Silver price framework: Both money and a commodity

In this paper, we introduce a framework for understanding the formation of silver prices. Silver is both money (store of value) and an input commodity and thus the impact of both industrial and monetary demand need to be taken into consideration. We also introduce a silver price model that captures the relative price drivers under this framework, including the Goldmoney “energy proof of value” addition to the standard real-interest rate price model for precious metals. Silver prices are currently about 10% below predicted values, but more importantly, the model indicates that we are still near the bottom of this price cycle.

While market analysts, financial media, and commodity investors often regard silver as gold’s temperamental cousin, simply viewing silver as a more volatile version of gold fails to give the metal due consideration. Just as the physical properties of gold destined it to become an ideal store of value, silver’s properties make the metal special in its own right.

As explained in our Gold Price Framework, gold is not a flow commodity. Historical currency correlations and rate-driven volatility indicate that gold trades as a money
GOLDMONEY MACRO VIEWS AND RESEARCH HIGHLIGHTS

REAL INTEREST RATES VS. GOLD PRICE

UPCOMING IMPORTANT DATA RELEASES AND POLICY MEETINGS

February 28  US GDP data release
March 10  ECB monetary policy meeting
March 10  US non-farm payrolls
March 14-15  FOMC meeting
March 15-16  BOJ monetary policy meeting
March 16  BOE MPC
May 25  OPEC ordinary meeting

GOLD RETURNS IN VARIOUS CURRENCIES

PREVIOUS GOLDMONEY INSIGHTS HIGHLIGHTS

Gold Price Framework Vol. 1: Price Model
October 8, 2015 by Stefan Wieler and Josh Crumb

Price controls and propaganda
February 2, 2017 by Alasdair McLeod

Commodities and inflation under a border-tax regime
January 23, 2017 by Stefan Wieler

Gold – a primer for 2017
January 19, 2017 by Alasdair McLeod

Are Bitcoins now more valuable than gold?
January 4, 2017 by Stefan Wieler and Roy Sebag

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stock; however, silver is special because it’s similarly well-suited to be money\(^1\) as well as an input commodity consumed in a variety of industrial processes.

Thus, silver prices are driven by monetary demand as well as supply and demand for industrial purposes, the latter of which is an important differentiator. Above ground gold stocks have always grown at the same pace as new gold is mined, dampening the effects of inventory-determined price volatility; however, silver stocks grew much more slowly as industrial demand absorbed a large part of what is mined.

These findings provide insight into the factors that drive silver prices:

1. Silver is, like gold, a commodity store of value and free of counterparty risk, with energy-intensive replacement costs setting the lower boundary for prices (the same energy proof of value that underlies gold prices). As such, silver should be impacted by the same monetary drivers as gold prices: real-interest rate expectations, central bank policy, and longer-dated energy prices.

2. As silver is a commodity with extensive industrial applications, changes in industrial drivers (i.e. changes in available inventories) should impact the price of the metal.

We find that that a large part of the changes in the price of silver can be explained in a regression analysis using just a few drivers: Gold prices, TIPS yields, and changes in silver ETF holdings (representing the monetary demand for silver) as well as U.S. industrial production and the ISM manufacturing PMI (the industrial demand for silver). Indeed, these drivers explain close to 80% of the year-over-year changes in silver prices in a multi-variate regression analysis.

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\(^1\) To which my valued colleague Alasdair MacLeod commented: “The Austrians would firstly question whether or not silver is money. That is a decision for economic actors, and is liable to change. For it to be money, its purchasing power should be stable for the purposes of exchange, and desirably for the long-term as well. If silver can exhibit those qualities, it is likely that economic actors will consider it as money, in competition with other forms. It is not the function of an observer to say whether or not silver is money, except to the extent it is obviously accepted as such at a particular moment in time.”
A few drivers reflecting monetary demand for metal and industrial activity explain 80% of the changes in the price of silver

Year-over-year change in price, natural log

Further, we find that the impact of changes in real-interest rates on silver prices is larger than on gold prices. We believe there are two reasons for this:

1. The value of global silver stocks is much smaller than that of global gold stocks, which is the result of silver being used in industrial applications, and thus a change in monetary demand for silver has a disproportionate effect.

2. Because much silver is mined as a by-product of non-silver mining operations, the silver cost curve has a discontinuous shape; base production is relatively cheap, but more costly “pure” silver projects need to become economically viable in order to meaningfully ramp up supply. Accordingly, when an increase in monetary demand leads to a shift on the cost curve, prices tend to increase disproportionately.

The model framework presented in this report should not be construed as a day-to-day trading tool. We aimed to demonstrate (and validate with our statistical analysis) that silver is both money and a commodity, and silver prices should therefore follow a certain behaviour. The silver price model we have developed confirms our hypothesis that silver tends to outperform gold when falling real interest rates create monetary
demand for metals. 2016 was a textbook example: Real interest rates had peaked by the end of 2015 after the Fed’s first hike in December. Real interest rates then started to decline again as the market began to reassess the likelihood of further hikes. By the summer, real interest rates had again dropped into negative territory. This move in real-interest rates pushed gold prices higher, while silver prices moved nearly twice as much; however, the market began to price in that the Fed would likely only raise rates one more time, which meant that real-interest rates reversed. The election of President Trump led to a sharp upward move in real rates as the market was suddenly expecting higher economic growth. Gold prices were pushed lower again, and silver declined even more as a result. At the end of the year, gold was still up 8% and silver was up 15%. Going into 2017, the rally in nominal yields has stalled, though inflation expectations have continued to move higher. This implies that real-interest rates have been moving lower – and as a result, gold prices have risen 5% while silver prices have increased 10%.

**Silver prices spiked as monetary demand for precious metals increased**

USD/ozt (LHS), 10-year TIPS yield % (RHS), inverted

In addition to changes in monetary demand, changes in the economic cycle lead to shifts in industrial demand for silver (which overlays monetary demand).

As a result, while gold may be better-suited for steady long-term savings, silver can be more efficient for gaining exposure to changes in monetary policy, particularly around
industrial cycles. Changes in central bank policies have a 1:1 impact on the price of gold over the long run, meaning that the loss in purchasing power of the base currency of measurement is offset by the price increase. Therefore, gold can maintain its purchasing power in the long term, something no fiat currency has ever been able to do throughout history.

When it comes to silver, changes in central bank policy act like a combustive agent on the price, making silver more efficient for someone with a view on the direction of policy-driven impact on currencies who aims for maximum exposure.

However, savers typically do not have (and do not want to have) a view on the “direction” of their money. What they seek is stability, meaning they want to protect their wealth and ensure that the purchasing power of their savings is the same over long periods of time. Gold and silver are the only monies that have ever reliably done so notwithstanding the historical, political, or economic context.

Silver prices are currently about 10% below the levels predicted by the model; however, we’d like to reiterate that the model allows us to determine where we stand in a price cycle and should not be construed as a trading tool that can detect mispricings. As silver prices are formed by a number of macroeconomic factors rather than the fear and greed often tauted by financial media, understanding the outlook of these factors is key when predicting where prices are likely to go.

We believe that a trend transition point in monetary demand for metals has recently been reached as both longer-dated energy prices and real-interest rates have already passed their inflection points (in non-dollar terms the recovery in gold and silver prices is already well-established). While we do not expect longer-dated energy prices to move much higher in the near term, real-interest rates have little upside and a lot of downside over the long run. Therefore, there is a strong asymmetry in the outlook for gold prices from current levels. According to our model, silver should disproportionally benefit as gold moves higher on the back of increased monetary demand.

**SILVER PRICE FRAMEWORK**

Silver prices outperformed gold during the bull years (from the early 2000s to the peak in 2011) by more than 2:1; however, during the recent correction in prices from 2012 to 2015, the decline was much sharper as silver prices dropped almost twice as much. In the end, both metals had roughly the same performance from the lows in the early 2000s until now, but silver did so with much more volatility. The standard deviation of the monthly returns of gold in USD over that timeframe was 18%; the standard deviation for silver was 33%.
Figure 1: Silver has both out- and underperformed gold by 2:1 during the past 15 years
Cumulative performance in %

Source: COMEX, FRED, Bloomberg, Goldmoney Research

STORE OF VALUE

In an article from last year (“Is Gold a commodity”, 26 May, 2016), James Turk, founder of Goldmoney Wealth, comprehensively explains why gold is money and not a commodity, something we addressed in a more quantitative approach in our gold framework note last year. Silver is special because it’s an industrial commodity as well as money, thus silver prices are driven by monetary demand for silver in addition to supply and demand for industrial purposes.

To understand why silver is both money and a commodity, it’s best to understand first why gold is money and not a commodity. To use James’ words: “The interaction of supply and demand obviously determines an item’s price. While annual supply is a big factor in the price of commodities, the annual supply of newly-mined gold does not have much of an impact on the gold price. The real supply of gold is its above-ground stock, nearly all of which can be sold at a moment’s notice. This above-ground stock is all the gold mined throughout history, and with new mine production it grows consistently around 1.75% per annum. The above-ground gold stock and its relatively small, consistent annual
growth are among the distinguishing features that set gold apart from commodities because they are consumed and disappear. Gold does not get consumed, nor does it disappear. It gets accumulated.”

In a nutshell, gold is fundamentally different from a commodity; while it’s mined like a commodity (and often by the same companies), it’s not an input good in a production process and therefore never consumed. Oil, for example, is produced then run through a refinery to make gasoline, diesel, and other fuels. That gasoline is then burned in an engine and evaporates into the air as CO2 and inorganic gases. It is irreversibly consumed. Gold on the other hand is never consumed. One might argue that a huge part of annual gold production ends up in jewelry, which is correct, but gold jewelry is just another form of savings (think of Indian jewelry, the value of which is determined almost entirely by the value of the contained gold and not so much by the labour that went into making the jewelry). As such, all gold jewelry, even that of lower grades (i.e. 14K gold) can be quickly be turned into bullion form for minimal cost.

Gold will necessarily have to reflect its extraction costs, including labour, energy, and other raw materials going into the production process. Energy is an important factor in the production costs of gold, which is why gold should reflect the market’s expectation of future energy costs as we explain in great detail in our gold model framework note. This, from our point of view, is a key factor why gold can maintain its buying power for energy and goods that require energy as a large portion of their production cost (as opposed to services and downstream-marketed products). The labour, energy, and time that goes into the production of gold could be used to make something else: a house, a car, or even food commodities. Therefore, the production of gold always comes at the expense of something else – but unlike gold, everything else depreciates or deteriorates over time without a maintenance cost, and therefore has a different long-term value or utility as a form of savings. We call this relationship the energy proof of value of gold. The energy proof of value explains why gold has proven to be the best store of value over any prolonged time-period in human history.

So, while commodities are produced, transported, stored, consumed and then disappear (or have some recycling/repurposing cost relative to their use cost), gold is produced and used over and over again (in economic calculation as a result of it being money) with almost zero marginal cost of usage, near-zero storage and maintenance cost, and never disappears. Gold is accumulated because of its usefulness as money (a store of value relative to other commodities that are used and disappear).

So, what about silver? Silver has also been used as money throughout human history. The British pound is so named as 240 silver pennies were originally equivalent to 1 pound of silver. Few people are aware that the U.S. dollar was first officially defined as
371.25 grains of silver (24.056 g) in the U.S. Coinage Act in 1792. This was the weight of the Spanish milled dollar, the most widely circulating silver coin in the colonies – and probably the world – at the time. The silver standard was later replaced by a bimetallic standard which was then replaced by the gold standard in 1900.

In one way, silver has an advantage over gold when used as money, or at least this was the case in the past: it’s much more abundant and therefore not as precious as gold. While this sounds counterintuitive, silver’s abundance makes it easier to use for smaller purchases in a world in which transactions are settled with physical coins; however, this apparent advantage comes at a cost: the cost of storage. Because silver is much less value-dense (due to its lower scarcity it has a lower energy driven replacement cost), it’s more expensive to store as the silver value equivalent of any amount of gold requires much more space. This also makes transportation more costly relative to its replacement cost, and increases its marginal transaction cost. Silver also does not have the same level of non-reactive properties as gold. For example, it tarnishes over time, especially under certain conditions (such as exposure to sulfur). These factors therefore increase its carrying cost relative to gold, or its natural “monetary carry”. While this may be an insignificant carry at the individual level, at a macro level it can add up and dampen returns when currency carry is positive.

For gold, token coins\(^2\) have been used in the past to overcome the high value-density of gold for small transactions. Today, however, technology allows us to use gold even for the smallest transactions. Goldmoney clients transfer as little as 0.001 grams of gold, approximately USD0.04 at current prices. And because gold is much cheaper to store relative to its value, it’s more efficient to use gold for digital transactions rather than silver in today’s world. But the energy-proof of value argument continues to apply for silver as much as it does for gold, which means silver is still far superior as a store of value than any fiat currency over time, as demonstrated by the historical record.

**INDUSTRIAL APPLICATIONS**

While there are quite a few industrial applications for gold, the amount of gold that is irrevocably consumed every year is negligible. Gold demand from the industrial and other non-monetary sectors is limited (dentistry, high end electronics, space exploration), and most of the gold is recycled later as well (the gold we shot into space being the exception). Historically, the same was true for silver. In more recent history, however, silver demand from the industrial sector has grown dramatically. Today, industrial demand makes up roughly 50% of the annual demand for silver (2015).

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2 A token coin’s intrinsic value (the metal it contains) is worth less than its face value. A bullion coin is a coin which face value is covered by the intrinsic value. In a system where token coins can be exchanged for bullion coins made of gold at a fixed rate, smaller transactions can be conducted using gold as base money.
Monetary demand in the form of jewelry accounts for 19% and coins and bars for 25%. The rest is demand for silverware (see Figure 2). While on a relative basis industrial demand has been declining, on an absolute level it has remained relatively stable over the past 10 years even as one source of demand (photography) declined by nearly two thirds from 22% in 2006 to now just 8% of total industrial demand. However, as one source of demand disappeared, a new one emerged with the strong growth of the solar industry. The photovoltaic industry accounts for 13% of total industrial demand as of last year and is likely to continue to grow.

**Figure 2:** About 50% of the annual demand for silver is from the industrial sector (2015)

Million ounces

**Figure 3:** Absolute demand from the industrial sector has remained relatively stable over time but the composition has changed

Million ozt

**ABOVE GROUND STOCKS**

The importance of demand for silver in industrial applications leads to an important difference between gold and silver. For thousands of years, above ground gold stocks have grown at the same pace as new gold was mined. But silver stocks grew much more slowly because industrial demand absorbed a large part of what was mined. We estimate that about half of all the silver ever mined has been irrevocably consumed. Hence, while there are about 170,000 tonnes of above ground gold stocks worth about USD7 trillion at current prices, the value of all above ground silver stocks is far lower.

Estimates for silver stocks are harder to come by. We found estimates for total above ground silver stocks ranging somewhere between 550-850 thousand tonnes. Taking the average of that, the ratio of above ground silver to gold stocks is about 4:1 measured by weight. Compare this to the annual production volume of both metals, which averaged around 9:1 over the past 10 years. The natural abundance of both metals in the earth’s crust is even further apart at 20-25:1 according to most studies and our own estimate for the economic geology of prime deposits puts this number closer to 1:40. As one
can see, above ground silver stocks have not grown nearly as much as production or natural abundance imply, because much of the mined silver has been consumed. Hence, while there are about 170,000 tonnes of above ground gold stocks worth about USD7 trillion at current prices, the value of all above ground silver stocks is far lower.

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Does a 4:1 ratio of above ground stocks mean that the price of silver should be 1/4th of the price of gold? No, prices don’t form that way. For example, above ground stocks of Iridium, a very rare metal, are just a few tonnes at best, yet it trades at not even half the price of gold. The price of iridium is set where it clears the market, meaning the price ends up where demand and supply are in equilibrium. Hence, the ratio of above ground stocks of silver and gold doesn’t give any indication of what the price ratio of the two metals should be. However, knowing that industrial demand absorbs a large part of mining supply each year gives a lot of insight into why silver prices behave the way they do. Because silver is also a commodity, it partly behaves like a commodity. We have outlined this before. Commodity prices form in two steps:

1. Longer dated prices are set by the marginal cost of future supply. Forward prices must reflect the costs of the marginal supply project that is needed to meet expected future demand. For example, if the total amount of incremental new oil production needed by 2020 is 10 million b/d, the projects with the lowest costs that add up to 10 million b/d of new supply must be sanctioned now so sufficient oil is available by 2020 to meet all demand. The highest cost project that is to be sanctioned sets the forward price.

2. Inventories determine the shape of the forward curve and thus spot prices. In commodity markets, the shape of the forward curve is a function of inventories. In a market with very low inventories relative to demand, consumers (for example a manufacturer of a consumer good) of that commodity will be willing to pay a
premium for immediate delivery. The alternative is to risk running out of the commodity that is an input good in the manufacturing process. The result is that the consumer (manufacturer) would have to shut in production, which represents the worst-case scenario. A forward curve that is downward shaped (spot prices are above future prices) is trading in backwardation. The opposite of backwardation is contango. A curve is in contango when inventories are high relative to demand.

In a commodity market with high inventories, the likelihood for a commodity consumer to run out of the input good is very small. Hence, there is no incentive for a consumer to pay a premium for immediate delivery. Quite the contrary, storing commodities costs money (to rent the storage capacity, cover insurance and the opportunity costs of money). Hence, the holder of the commodity needs to be compensated for these costs. This compensation comes in the form of contango.

In a contango market, an owner of storage capacity can buy the commodity at a discount now, store in, and sell it forward simultaneously at a higher price.

Therefore, commodity sport prices are driven by costs, which set the forward price, and inventories, which determine the shape of the curve.

As we have described in our gold framework report, unlike for commodities, changes in above ground stocks have little to no impact on the gold forward curve. This is because gold is not a commodity, it is money. Gold is never consumed and thus there is no risk of running out of gold in a production process. Above ground stocks are so large that changes in supply simply don’t matter while demand for gold is fundamentally different from demand for a commodity. Demand for gold doesn’t mean it’s consumed and disappears. Demand for gold simply means that it changes ownership. But if silver is both money and a commodity, the shape of the forward curve should behave like a commodity to some extent. In fact, this is what we find. We analyzed time-spreads for COMEX silver futures and found that time-spread between the 1st and 10th contract is basically a function of registered COMEX silver stocks (see Figure 4). The caveat is that recently there have been increased concerns about silver time-spreads being the subject of manipulation. The silver futures market is much smaller than that for most other commodities, hence this cannot be ignored. And in fact, figure 4 shows that silver time-spreads do fluctuate strongly around the levels predicted by inventories. Nevertheless, silver time-spreads, unlike gold, have a relatively solid relationship to (registered) stocks, which is something we would expect from a commodity.
While silver behaves like a commodity to some extent, there are still differences to other commodities like copper or oil. Because silver inventories are still large relative to annual consumption when compared to most commodities, silver time-spreads tend to be in contango most of the time. In contrast, gold time-spreads always trade in contango (except for the very near-dated spreads, which, in extreme cases, can trade in backwardation). Industrial commodities like oil and copper trade frequently and for prolonged periods in backwardation.
While backwardation can occur in the silver market, it is much less pronounced than with other commodities. For example, the maximum backwardation in the silver 1-10 month time-spread over since the beginning of the 1990s was about 5%. In comparison, copper and oil traded at over 30% backwardation at times. As we pointed out before, gold time-spreads never trade in backwardation.
Figure 6: The silver forward curve is less susceptible to backwardation than other commodities, the result of silver being not just a commodity but also money

% delta 1-10m COMEX silver spread (LHS), COMEX registered silver stocks inverted

Source: COMEX, NYMEX, LME, Bloomberg, Goldmoney Research

HOW TO MODEL SILVER PRICES

The findings above give us a reasonably full picture as to what factors drive silver prices.

- On the one hand, silver is a counterparty-risk-free form of money where replacement costs set the lower boundary for prices, the same energy proof of value that underlie gold prices. Thus, silver should be impacted by the same drivers as gold prices: real-interest rate expectations, central bank policy, and longer-dated energy prices.

- On the other hand, silver is a commodity with extensive industrial applications. Hence, changes in industrial activity should impact the price of silver as well.

We find that that a large part of the changes in the price of silver can be explained in a regression analysis using just a few drivers: Gold, TIPS yields, and changes in silver ETF holdings (the monetary demand for silver) as well as US industrial production and
the ISM manufacturing PMI (the industrial demand for silver). These variables explain over 70% of the year-over-year changes in silver prices. The result can be further improved by using an adjustment variable for the sudden, sharp price spike in the late 1990s on the back of the Asian crisis, resulting in an adjusted r-squared of close to 80%.

**Figure 7: A few drivers reflecting monetary demand for metal and industrial activity explain 80% of the changes in the price of silver**

Year-over-year change in price, natural log

Alternatively, we ran a regression analysis on the nominal silver price instead of the change in price with the same variables and found similar results. The regression resulted in an adjusted r-squared of 98% for the period of 1990-2016.

We then extended the analysis to encompass also the volatile years of the late 70s and early 80s. Unfortunately, the history for some of the data doesn’t go back as far. One of the drivers that reflect monetary demand for silver is real interest rate expectations. Real interest rates are nominal interest rates minus inflation. The easiest way to track real interest rate expectations is via Treasury Interest Protected Securities (TIPS). TIPS pay a nominal interest, but the principal increases with inflation and decreases with deflation. TIPS are traded and, thus, changes in nominal interest rates or inflation expectations should be reflected in TIPS yields. However, the inflation measure utilized
to adjust the principal is the Consumer Price Index (CPI). (Whether the CPI is tracking inflation accurately is a hotly debated subject, and this is beyond the scope of this report.)

For this framework, we used TIPS to measure real rates, being aware of the potential shortcomings. Unfortunately, we don’t have data for real interest rate expectations going far enough back to run the same regression for the period of the late 70s and early 80s. But we wanted to test whether our framework works for this period as well. We therefore replaced real interest rate expectations with longer term inflation expectations. The University of Michigan publishes the results of two monthly surveys: 1-year inflation expectations starting in 1978 and 5-year-inflation expectations starting in 1979. We used the 1-year inflation expectations from 1978-79 and the 5-year inflation expectations from 1979 onwards. Inflation expectations are only half the story of real interest rate expectations; the other half are nominal interest rates. We therefore also added the generic 10-year government bond yield to our regression. The result is shown below in Figure 8.

**Figure 8: Nominal silver price model**

Source: COMEX, FRED, Bloomberg, Goldmoney Research
You might wonder why we use both gold prices AND real-interest rates in our model. As we have shown in our gold framework note, real-interest rates are one of the most important drivers for gold prices. When real-interest rates fall in one currency, its competitiveness against other currencies, including gold, declines. Hence, changes in real-interest rates impact the monetary demand for gold. The gold price should therefore already reflect changes in real-interest rates. In other words, when monetary demand for gold picks up, monetary demand for silver does too. As such, using gold prices in the regression analysis should cover the impact of real-interest rates. However, we find that the impact of changes in real-interest rates on silver prices is larger than on gold prices. We believe that there are two reasons for this:

1. Because the value of global silver stocks is much smaller than that of global gold stocks, the result of silver being used in industrial applications, a rise in monetary demand for silver has a disproportionally large effect. In other words, when demand for metals increases as an alternative to fiat currency, there is simply less silver around to change hands.

2. A large part of global silver production is a by-product of other mining activities, for example copper production. This base production is usually enough to meet industrial demand and “normal” monetary demand for silver. Because much silver is mined as a by-product, the silver cost curve has a discontinuous shape, meaning that base production is relatively cheap – but to meaningfully ramp up supply, much more costly “pure” silver projects need to become economically viable. Hence, when a sharp increase in monetary demand leads to a shift on the cost curve, prices tend to increase sharply. This is illustrated in Figure 9. On a smooth continuous supply curve, an increase in expected future demand leads to a shift on the supply cost curve from A to B. However, for silver, the cost curve is different; it has a “kink” (an abrupt, discontinuous change in the first derivative) as a lot of silver is produced as a by-product, meaning it is produced almost regardless of the silver price. As such, small shifts in expected future demand lead only to very small changes in marginal costs. However, a sharp increase in monetary demand for silver leads to a sharp increase in the marginal cost of future supply (C to D), as an increase in future supply can only be achieved by sanctioning high cost pure silver projects.
Figure 9: If the supply cost curve changes abruptly, an increase in demand can lead to a disproportionately large impact on the marginal cost of future supply.

This explains the spikes in silver prices that exceed the performance of gold when gold rallies due to declining real interest rates.

However, even using both gold prices and real-interest rates in our regression analysis, there are two distinct periods where the model under-predicts silver prices. Those two periods coincide with the two price extrema over the past 40 years, when prices peaked in 1979-1980 at USD49.45/ozt and in 2011 when silver prices reached USD44.48/ozt.
The 1980 peak in silver prices coincided with the peak in gold prices. However, silver outperformed gold during that rally by over 2:1. Despite the fact that we use both gold prices and real-interest rate to predict silver prices, the model under-predicts silver prices by about USD15/ozt for the 3 months from December 1979 to February 1980. This period coincides with the Hunt brothers’ attempt to corner the silver market and the subsequent efforts by the CFTC and COMEX to stop them, which eventually ended with a sharp correction in the silver price on what today is known as “Silver Thursday” (March 27, 1980). The Hunt brothers amassed massive long positions in the silver futures market and stood for delivery, which left short sellers scrambling for metal and sent prices sharply higher. As we don’t use any exogenous variables to account for this in our regression analysis, our model naturally falls short to predict the price spike on the back of this.

The second time-period where the model under-predicts silver prices is during 2011. Silver prices peaked in April 2011, four months before the peak in gold prices. By the time gold prices peaked, silver had already declined about 12% from the peak (monthly average price of USD43.10/ozt in April 2011). First, the regression analysis covering the time-period between 1990 and 2016 captured this spike much better, both when...
analyzing levels and year-over-year changes. Second, the period coincides with COMEX registered silver stocks falling to record lows (see Figure 11).

Figure 11: The peak in silver prices in 2011 coincided with COMEX registered inventories hitting all-time lows, but as of now, stocks are even lower

COMEX registered inventories, 10,000oz

Source: Bloomberg, Goldmoney Research

However, while registered silver stocks subsequently increased again, along with a fall in the price of silver, they once again began to fall sharply from spring 2015 and have since made new record lows, but without a corresponding reaction in prices. COMEX registered silver stocks are now >15% below the all-time lows in 2011. What did change, however, is that COMEX eligible stocks have increased dramatically since 2011. We suspect that this is partly the result of a sharp rise in silver ETF holdings (see Figure 12). What seems to stand to reason is that the high levels of eligible stocks have altered the markets’ tolerance for the low levels in registered silver stocks. This is consistent with the fact that, given the record low in registered stocks, the current level of backwardation is low compared to historical levels (see Figure 13). Whether the market is right about not being too concerned about low registered silver inventories remains to be seen. We suspect that a large chunk of the end-holders of the eligible stocks are focused on the flat price of silver and pay little to no attention to the forward curve. Hence, in order for COMEX shorts to convince the holders of eligible stocks to part with their metal in case they need it, flat prices would have to rise. This might pose
a problem for COMEX shorts if they expect that eligible stocks are readily available when worst comes to worse.

**Figure 12:** COMEX eligible silver stocks currently near their all-time highs, thanks to silver ETFs

**Figure 13:** Despite the extremely low levels of COMEX stocks, time-spreads are in contango

**TAKEAWAY**

The model presented above should not be construed as a day-to-day trading tool. Rather, we set about demonstrating that silver is both money and a commodity and therefore silver prices should follow a certain behavior, and we use statistical analysis to confirm our views. The silver price model we developed confirms what we have been suspecting: silver tends to outperform gold when monetary demand for metals spikes. In addition, changes in the economic cycle lead to changes in industrial demand for silver which overlays monetary demand.

Central bank policy, therefore, or expectations thereof, can have a much larger effect on silver than on gold. For example, if changes in central bank policy lead to both rising real-interest rates and a short-term slowdown in economic growth, silver prices are affected negatively in multiple ways. First, monetary demand for metals declines. However, the effect is larger for silver than for gold due to the larger relative impact on stocks. Second, industrial demand for silver slows down, leading to more stock builds, which in turn exacerbates the weakness in the price. The same mechanism works in the opposite direction as well. On net, due to its exposure to the industrial sector silver prices tend to be more volatile than gold prices.

Thus, while gold is better suited for long term savings, silver can be more efficient to gain exposure for trading purposes. Changes in central bank policies have a 1:1 impact on the price of gold over the long run, meaning that the loss in purchasing
power of the base currency is offset by the price increase. Therefore, gold can maintain its purchasing power over the long run, something no fiat currency has ever been able to do throughout history. However, when it comes to silver, changes in central bank policy act like a combustive agent on the price. This makes silver more efficient for somebody who has a view on the direction of prices and is aiming for maximum exposure. Savers typically don’t have (and don’t want to have) a view on the “direction” of their money. What they seek is stability, meaning they want to protect their wealth and ensure the purchasing power of their savings is the same over a long period of time. Gold is the only money does that.

We believe that we have reached an inflection point in monetary demand for metals. Gold and silver prices faced strong headwinds over the past few years as both real-interest rate expectations increased (from -75bp to +85bp) and longer dated energy prices declined sharply. This has pushed gold prices lower in USD terms (although, in a majority of the world’s most important currencies, gold has been in an uptrend for over 2 years now). However, gold prices in USD found a bottom at the end of 2015 and have since been in an uptrend as well. Longer-dated energy prices have stabilized over the past months and real-interest rate expectations have already turned and resumed their multi-decade downward trend.

The market was caught by surprise when Donald Trump won the U.S. presidential election back in November. As a reaction, rates began to move higher and the USD appreciated sharply. While the USD has given up some of its gains, Treasury yields remain at multi-year highs. This has pushed real-interest rates sharply higher which led to the initial sell-off of gold and silver. However, while normal interest rates have not yet retreated, inflation expectations have been going up steadily. Breakeven inflation expectations hit all-time lows in early 2016 and have been on an uptrend since. This trend has clearly accelerated since Election Day. As a result, real-interest rates have given up about half of their after-election rally and gold and silver prices have risen accordingly.
Figure 14: After hitting all-time lows by early 2016, breakeven inflation expectations have been going up steadily, a trend that accelerated after the US elections.
10-year breakeven inflation expectations in %

Source: Bloomberg, Goldmoney Research

The market is currently reassessing the likelihood for more hikes in 2017 and beyond. For the first time since the credit crisis, the Fed has increased its guidance for rate hikes, from two to three. In the previous years, the Fed had to continuously revise its expectations down and the last two years saw only one hike per year. After Trump won the U.S presidential election, the market began to aggressively price in higher future growth on the back of expected deregulation and fiscal stimulus. Higher economic growth would allow the Fed to hike rates more rapidly (or hike rates at all).

The Fed's median forecast for the terminal rate at this point is just 3%. That marks an increase from previously 2.8%, the first increase since the credit crisis. As for comparison, the average effective Fed funds rate over the 10 years prior to the financial crisis (1998-2007) was 3.9% (including three years of very low rates in the aftermath of the dot.com bubble). Over 20 years, it was 4.8% and over 50 years it was 6.0%.

Assuming that the Fed would only raise rates if inflation will come in at the Fed's target of 2%, this would imply real-interest rates of around 1% at the end of the hiking
cycle. Consequently, even under the best-case scenario, where there is no recession until the Fed raised rates as much as it currently hopes for, realized real-interest rates would end up barely above current levels. That means that, when confronted with a future recession, the Fed’s room for maneuver is very limited and would lead to renewed deeply negative real-interest rates. However, if the economy slows down or slips into a recession before the Fed had a chance to raise rates in the limited scope that it currently envisions, real-interest rate would most likely drop to unprecedented levels. The same would happen if inflation and / or inflation expectations keep going up. As inflation rises, real-interest rates would fall again even as the Fed keeps raising nominal rates.

At the moment, the market gives President Trump the benefit of the doubt. Whether or not a change in policy will indeed lead to higher growth needs to be seen, but rates could keep going up in the meantime anyway. Hence real-interest rates could rise again over the coming months. However, over the long run we expect real-interest rates to resume their multi decade trend. Given the level of debt in the system, it is very unlikely that central banks have too much leeway. A normalization of nominal rates back to 5%-6% or higher seems completely off the table. But this would be needed to avoid deeply negative real-rates when the next recession hits.

Both longer-dated energy prices and real-interest rates have already passed their inflection points. While we don’t expect longer-dated energy prices to move much higher in the near term (unless broad based inflation picks up), real-interest rates have little upside and a lot more downside over the long run. Therefore, there is a strong asymmetry in the outlook for gold and silver prices from current levels. As gold moves higher on the back of increased monetary demand, silver should disproportionally benefit.

Silver prices are currently about 10% below the levels predicted by the model; however, we’d like to reiterate that the model allows us to determine where we stand in a price cycle and should not be construed as a trading tool that can detect mispricings. As silver prices are formed by a number of macroeconomic factors rather than the fear and greed often tauted by financial media, understanding the outlook of these factors is key when predicting where prices are likely to go.
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