

Federal Reserve Bank of Cleveland

Gold Prices

by Joseph G. Haubrich

This January marked the 150th anniversary of a major event in American history: the discovery of gold at Sutter's Mill, California. Fittingly, gold made news again this year by dropping past \$300 an ounce to hit its lowest price in nearly two decades. While some of the subject's interest undoubtedly springs from an almost voyeuristic fascination with the precious metal itself, gold prices are nonetheless legitimate news, since they are considered harbingers of stability or future inflation. Careful observers' acquaintance with the gold market's particular twists, turns, and idiosyncrasies gives them a more reasoned understanding of its uses as an economic indicator. This *Economic Commentary* takes the confluence of historical and current events as an excuse to refine our understanding of gold, gold prices, and inflation.

■ Supply and Demand

Like any other good, gold's price depends on supply and demand. But unlike wheat, say, where most of the current supply comes from this year's crop, gold is storable and most of the supply comes from past production accumulated over centuries. In economists' jargon, the current stock far exceeds this year's flow. Of the total world supply of 125,000 metric tons of gold, annual production ranges around 2,400 tons. This means that in contrast to soybeans, corn, or pork bellies, this year's gold production has little influence on prices.

In this sense, gold behaves less like a commodity than like long-lived assets such as stocks or bonds. That characteristic makes expectations particularly important because, like the stock market, gold prices are forward-looking, and today's price depends heavily on future demand and supply.

Among other things, these expectations must take account of uncertainties in gold production, the most obvious being discoveries of new deposits. Production increased dramatically after discovery of the New World (which provided some exceptionally low-cost mines, such as Inca temples and palaces), and again in the 1850s when California and Australia became important producers. Equally essential, though less romanticized by Hollywood, have been technological changes. Development of the cyanide extraction process in 1890, for example, made it possible to recover gold from an inferior grade of ore. Further developments in chemistry and engineering continue to lower the price of extraction.

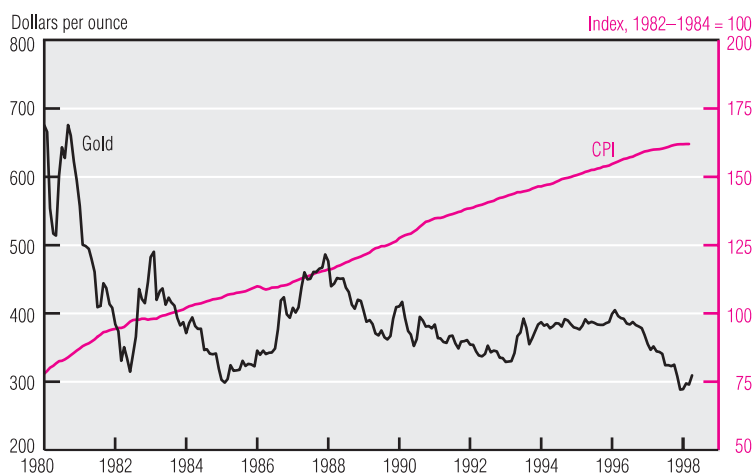
Still, unlike stocks, bonds, or Rembrandts, gold production does depend on prices. If the price of gold is very high, more mines will open up and existing ones will take out lower-grade ore. If the price is very low, some mines will shut down and others will curtail production, leaving low-grade ore in the ground. This adds a degree of "mean reversion" to the price of gold, which tends slowly to return to the cost of producing more gold.

Long after disappearing from our coinage, gold continues to command attention as a substance whose price foretells stability or inflation—and to retain a singular position on the balance sheets of central banks.

In the very short term, however, there may be no such mean reversion. A price increase today could signal an even bigger rise in the near future, enticing mine operators to reduce output until prices move up. Alternatively, high prices may reduce output temporarily by encouraging some mine operators to move to low-grade ore, which is only profitable when prices are high. Since production capacity can be somewhat fixed, the shift to lower-grade ore could mean a lower supply—and thus a higher price—of gold.¹

Gold demand puts its own spin on matters. Unlike oil, for example, which literally goes up in smoke, gold is rarely destroyed while being used.² The largest demand is for jewelry and investments (which are often lumped together because it's hard to categorize Kruggerand cuff links or ingot necklaces). Combined jewelry and investment demand runs about 2,800 tons a year. Dental and industrial demand is smaller, at 120 tons annually. Gold, of all known metals the

FIGURE 1 CPI AND GOLD PRICES



SOURCE: DRI/McGraw-Hill.

most malleable (easily shaped) and ductile (easily hammered flat or pulled into a wire),³ has many industrial applications. Fine wires are used in electronics; thin coatings are used to insulate glass. Since most gold survives its use, the total world stock continues to grow, and this characteristic too makes its prices resemble those of a long-lived asset. As a result, they show much less mean reversion than do prices of other storable commodities, such as oil or copper.⁴

Gold's extra, unique source of demand and supply, which is receiving intense scrutiny in 1998, relates to its role in the world monetary system, namely, the gold stocks of central banks. Of the total supply of 125,000 tons, between 28,000 and 35,000 are held by central banks around the world. The International Monetary Fund's current official figure is 35,623 tons, though this may be an underestimate because not all countries report their holdings.

Central bank sales were often blamed for pushing gold prices down in 1997. Early that year, Argentina sold 125 tons, an amount exceeding the average annual industrial demand; in July, Australia sold 167 tons. The Argentine sale illustrates how financial markets affect gold prices. Argentina's central bank did not sell

gold directly on the open market; instead, it exercised put options, financial contracts that entitled it to sell at a previously specified price. In November, Switzerland's central bank merely *proposed* selling 1,400 tons by the year 2000, and prices fell. This illustrates the already-mentioned "asset" side of gold, where expectations about future demand and supply matter a great deal.

A related controversy brought the point home even more powerfully. The European Union must decide how much gold the European Central Bank will hold. Fears were that it would hold a lower proportion of gold than do existing European central banks, and that this could entail selling some of the 2,900 tons currently held by the European Monetary Institute.

■ Gold Prices and Inflation

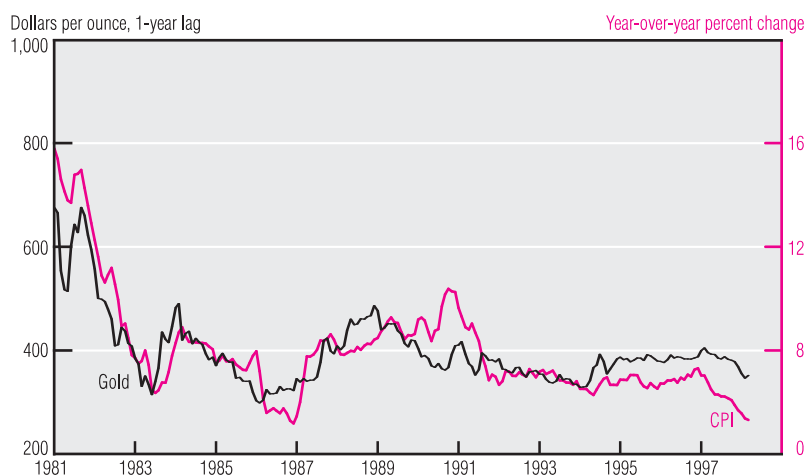
Treating gold simply as a commodity misses the point, fascinating as the particular details of its market may be. From earliest times, gold has served as money, and this association persists in many people's minds, despite the metal's disappearance from our coinage, the abandonment of the gold standard, and Mr. Keynes' wry comments about digging up gold only to bury it in bank vaults.⁵ Much of the discussion about gold prices

centers on whether the dollar remains "as good as gold"⁶ and what changes in the price of gold mean for prices and inflation in the rest of the economy.

Gold's most natural relationship to the general price level is what one might expect for any good or asset: A higher general price level should be associated with higher gold prices.⁷ To put it differently, cars cost more in 1998 than they did in 1958; so do haircuts and movie tickets. If it takes more dollars to buy cars, haircuts, and movie tickets, it seems likely that more dollars would also be needed to buy an ounce of gold. Over the long term, this generally holds true: An ounce sells for more now than it did in 1970 (\$285 versus \$35). On shorter time horizons, however, the Consumer Price Index (CPI) and the price of gold often go their separate ways. In recent U.S. experience, the relationship between the two is tenuous at best (see figure 1). Gold prices today are less than half what they were in January 1980, while the CPI has more than doubled. This is not due solely to the gold price spike of the early 1980s; gold prices now are lower than they were in 1985, even though the CPI has risen more than 50 percent since then. Such a relative price change is not unique. Consider the price of computing power, which has dropped so precipitously that a 1998 laptop is more powerful than a 1960s commercial mainframe.

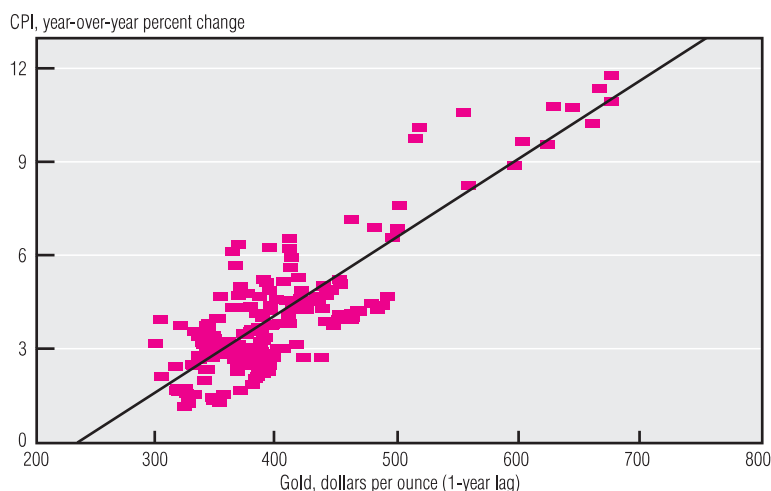
A closer relationship exists between gold prices and inflation, that is, the rate of change in the general price level.⁸ Figure 2 plots both these series, lagging gold by a year. Figure 3 further clarifies the relationship by plotting the CPI inflation rate in each period against the gold price in the previous period. Two periods particularly stand out: The high inflation of the early 1980s is matched by high gold prices, which definitely appear to "lead" the CPI inflation rate by about a year, a relationship that doesn't break down until 1988. The most recent decrease in the inflation rate also corresponds to a drop in gold prices, though that relationship is much more synchronous, without a clear lead or lag time.

FIGURE 2 CPI AND LAGGED GOLD PRICES



SOURCE: DRI/McGraw-Hill.

FIGURE 3 CPI VS. GOLD PRICES



SOURCE: DRI/McGraw-Hill.

The scatterplot diagram of figure 3 highlights the relationship more fully, though it obscures the leads and lags on view in figure 2. The slope of the line suggests that a \$100 rise in the price of gold is associated, on average, with higher inflation in the following year of 2.4 percentage points. This pedantic terminology is supposed to convey the idea that figures 2 and 3 do not say anything about causality. While gold prices do tell us something about the inflation rate, it need not be either that inflation raises gold prices or that higher gold prices cause inflation. Some third factor, such as the money supply, may influence both.

Pedantry aside, the statistical relationship does look fairly strong: Gold prices can account for more than 70 percent of variation in the inflation rate. Significantly, however, a lot of the relationship comes from high-inflation environments; without those data points, it is decidedly weaker.

There are several possible reasons for this. The relationship may only become apparent when there are big swings in the inflation rate; without them, the noise may overwhelm the signal. If this is so, we should be warned not to read too much into the current numbers, just as it's unwise to anoint any basketball

player who sinks a few shots as the next Michael Jordan. In both cases, though, it pays to keep watching.

Another feature that weakens the relationship between gold and inflation is that it may change over time. This is especially likely if some third factor, such as monetary policy, is causing the relationship. Conceivably, a monetary policy designed to bring down inflation, as in the early 1980s, might have a different impact than one promoting a stable, low-inflation environment, like that of the 1990s.⁹

The other factor to notice is the quantitative side of the relationship. Does the rebound in gold prices since January indicate a resurgence of inflation? Apart from the statistical caveats already given, it is wise to look at the actual relationship in figure 3. The rebound, lifting prices from \$280 to \$300 an ounce, predicts that inflation will increase 0.48 percent. Similarly, the newsmaking drop in the price of gold from its local high in February 1996 (when it topped \$400) to its nadir in January 1998 (just below \$280) suggests an inflation rate decrease of 2.9 percent, a more significant shift.

Conclusion

In a memorable essay, Milton Friedman wrote that "millions of people all over the world regard gold as 'money,' if not the only 'true' money."¹⁰ As a consequence, the price of gold commands attention, and rightly so, because it serves to indicate general price stability or inflation. But gold is also a commodity, used in jewelry and by industry. This means that the details of its demand and supply affect its pricing, and need to be considered when gold is used to assay monetary policy.

■ Footnotes

1. This is a simplification, as the full argument relies on other factors such as mines' inventory policy. The evidence seems to support the idea that higher gold prices mean lower output in the short run (see James Barney Marsh, "Keynes on the Supply of Gold: A Statistical Test" *Eastern Economic Journal*, vol. 9, no. 1 [January–March, 1983], pp. 7–12).
2. Of course, it is not always recycled after its industrial uses, and in certain other cases it is destroyed or irrecoverable. For example, gold leaf of 20 carats and above is edible (see Martha Stewart, *Martha Stewart's Christmas*, New York: C.N. Potter, 1989).
3. One ounce of gold, about the size of a human teardrop, can be beaten into 187 square feet of gold leaf or drawn into a mile of fine wire.
4. For a sophisticated discussion of these results, see Eduardo S. Schwartz, "The Stochastic Behavior of Commodity Prices: Implications for Valuation and Hedging," *Journal of Finance*, vol. 52, no. 3 (July 1997), pp. 923–73.
5. See *The General Theory of Employment Interest and Money*, New York: Harcourt, Brace and Company, 1936, sec. 6, chap. 10, pp. 128–31.
6. The phrase, oddly enough, is from Charles Dickens, *A Christmas Carol* (1848), stave III.
7. The meaning of "inflation" has changed over the years and is not completely standard even today (Michael F. Bryan, "On the Origin and Evolution of the Word Inflation," Federal Reserve Bank of Cleveland, *Economic Commentary*, October 15, 1997).
8. Two recent discussions that highlight this relationship are Jude Wanninski, "The Optimum Price of Gold," *The Wall Street Journal*, January 7, 1998, p. A22, and Wayne Angell, "The Fed: On the Right Course," *The Wall Street Journal*, December 16, 1997, p. A18.
9. Whether further reductions in the inflation rate are desired is a separate, and often disputed, matter.
10. "A Commodity Reserve Currency" in *Essays in Positive Economics*, Chicago: University of Chicago Press, 1953, p. 239.

Joseph G. Haubrich is a consultant and economist at the Federal Reserve Bank of Cleveland.

The views stated herein are those of the author and not necessarily those of the Federal Reserve Bank of Cleveland or the Board of Governors of the Federal Reserve System.

Economic Commentary is available electronically through the Cleveland Fed's site on the World Wide Web: <http://www.clev.frb.org>. We also offer a free online subscription service to notify readers of additions to our Web site. To subscribe, please send an e-mail message to econpubs-on@clev.frb.org.

**Federal Reserve Bank of Cleveland
Research Department
P.O. Box 6387
Cleveland, OH 44101**

Return Service Requested:
Please send corrected mailing label to the above address.

Material may be reprinted provided that the source is credited. Please send copies of reprinted materials to the editor.

**BULK RATE
U.S. Postage Paid
Cleveland, OH
Permit No. 385**