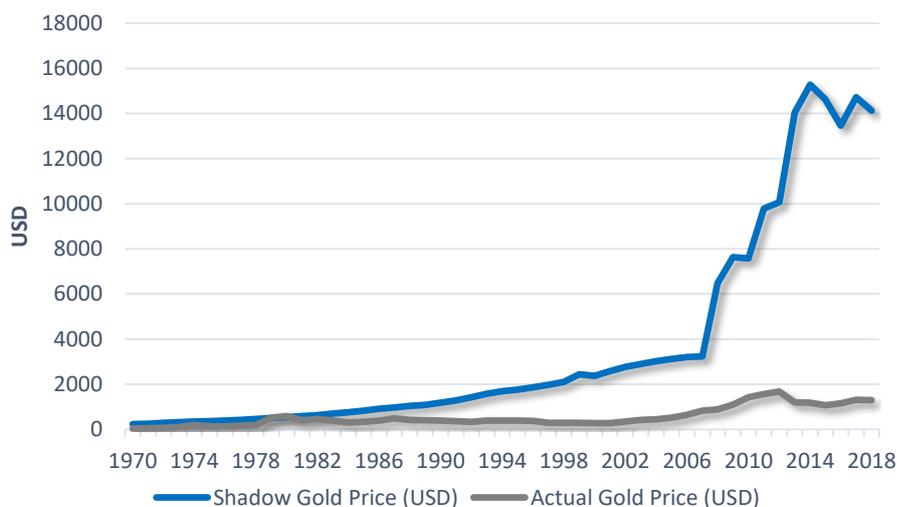
The Shadow Price of Gold

The linkage between the US monetary base and the implied price of gold

*“Oh Gold! I still prefer thee unto paper,
which makes bank-credit like a bark of vapour,”* Byron, Don Juan, Canto XII

- For non-cash generating assets such as gold, traditional valuation models have little to offer when estimating fair values
- We use a shadow price methodology which relates the monetary base to gold reserves to derive an implied or shadow price of gold
- Using data on the US monetary base and gold reserves, and assuming 100% backing of the monetary base we derive a shadow price of gold of \$14,119 per troy ounce
- Using the more conservative assumption of only 25% monetary backing we estimate the shadow price of gold to be \$3,530 per troy ounce
- Comparing the differential between the actual and shadow price of gold over discrete ten-year periods we find a relatively close relationship between the average inflation rate and the average actual/shadow gold price ratio
- On the basis of the actual-to-shadow gold price ratio, we estimate that a relatively limited increase in the medium-term inflation rate could have a significant impact on the price of gold
- Using the shadow price methodology in conjunction with the historic gold-silver price ratio we calculate a shadow price of silver to be \$249
- Using our analysis on shadow prices, we conclude that there is significant upside potential for both gold and silver prices

Figure 1: The shadow price of gold (1970 to 2018)



Source: St Louis Federal Reserve, IMF, SEAL Advisors, 2018

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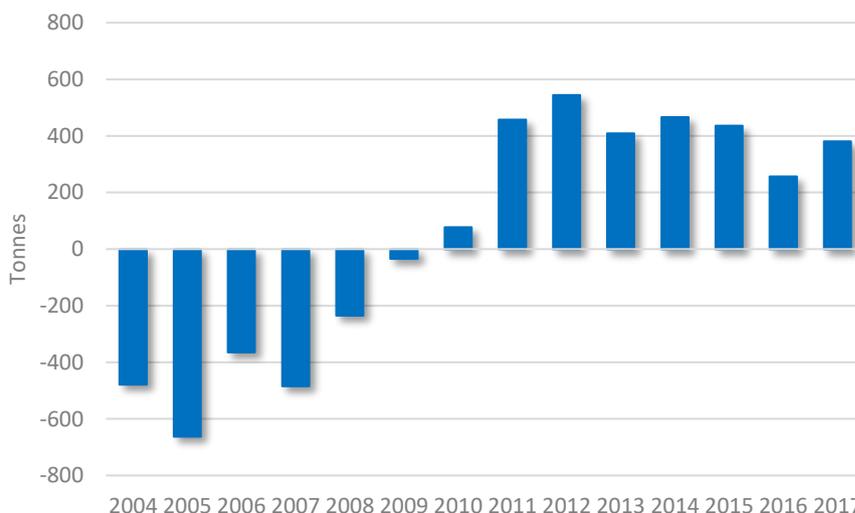
Jumping at Shadows

A barbarous relic

Written off with Keynesian disdain by many financial markets commentators as a “barbarous relic”, global central banks have, post the global financial crisis (GFC) shown a keen interest in adding to their reserve allocations of gold. As shown in figure 2, prior to the financial crisis central banks had been net sellers in every year from 2004 to 2008, reducing official reserves by over 2,000 tonnes over the period. Since 2010, this trend has sharply reversed with net additions of just over 3,000 tonnes between 2010 and 2017.

Central banks have been buyers

Figure 2: Net official gold sales/purchases (tonnes)



Source: GFMS Gold Survey

Yellow metal has merits

If we can take this trend reversal as evidence that central banks consider the merits of the *yellow metal* to be anything but obsolete, this does raise the question of what role gold plays in a *fiat* money global financial system.

For us, however, rather than look at the role gold has as a component of central bank reserves, the more interesting question is what, if any does the link between the monetary base and gold reserves have to say for the potential intrinsic or shadow price of gold.

The shadow price of gold

On this subject, principals Paul Brodsky and Lee Quaintance of QB Asset Management described in an investor letter written in 2011 how a “shadow price of gold” can be calculated by dividing the US monetary base by the official US gold reserves. The concept is relatively simple and dates back to the time when the monetary base (i.e. the dollar) was fully backed by gold.

While the direct link between the gold price and the monetary base is now something of a distant memory (the US having abandoned gold backing of the dollar in 1963), we believe there remains some merit in examining the relationship between gold reserves and the monetary base as an indicator of the implied price of gold. Using the same methodology as Brodsky and Quaintance (2011), we have extended the calculation to include the period from 2011 to 2018.

Using the adjusted monetary base figure provided by the Federal Reserve Bank of St Louis (\$3.7 trillion as of May 2018) and US official Gold Reserves of 8,134 tonnes (0.261bn troy oz), the implied shadow gold price from our calculations is approximately \$14,100. This compares to a spot gold price of c\$1,280¹. In effect, the implied price being c.11x higher than the current spot price.

¹ 31st May 2018

Two considerations

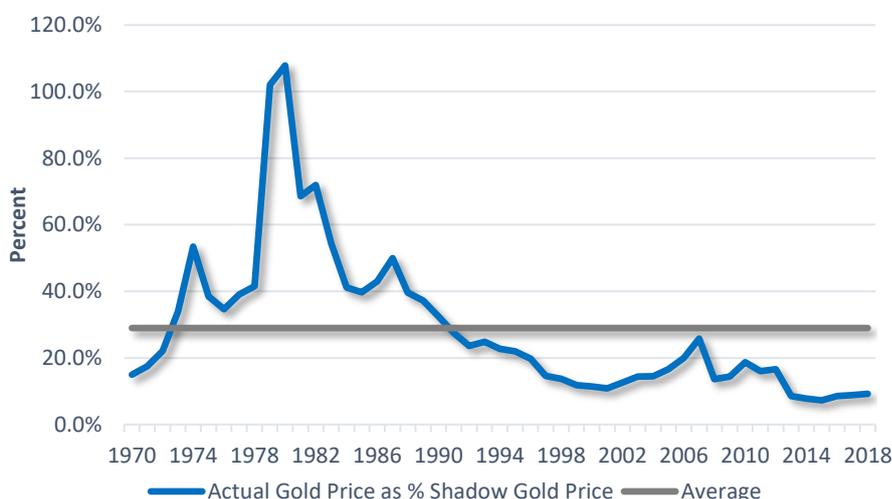
Before jumping to conclusions regarding a ‘fair price’ for gold, we need to consider two potential issues with this analysis. Firstly, how has the relationship between the actual and shadow price varied over time (i.e. how well has the shadow price predicted the actual price). Secondly, given the expansion of the monetary base since the gold standard was abandoned (see figure 5), how does the shadow price vary with the level of assumed gold backing of the monetary base.

The shadow price over time

On the first issue, figure 1 plots the actual and estimated shadow price (based on 100% monetary backing) between 1970 and 2018 and shows that since the late 1980s there has been a significant divergence between the two. Figure 3 uses the same data but expresses the relationship as the actual gold price as a percentage of the shadow price in order to give a clearer idea when the two have converged and diverged.

As can be seen from the figure, the actual price of gold approximated the theoretical shadow price of gold in only two years out of the sample period of 48 years.

Figure 3: Actual gold price as a percentage of the shadow gold price (1970-2018)



Source: SEAL Advisors

Interestingly, these two years happened to be 1979 and 1980, where the actual price of gold was 102% and 108% respectively of the shadow gold price. These two years, as we show in figure 4 which plots the year-on-year of US CPI inflation, were also stand out years for inflation.

Not easily traded before 1974

We could be tempted to conclude, that for the actual gold price to converge with the shadow gold price (and our methodology to have merit) it requires extreme CPI inflation rates (for example, over two standard deviations above mean). However, the experience of 1974 when inflation met this criterion, but the actual gold price only reached 53% of the shadow gold price would tend to refute this. Prior to 1975, however, gold could not be easily traded as this was before the introduction of exchange-traded gold futures contracts in the US². Hence, there is some justification to argue that the 1974 experience was not representative given the lack of the tradability of gold.

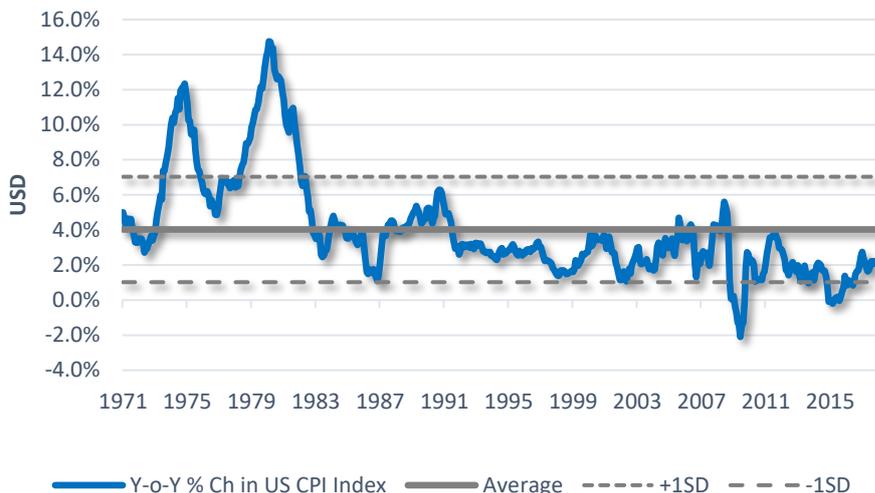
However, even stripping out 1974, using the assumption of 100% backing by gold, simply plotting the data over time does not say a great deal in favour of the shadow price as a predictor of the spot gold price. For the period as a whole, the average percentage rate is less than 30%.

² Exchange traded gold futures were introduced in January 1975

Expansion of the monetary base

But as we have already highlighted, during the post gold standard period the monetary base has significantly expanded. Figure 5, plots the US monetary base in both nominal and real terms (1983 being the base year for the real series) and shows the substantial growth over the period. The rate of expansion increased dramatically in the post financial crisis period as the Federal Reserve flooded the market with liquidity.

Figure 4: Year-on-year change in US CPI (1971 to 2018)

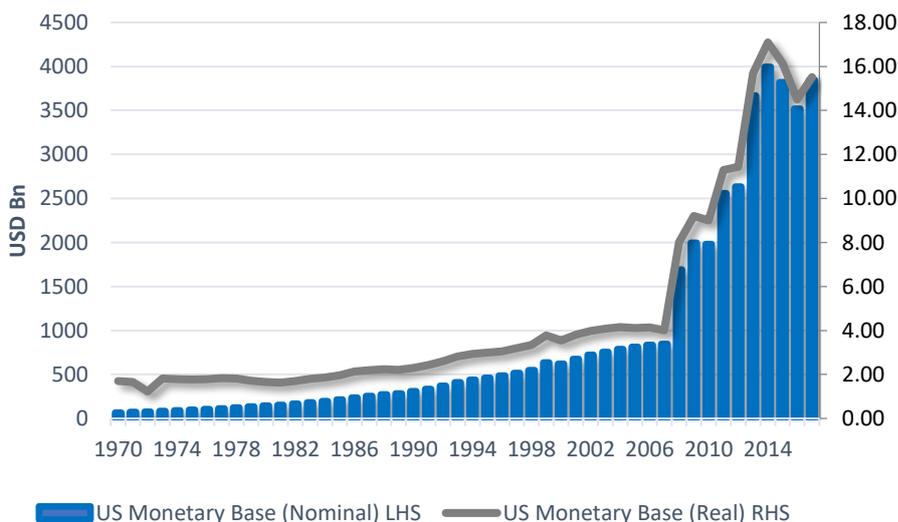


Source: SEAL Advisors

25% backing more reasonable

Given this expansion, using a 100% backing of the monetary base could be seen as an extreme level and so it is not surprising that it has relatively low predictive power. Addressing our second issue of assumed level of monetary backing, therefore, we repeat the analysis with an assumed level of 25%.

Figure 5: US Monetary base, nominal and real 1970 - 2017

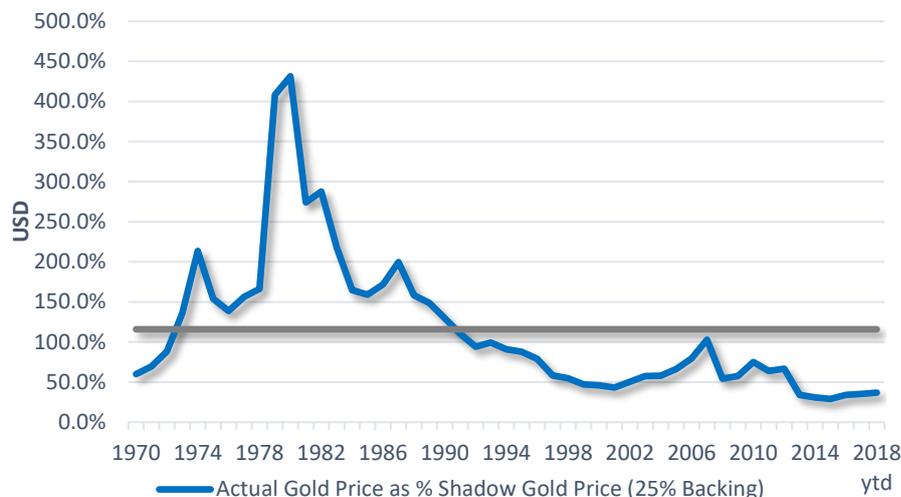


Source: SEAL Advisors

Closer relationship

Figure 6 plots the resulting shadow price based on the lower assumed backing level. While, there remains significant deviations, the average percentage for the period increases from less than 30% (for 100% backing) to just over 100% using the 25% backing assumption.

Figure 6: Actual gold price as a percentage of shadow gold price (25% backing)



Source: SEAL Advisors

Relationship with inflation

Given this closer relationship when using the lower backing assumption, we take the analysis further by splitting the comparisons of the actual gold price to the shadow price into discrete ten-year time periods. Table 1 compares the average actual-to-shadow ratio for each period, along with the average CPI inflation rate for the same period.

What our analysis shows is that on the assumption of a 25% monetary backing, the differential between the actual gold price and the shadow gold price is at its largest during periods of high inflation and at its smallest in periods of low inflation.

Table 1: Relationship between gold prices and inflation

Period (average)	Gold/Shadow gold price ¹	CPI Inflation
1970s	159%	7.3%
1980s	221%	5.5%
1990s	85%	3.0%
2000s	62%	2.6%
2010s	41%	1.7%
Whole period	116%	4.0%

¹At 25% monetary backing

Source: Bloomberg, US Bureau of Labour Statistics, SEAL Advisors

Given this relationship, the question arises of whether what we have shown is simply the actual gold price being a proxy for inflation or expressed in investment terms; an inflation hedge.

Academic work is inconclusive

On this issue there has been a considerable amount of academic work which has looked at the relationship between gold and inflation. In an early study, Jastram (1977) finds that gold is a poor hedge for inflation in the short run, though a good hedge in the long run. In a more recent study Aye, Chang and Gupta (2016) using data between 1833 and 2013 find that gold is a good inflation hedge in the long run, but the relationship breaks down during certain periods for various reasons. Iqbal (2017) using shorter term data between 1990 and 2013 finds that gold hedges inflation risk in the US but only during average and bearish conditions for gold markets and not in bull market times. Erb and Harvey (2012), however, find that gold is not a good hedge of inflation in the long run if the long run is defined as periods of 10 years or more.

If the relationship between the actual gold price and inflation is not as close as some would claim, what conclusions can be drawn from our analysis looking at the relationship between the actual and shadow gold price and the level of inflation?

Key conclusion.....

Our key conclusion is that while the actual gold price may not be the perfect hedge for inflation, when measured over longer periods (i.e. ten years) we find the quantum of the *differential* between the *actual* and the *shadow* price of gold is closely related to inflation. At high levels of inflation, the actual price “over-shoots” the shadow price and at low levels of inflation the opposite is true. Moreover, in a period when the average inflation rate was close to the long-run average (i.e. 4%), namely the 1990s, the actual gold price was 85% of the shadow price.

....relationship with inflation

Given this relationship between the actual and shadow price and inflation, all things being equal, we could conjecture that we do not need to return to the days of hyperinflation for the actual-shadow price differential to dramatically reduce (i.e. by a rise in the actual gold price). For example, with an inflation rate of just 3% (the average for the 1990s), we could see the actual gold price more than doubling if the differential converged to the 85% actual/shadow ratio from the current ratio of below 40%.

The shadow price of silver

This shadow price methodology does not have to be confined to gold. For those who have a greater interest in silver as an investment, we can use the above methodology in tandem with an average historic gold-silver ratio (spot gold price/spot silver price) to derive a shadow price of silver

Figure 7: Historic gold-silver price ratio (1970-2018)



Source: Bloomberg

Figure 7 above plots the historic gold-silver price ratio between 1975 and 2018. The average ratio for the whole period is 56.6. By dividing the shadow price of gold by this ratio the shadow price of silver for different monetary backing assumptions is shown in table 2. As shown in the third column of the table, using the 25% backing assumption the shadow silver price is calculated to be \$62. At the time of writing this is almost four times the spot silver price of \$16.4³.

³ 31st May 2018

Table 2: Comparison of shadow gold and silver prices

Price (USD)	100% monetary backing	25% monetary backing
Shadow gold	\$14,119	\$3,530
Shadow silver	\$249	\$62

Source: SEAL Advisors

In summary

As a non-cashflow-generating/non-yielding asset, the absence of a numerator (such as a dividend, earnings or cash flows in the case of equities, or a coupon in the case of bonds) means that traditional valuation approaches are of little use when trying to determine a fair value for gold. The shadow price methodology discussed in this analysis which derives an implied price by dividing the US monetary base by the US official gold reserves offers a potential approach to this valuation problem.

Over the past half-century, on average an adjusted shadow gold price assuming 25% backing of the monetary base possesses reasonable explanatory power for the actual gold price, although large differentials have existed over extended periods of time.

Comparing the actual-shadow price differential over discrete ten-year periods reveals a close relationship with the inflation rate. For those who believe that inflation is not dead, relatively low levels of inflation compared to long run averages would appear to be sufficient to bridge much of the gap between the actual gold price and the adjusted shadow gold price. A relatively limited rise in inflation to 3% could lead to a significant reduction in the existing differential between the actual gold and the implied gold price. Which all things being equal implies a gold price of more than double the current spot price.

Using the same methodology for silver and comparing this to the long-run gold-silver price ratio implies an even greater upside for silver.

While history never repeats exactly, and academics continue to disagree about the role gold has to play as an inflation hedge, our analysis indicates that gold and silver prices have great potential and can play a valid role in a well-diversified portfolio.

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