Commodities Investment Insight

Inflation and Commodities: Examining the Link

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Introduction

Commodities are commonly viewed as an inflation hedge. This perception is driven by two factors—the first being the numeraire effect of U.S. dollar pricing and the second due to how inflation may be defined. A common way to measure the inflation rate is to calculate the percentage change in the consumer price index (CPI). In the United States, the Bureau of Labor Statistics (BLS) publishes the monthly price index based on a pre-determined basket of goods and services. A large fraction of the U.S. CPI basket contains exposure to commodities[1].

We focus on the properties of commodities returns in relation to U.S. inflation. The analysis is divided into two parts (1) assessing the linear relationship between inflation and commodities returns and (2) examining commodities' return characteristics, controlling for the level of inflation. Since the aim is to assess the changes in the CPI, we use non-seasonally adjusted CPI data.

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Data

Commodities data are available from January 1960 for the Bloomberg Commodity Index (BCOM). The start dates for the sector indices are February 1960 (agriculture), January 1975 (precious metals), January 1984 (energy), January 1987 (livestock) and January 1991 (base metals). The tickers for the sector indices on the Bloomberg Terminal are given by BCOMAG Index, BCOMPR Index, BCOMEN Index, BCOMLI Index and BCOMIN Index. This long index history allows us to analyze the commodity-inflation relationship over multiple business and economic cycles. The BCOM 3-months deferred index (BCOM3F Index), which we use in the last section, begins in 1992. When making inter-sector comparisons throughout this paper, the reader should be mindful of the differing sample sizes due to varying start dates.

In this publication, we use a quarterly frequency for commodities returns and the inflation rate is measured as the quarterly percentage change in the original (not seasonally adjusted) U.S. Consumer Price Index for All Urban Consumers (CPI-U). The BLS periodically revises historical CPI data. In this publication we use the revised data, not the originally published data.

Inflation betas

The term 'inflation beta' is sometimes used when discussing the inflation hedging properties of equities and commodities. It simply refers to the slope coefficient when regressing asset returns on inflation and is intended to provide an indication of suitability as a hedging instrument. Given interest is driven by whether passive exposure to the asset can be used as a hedge, establishing the statistical significance of the coefficient (the t-statistic) is arguably more important than the actual value of the coefficient (since the latter simply implies the level of scaling of exposures).

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[1] Bureau of Labor Statistics (https://www.bls.gov/news.release/cpi.t01.htm)

Aggregate index

The first step is to run a full-sample univariate regression of BCOM on inflation. This reveals a statistically significant coefficient with an R-squared of 0.15 and a slope coefficient of 3.9 (Figure 1).

Figure 1: The full sample displays a positive relationship

$y = 3.9x - 0.025$
$R^2 = 0.15$
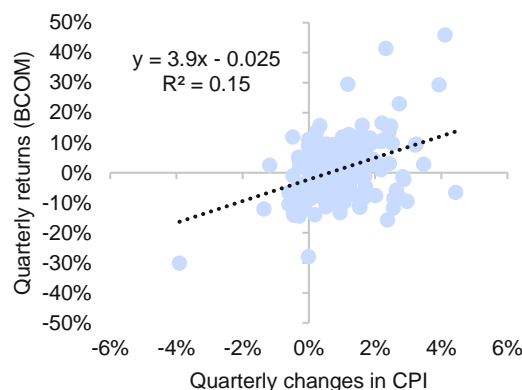
Source: Bloomberg

Does this relationship vary over time? We run rolling regressions over eight years[2] of quarterly data to examine how the relationship evolved over time. In all the regression figures we display the ±2 t-stat thresholds, since they refer to the commonly used significance level of 0.05. Thus, a t-stat greater than 2 or less than -2 implies a statistically significant relationship over the preceding eight years.

Figure 2: The strength of the relationship is time-varying
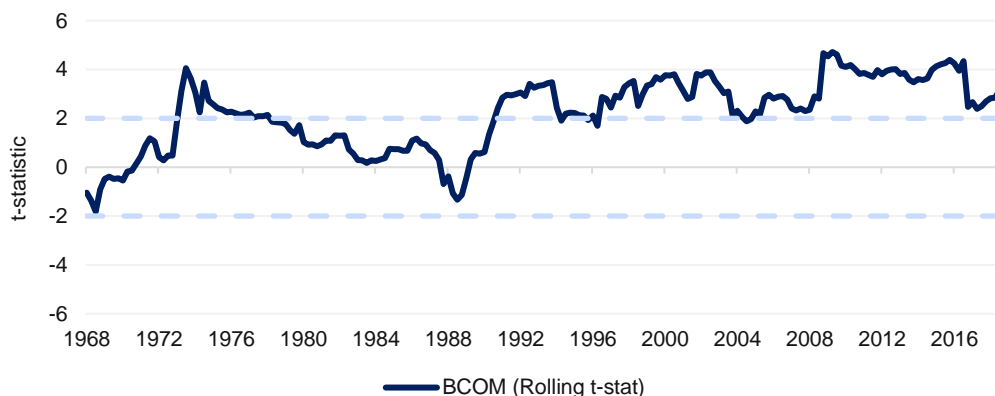
Source: Bloomberg

The regression reveals the time-varying nature of the relationship. As seen in Figure 2, aside from a brief period around 1966-1970 (since the regression is over an eight-year period, significance in 1974 is driven by data from 1966-1974), changes in commodity prices displayed a weak and statistically insignificant relationship to inflation. This changed around 1984—after which the regression coefficient (or 'inflation beta') has remained significant.

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[2] To account for the length of the average business cycle
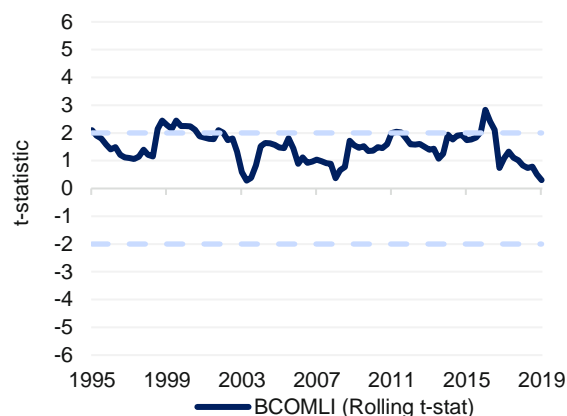
Sector indices

We now look at the variation between the five sectors comprising the BCOM index. In Figures 3-7 we see a significant amount of variation in both patterns and the magnitude of the t-statistics.

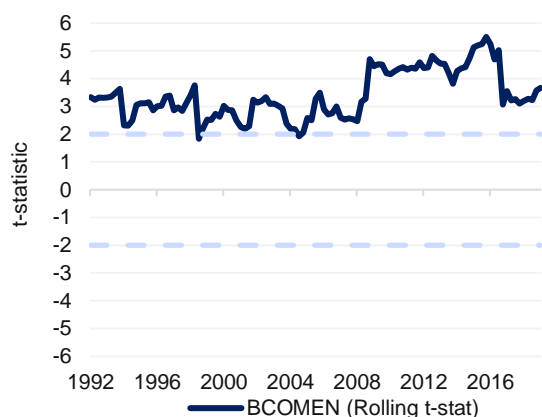Figure 3: Agriculture (1960 – 2019)

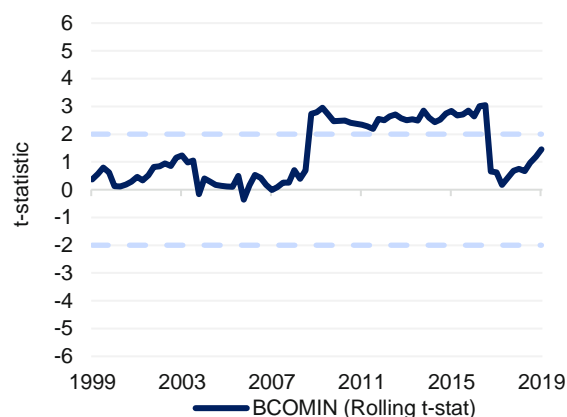Source: Bloomberg

Figure 4: Livestock (1987 – 2019)

Source: Bloomberg

Figure 5: Energy (1984 – 2019)

Source: Bloomberg

Figure 6: Base metals (1991 – 2019)

Source: Bloomberg

The two most contrasting results are the significance displayed by the energy sub-index (Figure 5) and the marked lack of significance of precious metals (Figure 7). The results tend to support the common belief that energy is a good (passive) inflation hedge. On the other hand, the rolling t-statistic for precious metals does not provide supporting evidence for the same claim for this sector.

Figure 7: Precious metals (1975 – 2019)
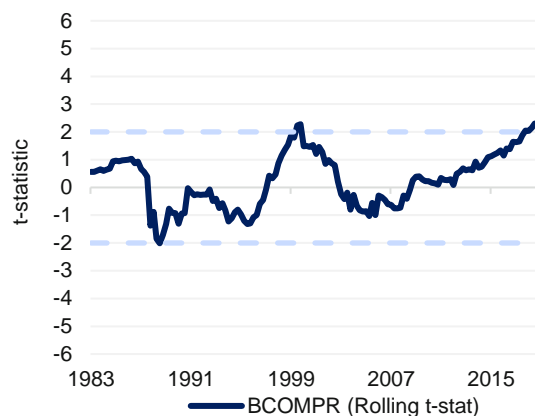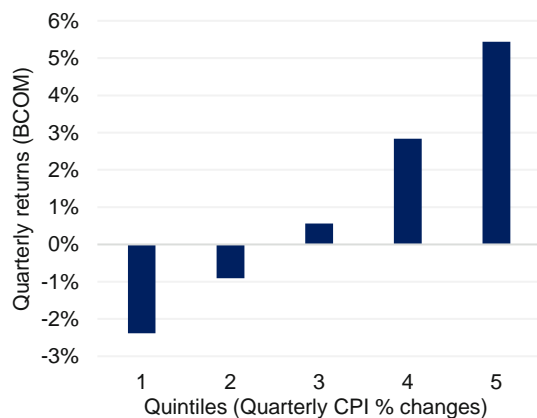

Source: Bloomberg

Another perspective: non-linear relationships and tail hedges

While simple, assessing the effectiveness of commodity sectors to hedge inflation through an OLS regression framework only identifies linear relationships. Establishing whether there is a level effect (i.e. whether the behavior in the tails is different from other periods) is also important. Based on the full data sample of the BCOM index and the sub-indices, we run a quintile-based analysis to try and answer this question. The data history is identical to that used for the regression analysis.

Quarterly changes in CPI (once again, non-seasonally adjusted) are ranked in ascending order and the corresponding index returns are calculated. The typical analysis calculates the mean index return for each quintile and assesses the performance. This can be seen in Figure 8 for the BCOM index.

A quick look at the mean returns of each quintile seems to suggest a stable relationship (monotonically increasing returns by quintile) and attractive hedging properties, but such a simple look at the data may be misleading. Summary statistics for the returns in each quintile—the mean, median, interquartile range (IQR) and values which lie up to 1.5x the IQR—provide more information with which to assess potential hedging capabilities.

Figure 8: BCOM (Average returns)

Source: Bloomberg

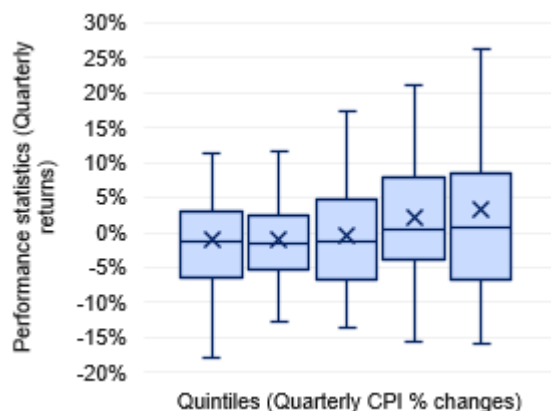Figure 9: BCOM (Summary statistics)
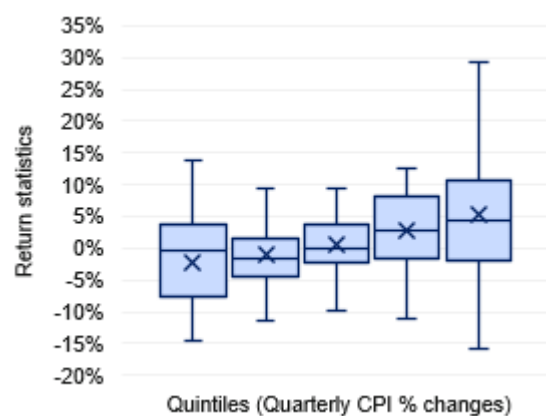
Source: Bloomberg

The summary statistics for BCOM are displayed in Figure 9. For explanatory purposes, the boxes contains the IQR, the horizontal line in the box is the median, the cross represents the mean (average) and the extended bars display the range of values up to 1.5x the IQR. This more complete picture of returns shows that the monotonic pattern observed in Figure 8 is driven by a few large negative/positive returns in quintile 1/quintile 5. Medians tend to be a more robust estimate as they are impervious to outliers, unlike the mean. Quintiles 1-3 display little-to-no pattern, with median values of quarterly BCOM returns ranging from -1.6% to 0.1%. Quintiles 4 and 5, however, display positive medians (2.7% and 4.4%, respectively). The dispersion of returns in quintile 5 also appears to be the largest. This indicates that while the BCOM index does have favorable hedging properties over the full sample when inflation was high, it also would have suffered from sporadic large losses during those periods.
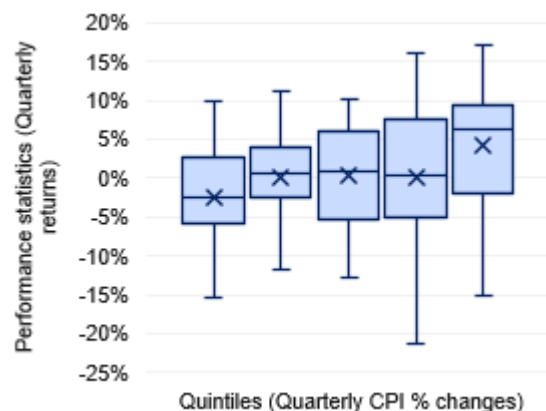
We repeat this analysis for each of the five subsectors (Figures 10-14). For comparison purposes, the corresponding quintile analysis for only the means are provided in the appendix.

Figure 10: Agriculture (summary statistics)   Figure 11: Livestock (summary statistics)

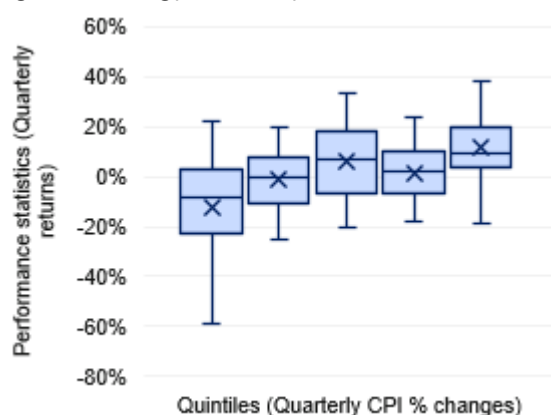Source: Bloomberg   Source: Bloomberg

For agriculture, the pattern of both the mean and median quarterly returns is similar to the BCOM index. Once again, Q5 displays high dispersion—exceeded on the downside only by Q1.

The livestock sector displays slightly different characteristics. Returns in Q1 display poor performance (mean of -2.5% and median of -2.6%). The middle quintiles (Q2-Q4) have mean and median returns that are slightly positive, while returns in Q5 are highly positive (mean and median of 4.2% and 6.4% respectively). Once again, we note the dispersion in returns (length of the extended bars) does not appear to follow a consistent pattern from Q1 to Q5.

Figure 12: Energy (summary statistics)

Source: Bloomberg

Figure 13: Base metals (summary statistics)
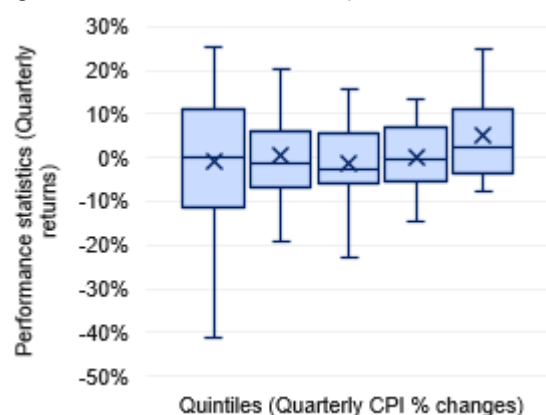
Source: Bloomberg

Energy displays sharply contrasting behavior in the tails (Figure 12). When inflation is lowest, the median return is -8.5% with a large negative skew. When inflation is in the top quintile, energy returns have a median of 9.7% and a positive skew.

Base metals is a mixed bag (Figure 13). There is little discernable pattern from Q1 to Q4 with the median return ranging from -2.4% to 0.3%. However, during periods when inflation was highest, returns were correspondingly high—with a mean and median of 5.3% and 2.3% respectively.

Figure 14: Precious metals (summary statistics)
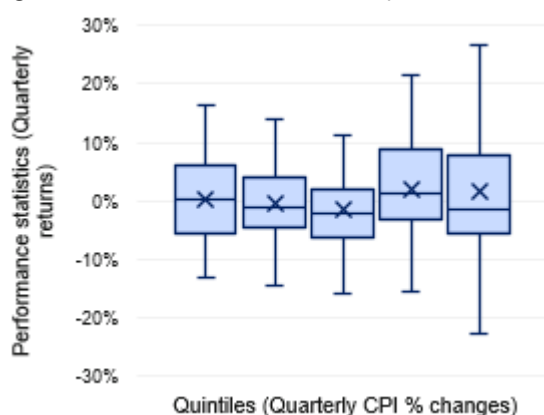
Source: Bloomberg

The returns of precious metals by quintile displayed no discernable pattern, either in the means/medians or the dispersion of returns.

Considering roll returns

Most commodity investors access the market through futures instruments. As a result, not only do they accrue the spot return, but also the roll return—which is a result of 'rolling down/up' the futures curve. Can we incorporate this feature to improve the return characteristics of the commodities allocation? To answer this question, we look at the BCOM index and the 3-month deferred index (ticker on Bloomberg is BCOMF3 Index) over the period 1992-2019. The 3-months deferred index is constructed by replicating returns accrued by investing in contracts around the 3-months point, rather than the contract for immediate delivery.

Using the quintile-based analysis, we do a side-by-side comparison between the nearby and deferred indices. The blue boxes represent the nearby index (BCOM) returns. The purple boxes represent the 3-months deferred index (BCOM3F).

Figure 15: Nearby versus 3-month deferred indices: Comparing performance (1992 – 2019)
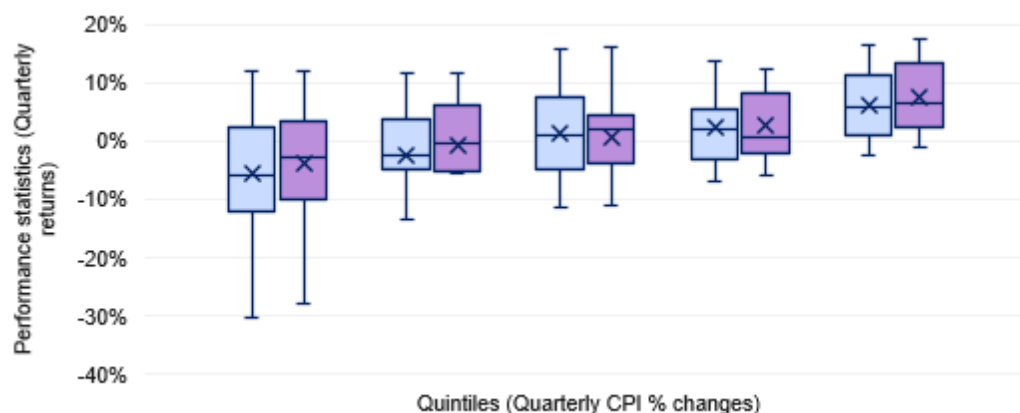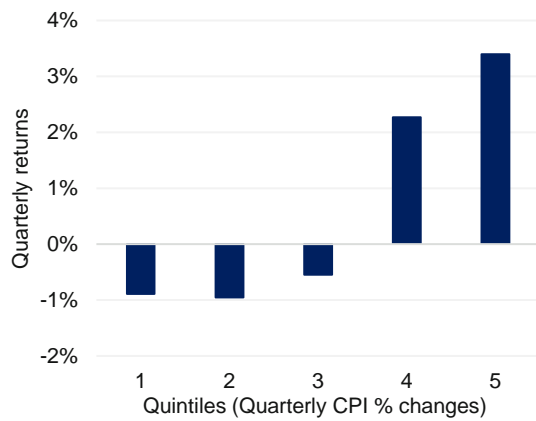

Source: Bloomberg

Both the mean and median returns from the deferred index are larger to that of the nearby with the minor exception of quintile 4. This is accompanied by a lower dispersion of returns per quintile.

In conclusion, the results of our analysis indicate the link between commodities and inflation is more nuanced than a simple view that "commodities hedge inflation". As shown here, the relationship is time-varying and differs by sector. Given commodities are typically accessed through the futures market, the impact of roll yield also plays an important part.
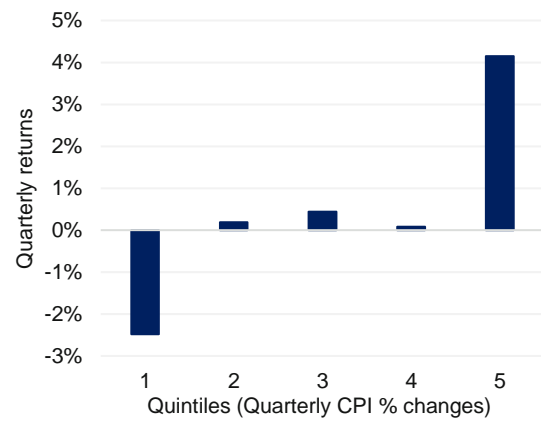
Appendix

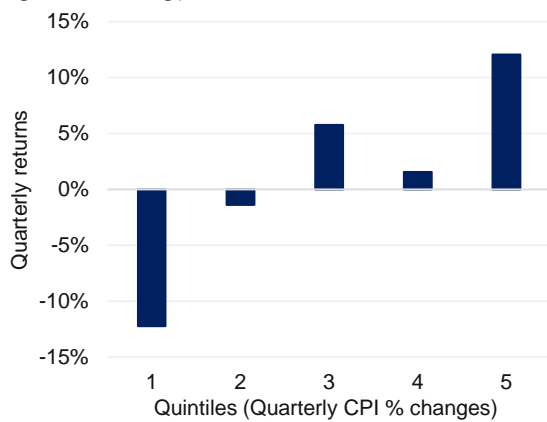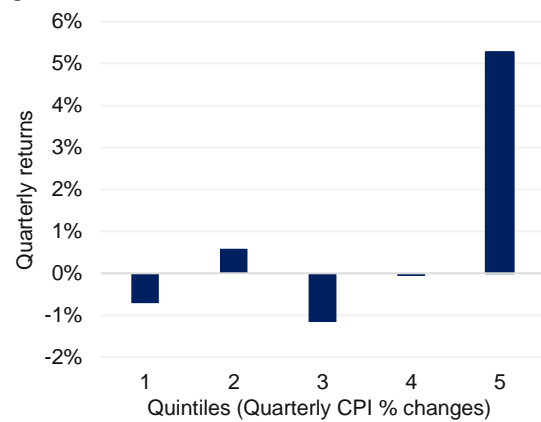Figure 16: Agriculture

Source: Bloomberg

Figure 17: Livestock

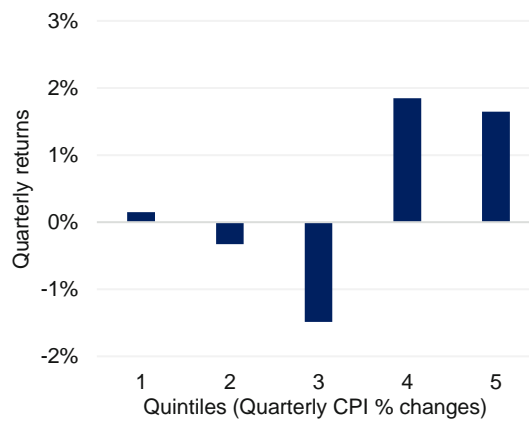Source: Bloomberg

Figure 18: Energy

Source: Bloomberg

Figure 19: Base metals

Source: Bloomberg

Figure 20: Precious metals

Source: Bloomberg

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