CHAPTER 1

COMMODITY SPECIAL FEATURE

Online Annex

Precious Metals as Inflation Hedge

A. Testing Inflation Hedging Properties of Precious Metals

Based on Beakert and Wang (2010), nominal local-currency returns are regressed on a constant and CPI inflation at various horizons (1-month, 6-month, 1-year, 5-year), for all precious metals and across countries. A coefficient equal to 1 indicates that the asset is a perfect inflation hedge in *expectation* over the specified horizon.[1] A low R-squared, however, indicates that what works in expectation, in practice, rarely does. The equation for each country is

$$R_{k,t,t-j} = \alpha_k + \beta_k \pi_{t,t-j} + \varepsilon_{k,t}$$

Where π is the realized inflation rate and $R_{k,t,t-j}$ is the realized return on precious metal-k over the period [t-j, t] with the price of the precious metal expressed in local currency.

B. Data Description and Results

The dataset includes 142 countries: the G7 countries, other 26 advanced economies, 71 emerging markets and developing economies, and 38 low-income developing economies. Data are at monthly frequency. Precious metal prices are in USD from Thomson Reuters Datastream. Nominal returns of precious metals for each country are the logarithmic difference of nominal precious metal prices expressed in local currency. Exchange rate and CPI data are from IMF's International Financial Statistics. Our sample period ends in April 2019, whereas the starting point is constrained by data availability for some countries. Gold and silver prices are available from January 1970; platinum and palladium prices are available from January 1976 and January 1987, respectively.

Annex Table 1.SF.1 shows the weighted average betas from the regressions where weights are derived using the inverse of the betas' robust standard errors (Newey-West 1987). Betas vary substantially across countries groups. For EMDE and LIDC, betas of all precious metals increase with the horizon and are around 1 at the 5-year horizon, probably due to periods of high inflation. For G7 countries, instead, the betas for gold and silver are bigger than 1 also at 1-month horizon. Palladium prices are not an inflation-hedge in the sense of Bekaert and Wang for AEs.

[1] In Fama and Schwert (1977), a classic paper on inflation hedging, an asset is viewed as a complete hedge against inflation if it has coefficients equal to one on both variables in this regression. In periods of low inflation volatility results do not change qualitatively when inflation expectations are introduced. It is, instead, more challenging to find reliable inflation expectation data for a period of high inflation such as the 1970s and 1980s or also in some countries that experienced a period of high inflation, such as Brazil in the 1990s.

Annex Table 1.SF.1 Inflation Betas by Country Group (Averages)

All	Horizon	Gold	Silver	Platinum	Palladium
	1 Months	0.42	0.48	0.44	0.40
	6 Months	0.77	0.81	0.77	0.66
	12 Months	0.90	0.89	0.82	0.61
	5 Years	1.05	1.05	0.89	0.72
G7	1 Months	1.33	1.45	0.74	0.44
	6 Months	2.09	1.86	1.05	-1.10
	12 Months	2.30	1.95	1.10	-5.62
	5 Years	2.41	2.06	1.30	-9.16
AE	1 Months	0.48	0.52	0.44	0.38
	6 Months	0.82	0.76	0.70	0.27
	12 Months	0.93	0.79	0.65	-0.54
	5 Years	1.42	1.23	0.80	-2.32
EMDE	1 Months	0.53	0.58	0.52	0.46
	6 Months	0.86	0.89	0.84	0.74
	12 Months	0.94	0.92	0.87	0.72
	5 Years	0.99	1.00	0.88	0.92
LIDC	1 Months	0.22	0.29	0.30	0.29
	6 Months	0.54	0.64	0.63	0.59
	12 Months	0.78	0.84	0.75	0.66
	5 Years	1.05	1.17	1.00	1.16

Sources: IMF, International Financial Statistics; IMF, Primary Commodity Price System; and IMF staff calculations.

Note: The betas reported are weighted average by country group (weight = the inverse of the Newey West std). Betas for each coutnry come from regressions between log difference of 1-month, 6-month, 12-month, 5-year's nominal precious metal price in local currency and infaltion corresponding to the same horizon. Countries include AE = Advanced economies; EMDE = Emerging market and developing economies; LIDC = Low-income developing economies.

Determinants of One-Month Return on Precious Metals

Table 1.SF.5 shows the results of regressing nominal metal returns on global industrial production, expected and surprise inflation, yields of U.S. treasury bill, lagged real metal price, inflation volatility, and the U.S. nominal effective exchange rate orthogonalized relatively to all other regressors. Oil prices are introduced as control variable.

Metal returns are defined as monthly log-differences of metal prices denominated in U.S. dollars (Thomson Reuters Datastream). The sample's end of the period is December 2018, the beginning of the period is determined by data availability: Gold, silver, platinum, and copper prices are available from January 1980 while palladium prices are available from January 1987.

Inflation is the monthly logarithmic difference of the U.S. consumer price index, CPI (IMF's International Financial Statistics). Real metal prices are deflated by the U.S. CPI. Expected inflation is from University of Michigan's Consumer Sentiment before October 1989 and Consensus Economics afterward. Consensus Economics surveys inflation expectations for the current and next calendar year every month. Hence, within the same calendar year, inflation expectations become more accurate as time goes by introducing seasonality in the volatility of the inflation surprise series. To remove this seasonality, a weighted inflation expectation series is constructed using equations as follows

$$E_t\pi_{t+12} = w_m E_t\pi^{current} + \left(1 - w_m\right) E_t\pi^{next}$$

$$w_m = \frac{13-m}{12}$$ where m = 1,…,12 refer month of the year

Inflation surprises are the difference between inflation and expected inflation. Inflation volatility is the rolling standard deviation of year-on-year inflation over the past 36 months. Alternative measures of inflation uncertainty have also been used such as Consensus Economics' inflation forecast dispersion, but the beginning of the sample period is restricted to 1990.

U.S. treasury bills are the 1-month treasury constant maturity rate after June 2001 and the 3-month treasury bill secondary market rate before July 2001 (Thomson Reuters Datastream). The exchange rate is the U.S. JP Morgan Nominal Effective Exchange Rate from Thomson Reuters Datastream. Finally, global industrial production is from IMF's Global Data Source; oil price is the average petroleum spot price from IMF's Primary Commodity Price System.