

Gold: the most effective commodity investment

Why it is under-represented in
commodity indices and the potential
impact on your portfolio



About the World Gold Council

The World Gold Council is the market development organisation for the gold industry. Our purpose is to stimulate and sustain demand for gold, provide industry leadership, and be the global authority on the gold market.

We develop gold-backed solutions, services and products, based on authoritative market insight and we work with a range of partners to put our ideas into action. As a result, we create structural shifts in demand for gold across key market sectors. We provide insights into the international gold markets, helping people to understand the wealth preservation qualities of gold and its role in meeting the social and environmental needs of society.

Based in the UK, with operations in India, the Far East and the US, the World Gold Council is an association whose members comprise the world's leading gold mining companies.

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Gold: not your typical commodity

Gold is the most effective commodity investment, yet it is under-invested

Gold allocations of 2%-10% in a typical pension portfolio¹ have provided better risk-adjusted returns than those with broad-based commodity allocations.

Investors have long recognised the benefits of investing in commodities. Over time, they have been shown to improve portfolio risk-adjusted returns, offering diversification, inflation protection and an element of smoothing across economic cycles.

Most investors access this asset class via commodity indices, which invariably include gold.

But gold's weighting within these indices undervalues its importance as a strategic portfolio asset (**Table 1** and **Table 2**). Gold is, of course, a raw material used in the production of manufactured goods – the very definition of a commodity. But gold is much more than that. As both an investment and a consumer good, it is a multi-faceted asset that enjoys diverse supply and demand dynamics that play an important role in gold's performance (See **Appendix II** for more information).

Standing apart from the commodities complex, gold deserves to be seen as a differentiated asset as it has historically benefited from six key characteristics.

- It has delivered better long-term, risk-adjusted returns than other commodities
- It is a more effective diversifier than other commodities
- It outperforms commodities in low inflation periods
- It has lower volatility
- It is a proven store of value
- It is highly liquid.

Ultimately, commodities can be a relevant tactical asset, but a strategic gold allocation can supplement or replace a broad-based commodities investment alone, as it may offer more widespread benefits (**Chart 15**).

Better returns, effective diversification

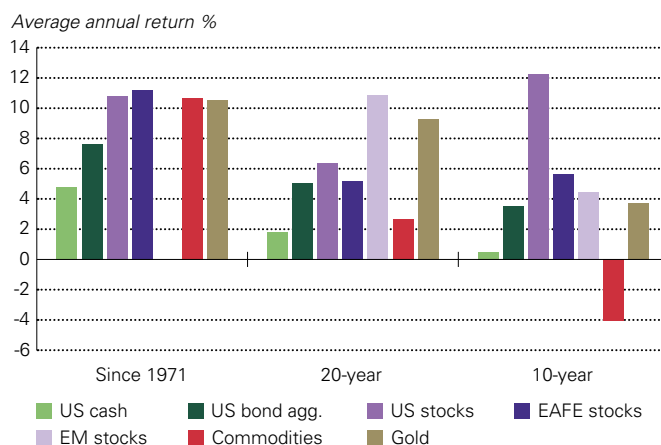
Outperforming commodities

Gold has performed broadly in line with the S&P 500 over the long term, delivering average annual returns of 10.4% since the elimination of the gold standard in 1971 (**Chart 1**), and a compound annual return of 7.6% (**Chart 16, Appendix I**).

But, when compared to commodities, gold has outperformed not only broad-based indices but sub-indices and most individual commodities too. All sub-indices, including precious metals, have fallen over the past five years. But gold has risen during that time. Gold has also outperformed major commodity sub-indices over the past 10 and 20 years (**Chart 2**), and outperformed most individual commodities, many of which have delivered negative returns in recent decades (**Chart 17, Appendix I**).

Chart 1: Annualised returns of gold and other assets

Gold returns are on par with the stock market over the long run*



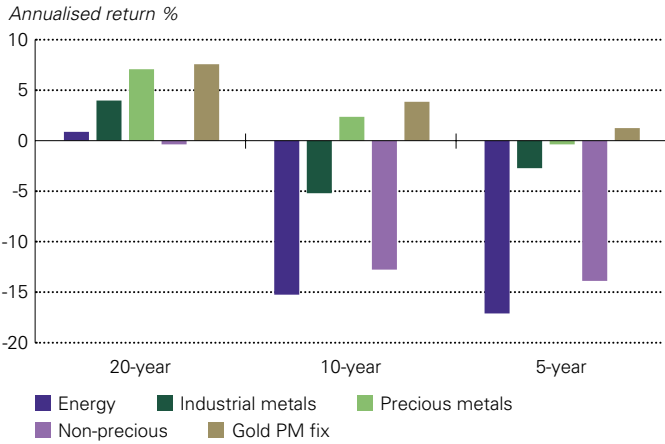
*As of 30 June 2019. Based on total returns indices including MSCI US, MSCI EAFE, MSCI EM, JP Morgan 3-month US cash, BarCap US Bond Aggregate, Bloomberg Commodity for the 10- and 20-year average, and S&P GSCI Index since 1971 due to data availability. Gold performance based on the LBMA Gold Price. Data between January 1971 and 30 June 2018.

Source: Bloomberg, ICE Benchmark Administration, NBER, World Gold Council

¹ The average PF portfolio is based on Willis Towers Watson Global Pension Assets Study 2017 and Global Alternatives Survey 2016. It includes a 60% allocation to stocks (35% Russell 3000, 20% MSCI ACWI ex US, 5% FTSE REITs Index), 40% allocation to fixed income (30% Barclays US Aggregate, 5% Barclays Global Aggregate ex US, and 5% short-term Treasuries).

Chart 2: Commodity sub-index returns

Gold outperformed commodity sub-indices over the past 5-, 10- and 20-years*



*Annualised returns through June 2019. Indices include: S&P GS Energy Index, S&P GS Precious Metals Index, S&P GS Industrial Metals Index, S&P GS Non-Precious Metals Index, Gold (US\$/oz) London PM fix.

Source: Bloomberg, World Gold Council

Diversification that counts

Gold has important diversification properties that come into their own during periods of systemic risk.

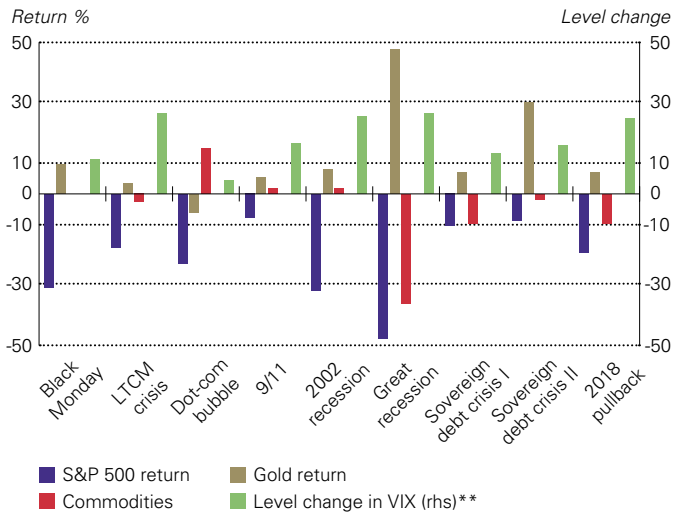
Gold has little or no correlation with many other assets, including commodities (Table 3), during times of stress. Crucially, however, the correlation is dynamic, changing across economic cycles to the benefit of investors.

Like other commodities, gold is positively correlated to stocks during periods of economic growth when equity markets tend to rise. However, gold is negatively correlated with other assets during risk-off periods, protecting investors against tail risks (Chart 3) and other events that can have a significant negative impact on capital or wealth – a protection not always present in other commodities.

This dynamism reflects gold’s dual nature as both a consumer good and an investment. When economic conditions are benign, expenditure tends to increase on items such as jewellery or technological devices (Chart 4), and this works in gold’s favour. During times of systemic risk, however, market participants seek high-quality, liquid assets that preserve capital and minimise losses. This can also benefit gold by boosting investment demand and driving up prices. In the Q4 2018 global equity sell-off, for example, the S&P 500 fell 14% and commodities fell 9%, yet gold rose 8%.

Chart 3: Gold, unlike commodities, tends to have a positive performance when volatility increases

Performance of stocks, gold, commodities and VIX during periods of systemic risk*

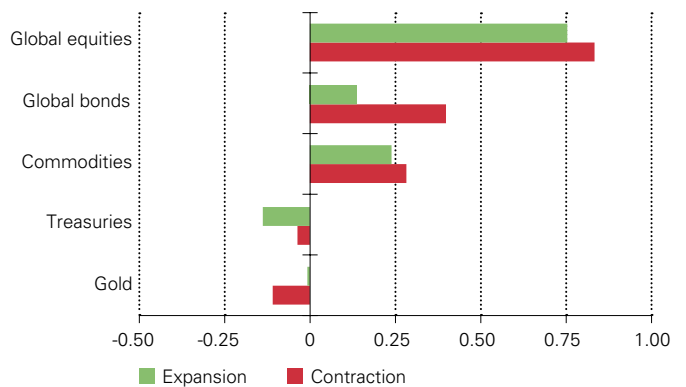


**The VIX is available only after January 1990. For events occurring prior to that date, annualised 30-day S&P 500 volatility is used as a proxy. Dates used: Black Monday: 9/1987-11/1987; LTCM: 8/1998; Dot-com: 3/2000-3/2001; September 11: 9/2001; 2002 recession: 3/2002-7/2002; Great recession: 10/2007-2/2009; Sovereign debt crisis I: 1/2010-6/2010; Sovereign debt crisis II: 2/2011-10/2011; 2018 Pullback 10/2018–12/2018. Commodities is the Bloomberg Commodity Index.

Source: Bloomberg, World Gold Council

Chart 4: US stocks' correlation to major financial assets during expansions and contractions

Gold is more negatively correlated to the market than Treasuries in periods of contraction*



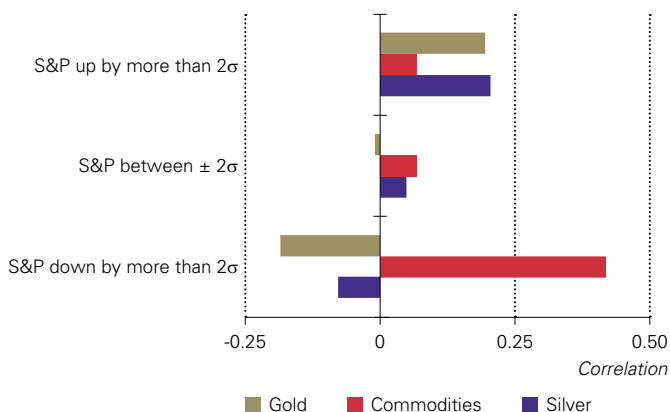
*As of 30 June 2019. Based on monthly returns from January 1987 to June 2019 of the S&P 500, MSCI ACWI ex US, BarCap Treasuries and Corporates, Bloomberg Commodity Index and LBMA Gold Price. Business cycles as defined by the National Bureau of Economic Research (NBER).

Gold is also a more effective diversifier than other precious metals. While gold's correlation to silver and platinum was positive during periods of growth, it decreased during market downturns as these other metals depend, to a greater extent, on industrial demand (**Chart 5** and **Chart 18, Appendix I**).

Gold and oil prices are not correlated, contrary to popular belief. At times, the two commodities move in the same direction, at others in opposite directions (**Chart 6**), but there is no consistent relationship between the two. Oil tends to behave more like a risky asset, while gold is widely regarded as a risk-off asset (**Chart 19, Appendix I**).

Chart 5: Gold and silver correlation

Correlation between gold, commodities and silver with US stock returns, in various environments of stocks' performance*



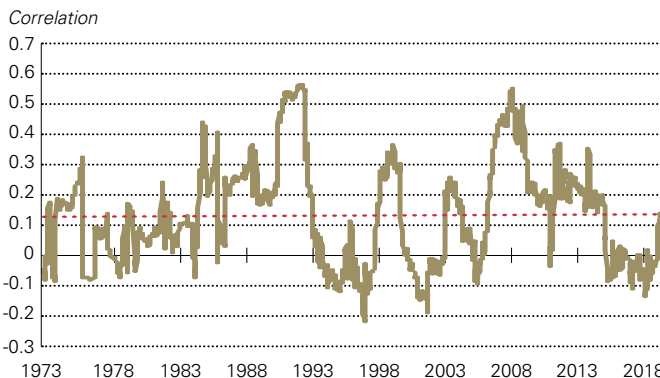
*As of 30 June 2019. Correlations computed using weekly returns based on the Bloomberg Commodity Index and the LBMA Gold and Silver Price PM since January 1987.

The middle bar corresponds to the unconditional correlation over the full period. The bottom bar corresponds to the correlation conditional on S&P 500 weekly return falling by more than two standard deviations (or 'σ') respectively, while the top bar corresponds to the S&P 500 weekly return increasing by more than two standard deviations. The standard deviation is based on the same weekly returns over the full period.

Source: Bloomberg, ICE Benchmark Administration, World Gold Council

Chart 6: Correlation between gold and oil (monthly returns)*

Looking back over the past 45 years, gold's correlation to oil ranges from -0.2 to 0.55 on a two-year rolling monthly basis



*As of 30 June 2019.

Data is calculated using the rolling two-year correlation of monthly returns of oil and gold. The LBMA PM fix price is used for the price of gold and the oil prices are determined via the Bloomberg Historical Oil Price Index as well as the Bloomberg WTI Crude Oil Sub Index Total Return.

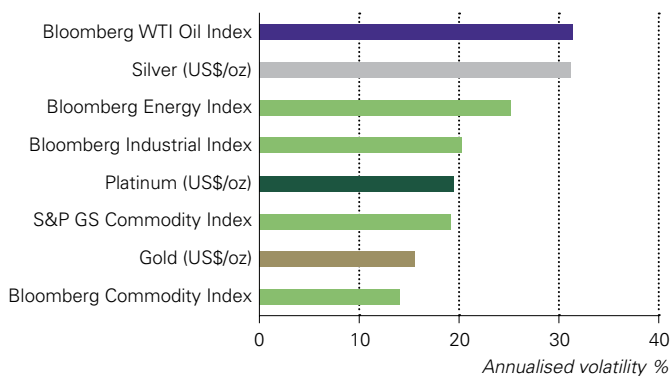
Source: Bloomberg, World Gold Council

Low volatility

Gold is less volatile than most individual commodities and broad commodity indices (**Chart 7** and **Chart 20, Appendix I**). It is also less volatile than equities: from individual stocks to industry sectors, to indices such as the Global MSCI series (**Chart 21, Appendix I**). As such, gold can enhance portfolio stability and improve risk-adjusted returns.

Chart 7: Gold, precious metals and commodity index volatility

Gold is less volatile than most major commodity indices*



*June 2009 to June 2019 annualised daily volatility of various commodities.

Source: Bloomberg, World Gold Council

Protecting against inflation

Commodities are often used for diversification during periods of high inflation. While it is true that commodities have performed well during inflationary periods, gold has performed better. And in periods of low inflation, commodities delivered negative nominal returns, while gold posted positive returns, reflecting increased demand when economic conditions are robust (**Chart 8**).

This behaviour is particularly relevant today. Current inflation expectations are low, so gold should outperform other commodities. Future expectations suggest a growing risk of higher inflation. This should also drive demand for gold.

Gold as store of value

Gold has a long and influential role as a monetary asset. Other metals, including silver and copper, have historically been used as currency but gold's role in the monetary system is far more extensive. Considered a rare and precious asset for centuries, gold was a logical choice as a currency anchor and performed this role until the US came off the gold standard in 1971. As such, it made an important contribution to global economic architecture and, to this day, is considered a valuable international asset, protecting against currency declines (**Chart 22, Appendix I**). Prior to 1971, major commodities enjoyed periods of time where their value in gold terms reflected inflation and increased, whilst the price of gold was

pegged to the US dollar. After 1971, when the price of gold was able to float, the value of commodities in gold terms fell sharply.

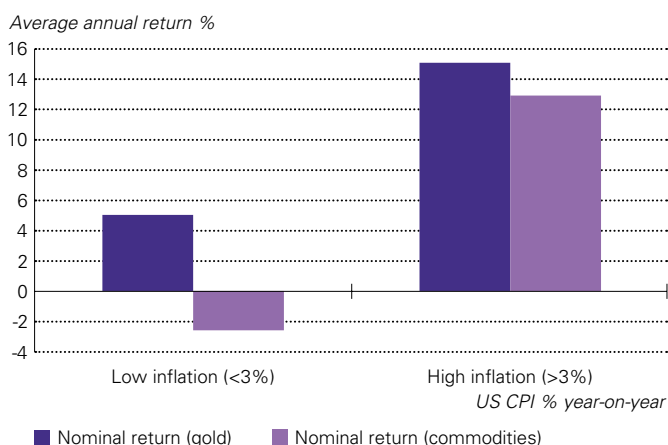
Indeed, while gold no longer plays a direct role in the international monetary system, central banks and governments still hold extensive gold reserves (**Table 9, Appendix II**) to preserve national wealth and protect against economic instability. Central banks are buying gold at an ever-increasing pace (**Chart 27, Appendix II**); in 2018 alone they purchased more gold than at any time since the end of the gold standard – and that trend has persisted through the first half of 2019. Today, gold is the third largest reserve asset globally, following US dollar- and euro-denominated assets. Moreover, gold is increasingly used as collateral in financial transactions, much like other high quality, liquid assets such as government debt.

Global liquidity on a physical-linked market

The gold market is robust and highly liquid. On the futures market, daily volumes average US\$51bn (**Table 4, Appendix I**), second only to oil (**Chart 9**); and on the OTC market, estimated volumes are even higher, at around US\$61bn. There is a thriving physical gold-backed ETF market too, with daily volumes averaging US\$1bn.² Overall, average daily trading in the global gold market ranges between US\$100bn and US\$200bn a day (**Table 5, Appendix I**).

Chart 8: Gold and commodity returns as a function of inflation

Both work well in high inflation environments but commodities break down in low inflation markets*

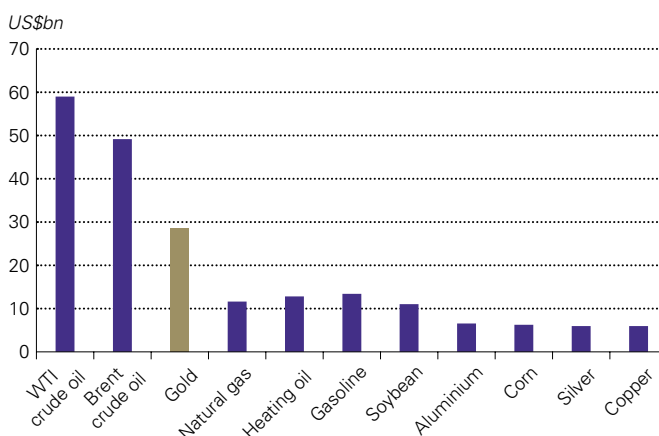


*Based on year-on-year changes of the LBMA Gold Price, Bloomberg Commodity Index and US CPI between 1971 and 2018.

Source: Bloomberg, Bureau of Labour Statistics, ICE Benchmark Administration, World Gold Council

Chart 9: Daily volume in gold futures is higher than all commodities except oil

Average daily trading volume in US dollars*



*Based on one-year average trading volumes as of June 2019.

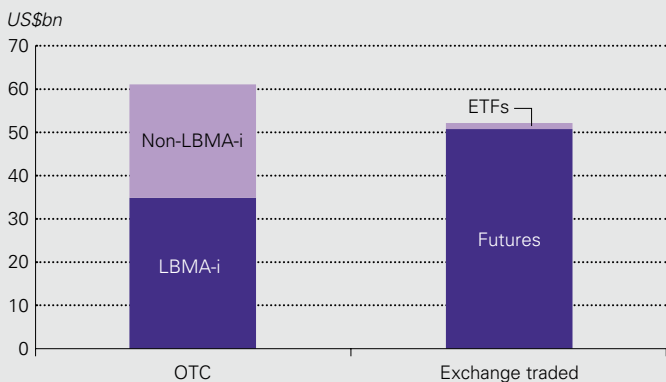
Source: Bloomberg, COMEX, Dubai Gold & Commodities Exchange, ICE Benchmark Administration, London Bullion Market Association, London Metal Exchange, Multi Commodity Exchange of India, Shanghai Gold Exchange, Shanghai Futures Exchange, Tokyo Commodities Exchange, World Gold Council

2 See details on goldhub.com <https://www.gold.org/goldhub/data/trading-volumes>

Focus box 1: A differentiated market

Most commodities trading is dominated by futures trading, while physical delivery is extremely low. On the gold market, by contrast, around 60% of trades are conducted via the OTC or in exchanges usually linked to physical delivery, with gold futures representing less than 40% of all gold volume (**Chart 10** and **Table 5, Appendix I**). Physical delivery or holding of gold all but eliminates the credit risk that could be present in commodities futures markets.

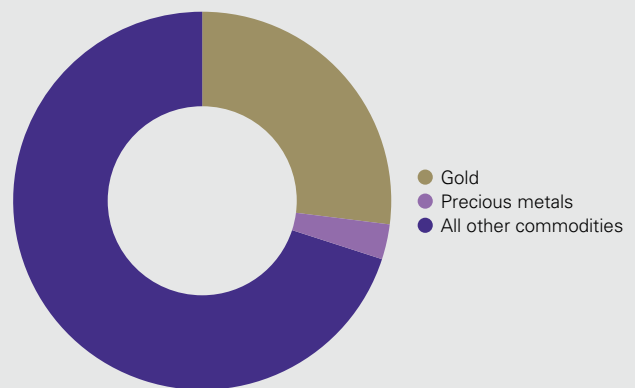
Chart 10: Average daily gold trading volume
Gold futures represent less than half of all gold traded*



*As of 30 June 2019.
See details on goldhub.com <https://www.gold.org/goldhub/data/trading-volumes>
Source: Bloomberg, COMEX, Dubai Gold & Commodities Exchange, ICE Benchmark Administration, London Bullion Market Association, London Metal Exchange, Multi Commodity Exchange of India, Shanghai Gold Exchange, Shanghai Futures Exchange, Tokyo Commodities Exchange, World Gold Council

It is worth noting too that gold makes up 27% of total average daily OTC open interest in commodities, with other precious metals accounting for just 3%. All other commodities combined represent 70% of the commodities OTC market, highlighting the depth and breadth of the gold market (**Chart 11**).

Chart 11: Global commodity OTC open interest
Gold makes up a significant portion of all global OTC open interest*



*As of December 2017.
Source: Bank of International Settlements (BIS)

This extensive liquidity allows investors to access gold in a range of ways, particularly when compared to other commodities, and highlights how gold operates within a differentiated market (**Focus box 1**).

Futures and roll costs

As we state above, investors tend to access commodity markets via futures contracts. Because futures contracts are based on expectations of future prices, as well as the costs of carry, storage and interest, investors are exposed to an additional source of variability: the shape of the

futures curve. In general, futures curves have less of an impact on gold and other precious metals returns than on most commodities.

Storage costs in particular account for a large portion of the futures cost or cost of carry. The storage costs of physical gold are negligible compared to those of other metals, while commodities such as natural gas incur extremely expensive storage costs.

These costs are typically represented by a futures curve in contango,³ when futures prices are higher than spot prices.

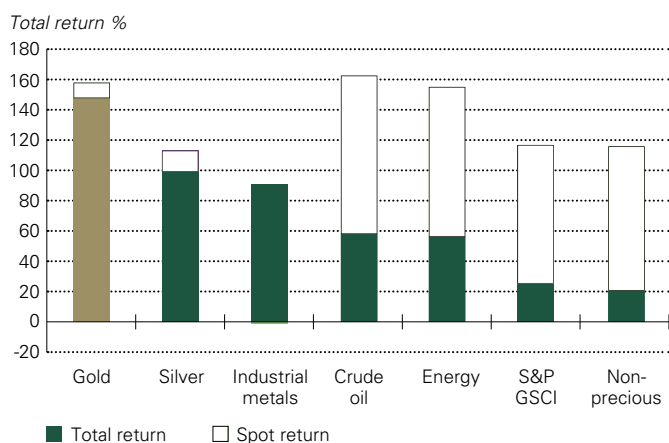
³ Contango is a situation where the futures price of a commodity is higher than the spot price. Contango usually occurs when an asset price is expected to rise over time. This results in an upward sloping forward curve, which can increase the cost of maintaining exposure to a particular asset.

The shape of the curve, combined with the fact that futures contracts are typically rolled over or settled in cash, creates discrepancies between spot price returns and total returns. This difference can be very large in certain commodity markets, yet futures returns are not necessarily higher than spot returns.

The energy market between June 1998 and June 2019 exemplifies this point (**Table 6, Appendix I** and **Chart 12**). Cumulative total returns based on spot were 131%: based on the futures markets, they were only 18%. During the same period, gold's spot return was 156% compared to 146% on futures. In fact, the roll cost has averaged approximately 50bps a year over the past 20 years, compared to 5% for the S&P GSCI Index. This reflects two important differentials between gold and other commodities. First, the shape of the gold futures curve tends to be flat at the most actively traded front end of the curve. Second, most investors either trade in spot or can potentially take physical delivery of futures contracts (although this can be quite costly and happens rarely). It is worth noting that the Bloomberg Precious Metals Sub-index and gold futures deliver similar performances over the long run, largely because nearly 80% of the Sub-index is comprised of gold futures.

Chart 12: Spot versus total returns for select commodity and commodity indices

Most commodity indices' total return is far less than their spot return



As of 30 June 2019.

From December 1998 to June 2019.

Source: Bloomberg, World Gold Council

Gold – efficient, effective and under-represented

Despite gold's unique properties that differentiate it from other commodities, investors often cluster it into a commodities bucket that often represents a small allocation within their overall portfolio. Furthermore, the amount of gold allocated to this smaller commodities bucket is usually just a fraction of the bucket itself, further diminishing the weight.

Investors who access commodities via a broad-based index often assume they have an appropriate allocation to gold. In fact, most broad-based commodity indices have a very small allocation to gold. Indices such as the S&P GSCI Index⁴ or the Bloomberg Commodity Index⁵, for example, typically allocate between 3% and 12% to gold (**Table 1** and **Table 2**). We do not believe such weightings provide an appropriate exposure to gold, particularly as commodities tend to represent a small portion of an investor's overall portfolio.

Table 1: S&P GSCI sector weights*

Gold is a small component in the S&P GSCI index

Sector	Weight
Energy	63%
Agriculture	15%
Livestock	7%
Industrial metals	11%
Precious metals	4%
Gold	3.73%

*Weights as of January 2019; gold weighting is a sub weight of precious metals.

Source: S&P Global, World Gold Council

Table 2: Bloomberg Commodity Index*

Gold has a more prominent yet small weight in the Bloomberg Commodity Index

Sector	Weight
Energy	34%
Grains	20%
Industrial metals	18%
Precious metals	16%
Gold	12%
Softs	6%
Livestock	6%

*Weights as of 30 June 2019; gold weighting is a sub weight of precious metals.

Source: Bloomberg, World Gold Council

4 S&P GSCI Index is a world production-weighted commodity index based on the average of the previous five years.

5 Determinants and weights in the Bloomberg Commodity Index include economic significance, diversification, continuity and liquidity.

Focus box 2: Commodity index limitations

One of the most used commodity indices, the Bloomberg Commodity Index places greater emphasis on liquidity and economic importance, which boosts the weighting of gold, versus the S&P GSCI Index with its small weighting to gold. And while the index provides a more significant weight to gold than other indices, it still under-represents the appropriate weight to gold when considering the index's methodology and gold's performance.

This relates partly to the nature of the gold market. The Bloomberg Commodity Index bases liquidity on futures volumes (**Table 4, Appendix I**) but, as we highlight above, over 60% of gold is traded on the OTC market with most trading on spot. By contrast, the vast majority of trading in other commodities is conducted via the futures market. This significantly disadvantages gold's weighting in the index (**Table 2**).

Gold also suffers because the Bloomberg Commodity Index defines diversification based on maximum weights to specific commodities and sectors. There is, for instance, a maximum weighting to precious metals, of which gold represents a portion. They do not consider diversification from the perspective of cross-asset or global correlation, even though this may be a more appropriate measure of diversification at the portfolio level.

Finally, the economic significance of gold is not considered holistically. In particular, while gold plays a role in positive economic periods, its role is even greater during market downturns, setting it apart from almost every other commodity.

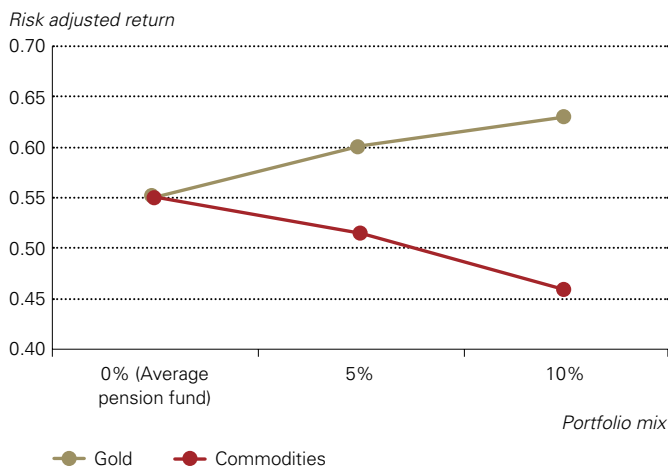
Under-allocated to gold: a missed opportunity?

Commodity exposure is generally limited to less than 10% of an investment portfolio. Gold usually accounts for less than 10% of that amount – in other words, a portfolio will have an overall exposure to gold of less than 1%.

Commodity exposure does provide diversification benefits. Our analysis suggests that adding a 5-10% portfolio allocation to commodities increased risk-adjusted returns over the past 20 years. However, gold can do much more. Looking back over the past two decades, replacing or supplementing a commodities allocation with gold provided two key benefits: it increased absolute returns and reduced portfolio volatility when compared to a portfolio with no commodity exposure or with broad-based commodity exposure (**Chart 13** and **Chart 14**).

Chart 13: Performance of a hypothetical pension portfolio with and without commodities or gold*

Gold allocations improved absolute and risk-adjusted returns more than commodities over the past 20 years



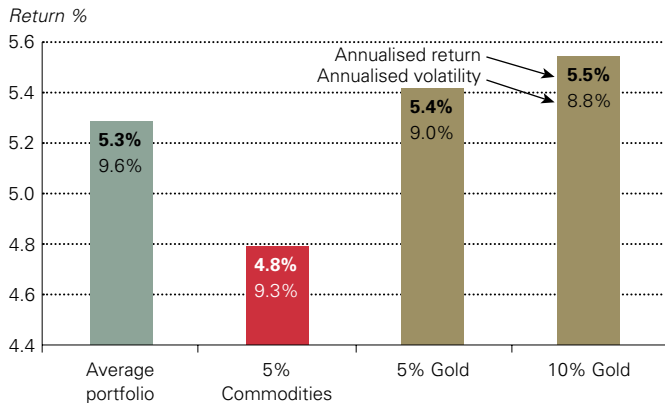
* *Risk-adjusted* return defined as portfolio return divided by annualised volatility and based on the total return indices and benchmarks listed below using data from June 1999 to June 2019 assuming monthly rebalancing.

A 0% allocation denotes an average pension fund portfolio and is based on Willis Towers Watson Global Pension Assets Study 2017 and Global Alternatives Survey 2016. It includes a 60% allocation to stocks (35% Russell 3000, 20% MSCI ACWI ex US, 5% FTSE REITs Index) and a 40% allocation to fixed income (30% Barclays US Aggregate, 5% Barclays Global Aggregate ex US, and 5% short-term Treasuries). The other mix of weights include either 5% of gold or commodities or 10% of gold or commodities and this allocation to commodities or gold comes from proportionally reducing all assets.

Source: Bloomberg, ICE Benchmark Administration, World Gold Council

Chart 14: Performance of a hypothetical pension portfolio with and without commodities or gold*

Gold improves absolute and risk-adjusted returns



*As of 30 June 2019.

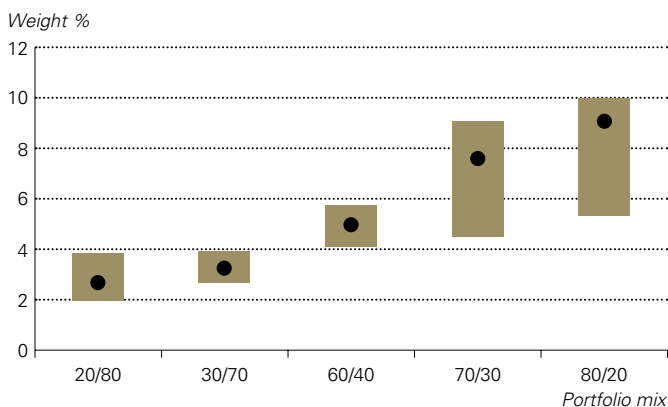
Based on monthly data from June 1999 to June 2019 assuming quarterly rebalancing.

The average PF portfolio is based on Willis Towers Watson Global Pension Assets Study 2017 and Global Alternatives Survey 2016. It includes a 60% allocation to stocks (35% Russell 3000, 20% MSCI ACWI ex US, 5% FTSE REITs Index) and a 40% allocation to fixed income (30% Barclays US Aggregate, 5% Barclays Global Aggregate ex US, and 5% short-term Treasuries). The allocation to commodities or gold comes from proportionally reducing all assets.

Source: Bloomberg, ICE Benchmark Administration, World Gold Council

Chart 15: Gold can significantly improve risk-adjusted returns of hypothetical portfolios across various levels of risk

Range of gold allocations and the allocation that delivers the maximum risk-adjusted return for each hypothetical portfolio mix*



● Optimal allocation that produces the highest risk-adjusted return

*Based on monthly total returns from June 1999 to June 2019 of ICE 3-month Treasury, Bloomberg Barclays US Bond Aggregate, Bloomberg Barclays Global Bond Aggregate ex US, MSCI US, EAFE and EM indices, FTSE Nareit Equity REITs Index, Bloomberg Commodity Index and spot returns of LBMA Gold Price PM. Each hypothetical portfolio composition reflects a percentage in stock and alternative assets relative to cash and bonds. For example: 60/40 is a portfolio with 60% in stocks, commodities, REITs and gold, and 40% in cash and bonds. Analysis based on New Frontier Advisors Resampled Efficiency. For more information see Efficient Asset Management: A Practical Guide to Stock Portfolio Optimization and Asset Allocation, Oxford University Press, January 2008.

Source: World Gold Council

Gold improves risk-adjusted returns across portfolio structures

To determine the optimum allocation to gold it is useful not only to compare gold with other commodities, but also to consider the broader impact that gold can have on portfolios. The World Gold Council has conducted analysis, based on typical US investment portfolio allocations of varying risks, and back-tested the ideal allocations of gold for each (**Chart 24, Appendix I**). This analysis indicates that US dollar-based investors can meaningfully improve the performance of a well-diversified portfolio by allocating between 2% and 10% to gold (**Chart 15**).

Broadly speaking, the higher the risk in the portfolio – whether in terms of volatility, illiquidity or concentration of assets – the larger the required allocation to gold to offset that risk.

Conclusion

A commodity is defined as an economic good, which is valued and useful and has little or no difference in composition or quality regardless of the place of production. While gold fits this definition, its market dynamics and the diversity of its application make it very different from other commodities.

This difference is underlined by gold’s robust performance profile in terms of returns, volatility and correlation. Taken together, these characteristics produce a more diversified portfolio than one with a simple, broad-based commodities exposure.

Looking at other commodities, some can be considered luxury goods, some have technological applications, and some are basic, everyday products. Some are used to hedge against inflation, some protect against currency devaluation and all of them provide a degree of diversification in an investment portfolio. Uniquely however, gold performs all these functions.

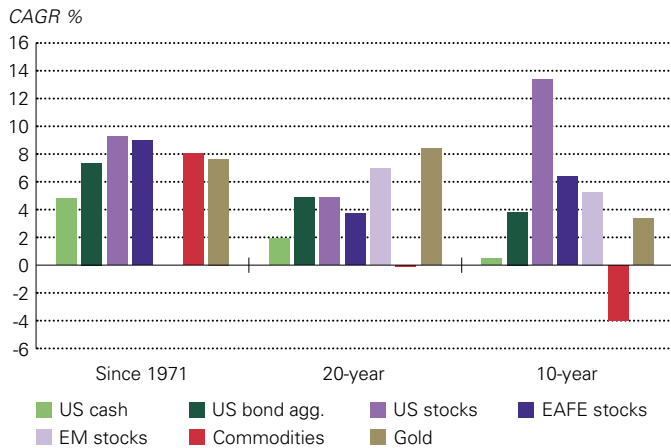
Indices such as the S&P GSCI Index or the Bloomberg Commodity Index are widely used by investors as benchmarks for their commodity allocations. However, gold’s weighting within these indices is small. More importantly, we find that under these conditions, an investor who only holds gold via a diversified commodities index will not achieve optimal returns (per unit of risk) or minimise expected losses.

Implementing an outright or supplemental position to gold reduces risk without diminishing long-term expected returns. In particular, strategic allocations ranging from 2% to 10% can significantly improve and protect the performance of an investment portfolio, while providing the exposure desired by the commodities investment itself.

Appendix I: Performance

Chart 16: Compounded returns of gold against other major asset classes

Gold returns are on par with the stock market over time*

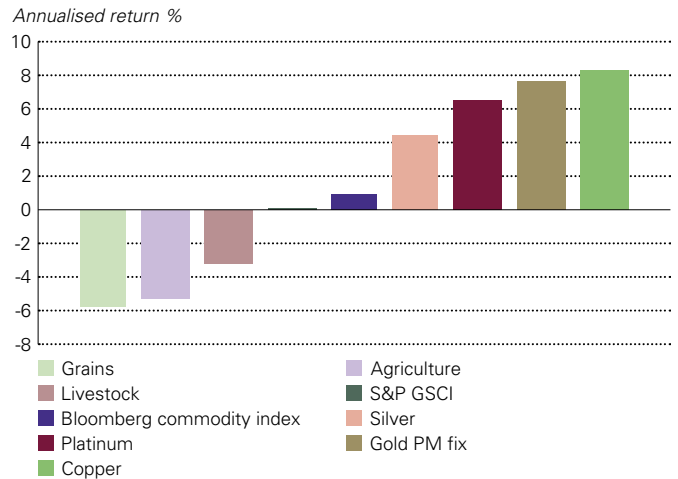


*As of 30 June 2019. Based on total returns indices including MSCI US, MSCI EAFE, MSCI EM, JP Morgan 3-month US cash, BarCap US Bond Aggregate, Bloomberg Commodity for the 10- and 20-year average, and S&P GSCI Index since 1971 due to data availability. Gold performance based on the LBMA Gold Price. Data between January 1971 and June 2018.

Source: Bloomberg, ICE Benchmark Administration, NBER, World Gold Council

Chart 17: Individual commodity returns

Gold has outperformed all major individual commodities except copper over the past 20 years*



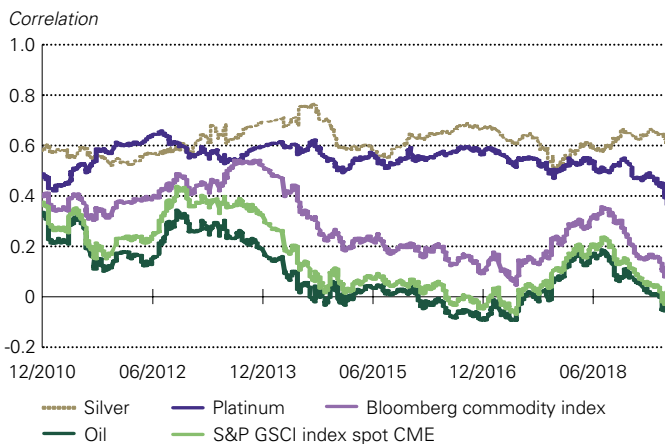
Annualised returns from June 1998 to June 2019.

*Indices include: S&P GS Commodity Index, S&P GS Agriculture Index, S&P GS Grains Index, Bloomberg Commodity Index, S&P GS Livestock Index, Gold (US\$/oz) London PM fix, Silver (US\$/oz) London fix, S&P GS Platinum Index, S&P GS Crude Oil Index, S&P GS Aluminium Index, and S&P GS Copper Index.

Source: Bloomberg, World Gold Council

Chart 18: Correlation of gold to commodities

Gold has modest correlation to precious metals but its correlation is low or negative when compared to other commodities*

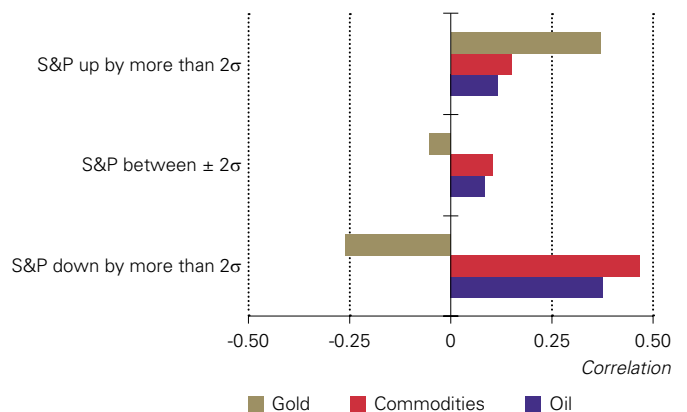


*As of 30 June 2019.

Source: Bloomberg, World Gold Council

Chart 19: Oil behaves like a risky asset in market sell-offs

Correlation between gold, commodities and oil with US stock returns in various environments of stocks' performance*

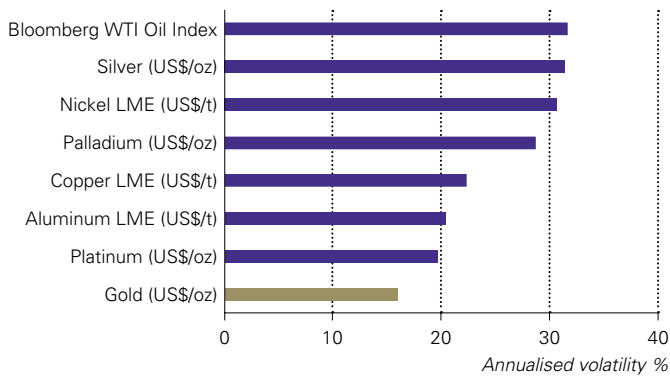


*As of 30 June 2019. Correlations computed using weekly returns based on the Bloomberg Commodity Index and the LBMA Gold Price PM and Bloomberg Oil Index since January 1987.

The middle bar corresponds to the unconditional correlation over the full period. The bottom bar corresponds to the correlation conditional on S&P 500 weekly return falling by more than two standard deviations (or 'σ') respectively, while the top bar corresponds to the S&P 500 weekly return increasing by more than two standard deviations. The standard deviation is based on the same weekly returns over the full period.

Source: Bloomberg, ICE Benchmark Administration, World Gold Council

Chart 20: Gold and other commodity volatility*
Gold is less volatile than all major individual commodities



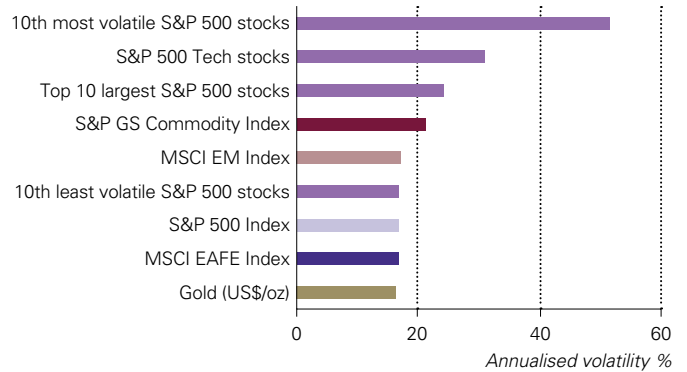
*Based on period of 1 June 2009 to 30 June 2019 annualised daily volatility of various commodities.

Aluminium, copper and nickel prices from LME; gold, silver, platinum and palladium prices from LBMA; oil prices from Bloomberg.

Source: Bloomberg, World Gold Council

Chart 21: Gold's volatility sits below that of many individual stocks and stock indices

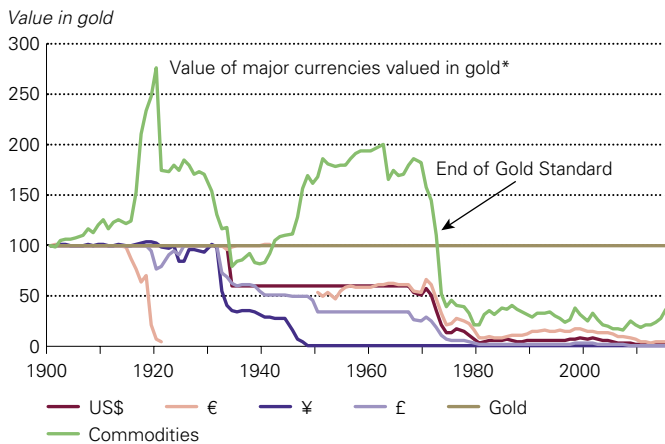
Realised volatility of stocks, stock indices and gold*



*Annualised volatility based on daily returns between 1 January 2009 and 31 December 2018. Only stocks and indices with 10 years' worth of data are included. Tech stocks vol based on average of the sector.

Source: Bloomberg, ICE Benchmark Administration, World Gold Council

Chart 22: Gold has held value against fiat currencies
Fiat currencies have declined significantly against gold

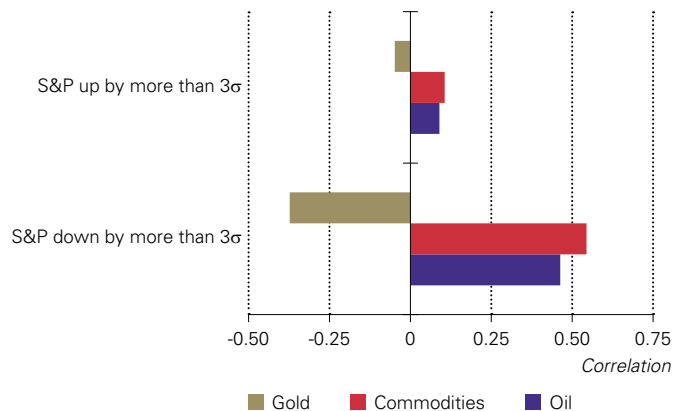


*The gaps in the deutschmark/euro line reflect hyperinflation in 1922 followed by the breakdown after WWII. Commodity prices prior to 1960 based on "Index number of Wholesale price" of the central statistical office; 1960-2018 data based on Bloomberg Commodity Index.

Source: Bloomberg, Thomson Reuters, World Gold Council

Chart 23: Gold, Commodities and Oil Correlation

Correlation between gold, commodities and oil decouples even more during 3σ downside moves*



*As of 30 June 2019. Correlations computed using weekly returns based on the Bloomberg Commodity Index and the LBMA Gold Price PM and Bloomberg Oil Index since January 1987.

The bottom bar corresponds to the correlation conditional on S&P 500 weekly return falling by more than three standard deviations (or ' 3σ ') respectively, while the top bar corresponds to the S&P 500 weekly return increasing by more than three standard deviations. The standard deviation is based on the same weekly returns over the full period.

Source: Bloomberg, ICE Benchmark Administration, World Gold Council

Table 3: Gold has low correlation to other commodities*

10-year correlation of gold to other commodities

	S&P GSCI	Industrial metals	Precious metals	Non-precious	Agriculture	Grains	Livestock	Gold	Silver	Platinum	Crude Oil	Aluminium	Copper
S&P GSCI	1												
Industrial metals	0.48	1.00											
Precious metals	0.31	0.34	1.00										
Non-precious	1.00	0.48	0.29	1.00									
Agriculture	0.43	0.33	0.24	0.43	1.00								
Grains	0.37	0.28	0.20	0.37	0.96	1.00							
Livestock	0.16	0.10	0.00	0.17	0.07	0.06	1.00						
Gold	0.28	0.29	0.99	0.25	0.21	0.18	0.00	1.00					
Silver	0.36	0.44	0.83	0.34	0.28	0.24	0.02	0.75	1.00				
Platinum	0.37	0.42	0.58	0.36	0.25	0.21	0.04	0.54	0.55	1.00			
Crude Oil	0.94	0.36	0.22	0.94	0.27	0.22	0.11	0.20	0.27	0.29	1.00		
Aluminium	0.41	0.85	0.28	0.41	0.29	0.24	0.08	0.24	0.36	0.38	0.31	1.00	
Copper	0.44	0.93	0.31	0.44	0.31	0.27	0.09	0.27	0.41	0.38	0.34	0.66	1.00

*As of 30 June 2019.

Source: Bloomberg, World Gold Council

Table 4: Commodity futures liquidity*

Daily average of open interest and notional volume

Commodity	Open Interest (US\$bn)	Volume (US\$bn)
WTI Crude Oil	124.0	57.8
Brent Crude Oil	123.1	48.4
Gold	59.8	26.5
Natural Gas	37.9	11.6
Soybean	36.0	11.1
Heating Oil	32.2	13.0
Corn	30.5	7.0
Gasoline	29.5	13.3
Aluminium	26.2	6.6
Silver	16.1	6.6
Copper	13.4	5.2
Nickel	9.5	2.6
Zinc	8.9	2.9
Cotton	7.9	1.0
Wheat	7.1	5.8

*Includes the daily averages for the past 10 years ended 30 June 2019.

Source: Bloomberg, World Gold Council

Table 5: Gold market trading volumes

Volumes are strong across multiple trading venues

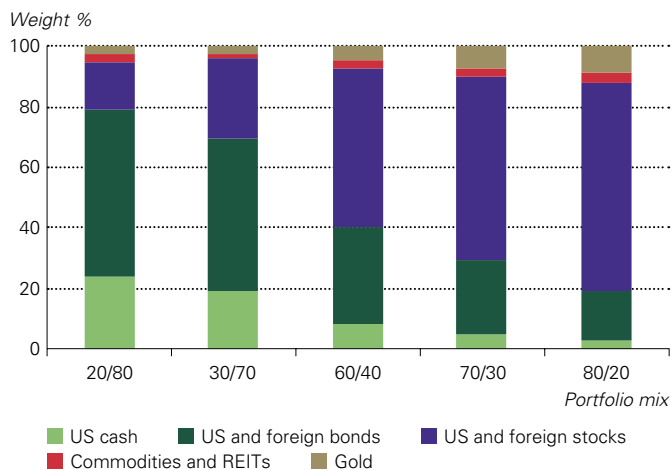
	Exchanges	2018 Average US\$(bn)
OTC	LBMA-i ††	35.02
	Non-LBMA-i (Mid ‡)	26.27
	<i>Total (Mid)</i>	<i>61.91</i>
Exchanges	COMEX	41.09
	Shanghai Futures Exchange	2.78
	Shanghai Gold Exchange §	5.35
	LME ¶	0.29
	All other exchanges ^	1.46
	<i>Total Exchanges</i>	<i>50.96</i>
Gold ETFs	North America	1.09
	Other Regions	0.25
	<i>Total gold-backed ETFs</i>	<i>1.34</i>
Global gold market liquidity		114.21

*As of 31 December 2018.

Sources: Bloomberg, COMEX, Dubai Gold & Commodities Exchange, ICE Benchmark Administration, London Bullion Market Association, London Metal Exchange, Multi Commodity Exchange of India, Shanghai Gold Exchange, Shanghai Futures Exchange, Tokyo Commodities Exchange, World Gold Council

Chart 24: Long-run optimal portfolio allocations based on asset mix*

Riskier portfolios benefit from larger gold allocations



*Based on monthly total returns from January 1989 to December 2018 of ICE 3-month Treasury, Bloomberg Barclays US Bond Aggregate, Bloomberg Barclays Global Bond Aggregate ex US, MSCI US, EAFE and EM indices, FTSE Nareit Equity REITs Index, Bloomberg Commodity Index and spot returns of LBMA Gold Price PM. Each hypothetical portfolio composition reflects a percentage in stock and alternative assets relative to cash and bonds. For example: 60/40 is a portfolio with 60% in stocks, commodities, REITs and gold, and 40% in cash and bonds. Analysis based on New Frontier Advisors Resampled Efficiency. For more information see Efficient Asset Management: A Practical Guide to Stock Portfolio Optimization and Asset Allocation, Oxford University Press, January 2008.

Source: World Gold Council

Table 6: US dollar return (%) for various commodities and commodity indices in selected periods¹

Gold's low storage costs help its total return when compared to other commodities*

	Cumulative spot return			Cumulative total return		
	June '98 – June '19	June '08 – June '19	June '14 – June '19	June '98 – June '19	June '08 – June '19	June '14 – June '19
Gold ²	155.7	40.8	6.1	145.6	33.1	2.9
S&P GSCI	99.6	-72.2	-46.3	-1.3	-145.7	-74.1
Energy	131.4	-88.7	-57.8	18.1	-184.5	-96.2
Industrial metals	82.9	-37.5	-10.7	82.8	-58.9	-13.8
Precious metals	153.4	34.6	2.2	146.0	26.4	-1.4
Non-precious	97.5	-75.4	-48.0	-6.8	-151.6	-77.0
Agriculture	38.2	-46.8	-18.9	-114.2	-101.0	-58.3
Grains	51.8	-55.2	-14.0	-124.4	-119.4	-58.7
Livestock	42.2	2.8	-42.4	-68.4	-56.7	-32.9
Crude oil	140.2	-89.3	-62.1	24.6	-227.4	-116.2
Silver ²	105.9	-14.2	-31.2	92.0	-26.5	-37.6
Platinum	83.7	-92.8	-58.1	133.0	-101.4	-60.4
Copper	129.3	-36.4	-13.4	168.7	-36.3	-10.9

*As of 30 June 2019.

¹ Calculations based on S&P GSCI indices and sub-indices except otherwise noted.

² Spot prices based on the London PM fix for gold and London fix for silver.

Source: Bloomberg, LBMA, Standard & Poor's, World Gold Council

Appendix II: Demand and supply

Gold demand is global

Demand for gold is global. Despite the perception that gold is a luxury good, bought for jewellery and investment purposes by developed nations, over 50% of demand comes from emerging markets (**Chart 25** and **Chart 26**).⁶

Commodities other than gold also have desirable characteristics and, as important inputs to the global economy, are increasingly attractive as alternative sources of diversification for institutional and individual investors alike. However, most commodities tend to be heavily exposed to one aspect or another of the economy and subject to idiosyncratic risks.

While oil's global importance as a primary source of energy makes it a highly liquid commodity, the oil market is far more dependent on the business cycle than gold as oil is primarily used for industrial purposes. Oil, which carries the largest weight in the commodity indices, only has 16% use outside of the energy space.⁷ Similarly, oil production is geographically more concentrated in certain regions of the world; for example, more than 50% of proven reserves of oil are currently located in the Middle East. It is incredibly difficult to know what percentage of oil demand is actually in investment, given investors don't take physical delivery and the majority of oil trades in the futures markets. Moreover, investors tend to access the oil market primarily via derivatives contracts, which in turn increase their counterparty risk exposure.

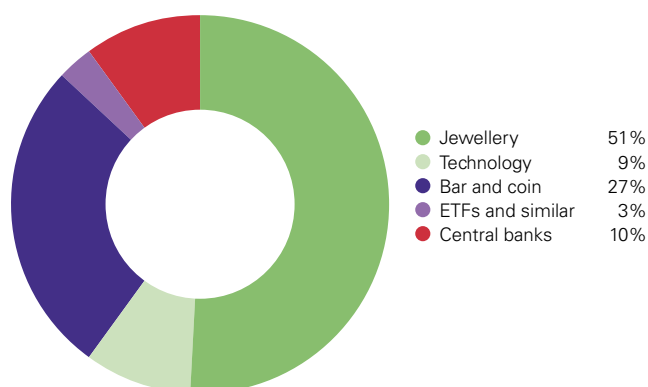
Gold is not consumed like typical commodities; its above ground stocks are available for continuous utilisation. Many other commodities tend to be much more highly specialised and lack gold's diverse demand; agriculture commodities, for instance, are largely used for food consumption.

Not surprisingly, gold shares more characteristics with other metals – in particular precious metals – than it does with any of the other commodity categories. For example, beyond the obvious similarities of mine production, many metals can be reused or recycled for new fabrication, thus providing an additional source of supply. This is in stark contrast to energy, agricultural and livestock commodities which are spent, consumed, or transformed but are rarely recoverable. Metals also tend to have longer shelf lives and are less susceptible to adverse storage conditions than agricultural commodities. They can also be transported without the need for specialised infrastructures such as in the case of oil or natural gas.

Gold differs from other commodities. Emerging economies not only purchase it as jewellery to fulfil cultural needs, but also invest in gold to protect against currency volatility, to move away from developed market currencies and to offset the risk of market downturns.

Chart 25: Gold demand

Demand for gold is diverse*

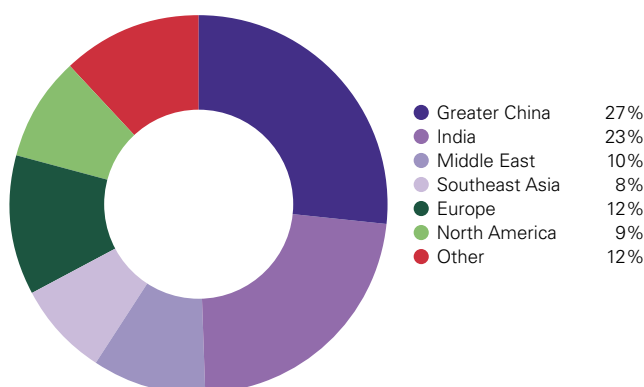


*Computed using annual demand from 2009 to 2018. Regional breakdown excludes central bank demand due to data availability.

Source: ETF company filings, Metals Focus, Refinitiv GFMS, World Gold Council

Chart 26: Gold demand by region

Demand for gold is diverse*



*Computed using annual demand from 2009 to 2018. Regional breakdown excludes central bank demand due to data availability.

Source: ETF company filings, Metals Focus, Refinitiv GFMS, World Gold Council

⁶ Ibid, page 06.

⁷ IEA: Key World Energy Statistics, 2014 <https://www.globalpetrolprices.com/articles/39/>

The technology and industrial sectors account for a much larger portion of demand for most other metals, including silver (**Table 7**). As such, these metals are more exposed to the business cycle. Moreover, gold is one of the densest elements, facilitating storage when compared to other metals such as copper; it is not only the most noble of metals (resistant to corrosion and oxidation), but also the most malleable and ductile known.⁸ Because gold is almost indestructible, all the gold that has ever been mined still exists in one form or another. Thus, recycled gold comprises a larger share of supply than for any other metal, allowing the market to absorb primary production shocks and shortages in a more effective way.

Gold supply is limited

Gold supply is scarce; we estimate that there are approximately 193,000t of gold above ground, worth more than US\$7.9trn. Mine production adds approximately 3,000t per year, equivalent to an annual 1.6% increment (**Chart 28** and **Chart 30**).⁹

The gold market has two attractive features for investors. Gold's scarcity supports its long-term appeal. But gold's market size is large enough to make it relevant for a wide variety of institutional investors – including central banks.

While short-term supply constraints can affect many commodities, those constraints are typically based on variable factors such as production rates. Fewer supply shocks exist for gold because mine production is evenly spread across continents (**Chart 29**), maintaining gold's low volatility compared to other commodities (**Chart 7**). And although gold mining can be increased, ultimately a finite amount of the commodity remains in the ground.

Table 7: Demand and supply by source (%) for selected metals*

Supply and demand for gold is more varied than other commodities

Commodity	Demand			Supply	
	Jewellery	Investment	Technology/ Industry	Mine Production	Recycled
Gold	60%	30% ²	10% ³	74%	26%
Silver	26% ⁴	15%	59%	86%	14%
Copper	2%	3%	95%	84%	16%
Platinum	29%	1%	70%	73%	27%

*As of 2018, except for gold for which 2017 figures are available, ² Includes net central bank activity which accounted for 2% of gold demand in 2010.

³ Primarily used in electronics and other high-end technology uses. ⁴ Includes silverware.

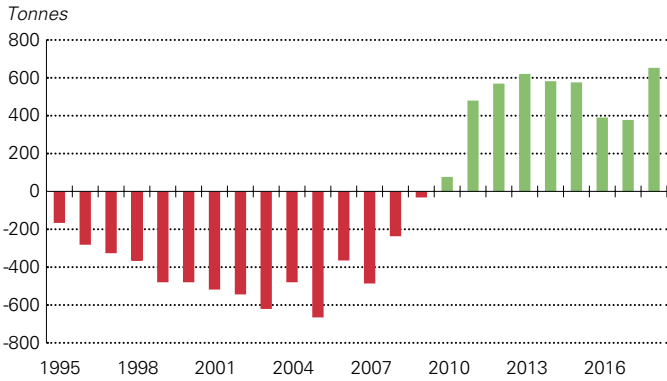
Source: International Copper Institute, Johnson Matthey, Refinitiv GFMS, The Silver Institute, US Geological Survey, World Gold Council

⁸ Eds, Corti, and Holliday, Gold: Science and Applications, 2010.

⁹ Based on the December 2018 LBMA Gold Price and 2018 above-ground estimates by Metals Focus, Refinitiv GFMS and the World Gold Council.

Chart 27: Central Bank Purchases

Central banks have become net buyers of gold over the past 10 years*

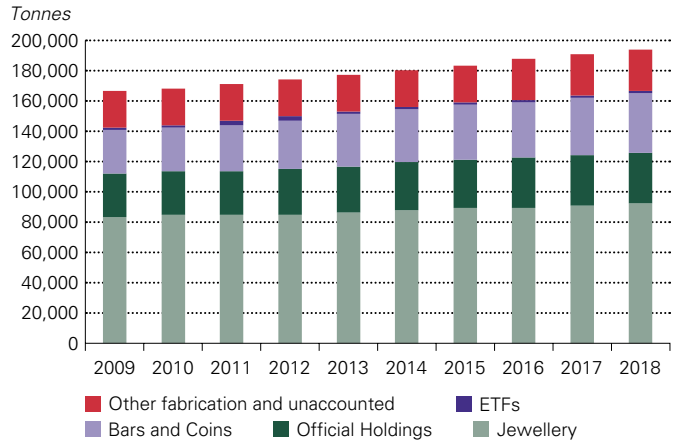


*As of December 2018.

Source: Metals Focus, Refinitiv GFMS, World Gold Council

Chart 28: Above-ground stock of gold (tonnes)

Stock of gold has grown at a steady pace*

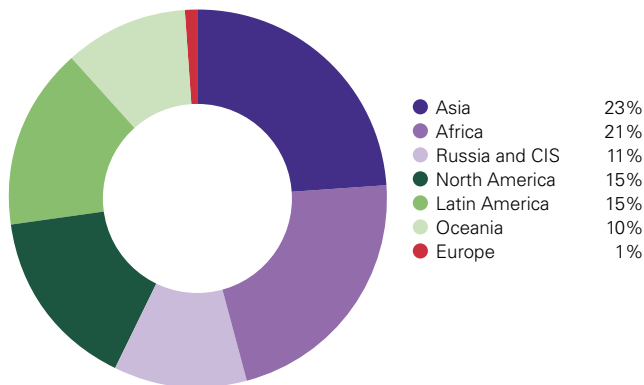


*As of December 2018.

Source: Metals Focus, Refinitiv GFMS, World Gold Council

Chart 29: Gold supply is a combination of mined and recycled gold; mine production is evenly spread across continents, contributing to gold's low volatility relative to commodities*

10-year average gold-mine production by region*

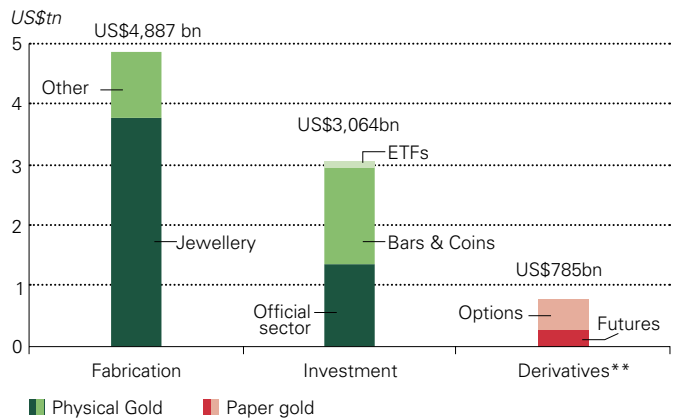


*Computed using annual demand from 2009 to 2018. Regional breakdown excludes central bank demand due to data availability.

Source: ETF company filings, Metals Focus, Refinitiv GFMS, World Gold Council

Chart 30: Value of above-ground gold and gold derivatives*

Gold has significant value in both physical and paper forms



* As of 31 December 2018.

** Represents open interest in COMEX, TOCOM and OTC.

Source: Bank for International Settlements, Bloomberg, ETF company filings, ICE Benchmark Administration, Metals Focus, World Gold Council

Production also constitutes a differentiating factor for the gold market. The production of many commodities, including some of the most actively traded ones, tends to be highly concentrated in particular regions of the world. For example, 40% of oil is produced in the Middle East and Eurasia, platinum primarily comes from South Africa (73%), the US is the largest source of corn production (39%), and silver is mainly mined in Latin America. Gold,

however, is more evenly distributed, with no single region accounting for more than 23% of production as of 2018 (**Table 8**). This diversification of production contributes to gold's lower volatility relative to other commodities, as it makes it less subject to geopolitical and other specific risks, such as weather variations resulting from climate patterns.

Table 8: Production from primary sources by region (%) for selected commodities*

Gold is produced globally

Commodity	North America	Latin America	Europe	Eurasia	Middle East	Africa	Asia	Oceania
Gold	15%	16%	1%	14%		23%	19%	11%
Silver	28%	32%	13%			2%	21%	4%
Copper	14%	41%	13%			10%	17%	5%
Platinum	16%			11%		73%		
Oil	23%	12%	6%	12%	28%	13%	5%	1%
Natural Gas	25%	5%	7%	24%	17%	6%	12%	3%

*As of December 2018. Primary sources exclude supply from recycling activities.

Source: CIA World Factbook, Refinitiv GFMS, International Copper Institute, Johnson Matthey, The Silver Institute, US Geological Survey, World Gold Council

Table 9: Gold represents a large percentage of central bank reserves

Total central bank holdings are growing at the highest levels in history*

Rank	Country	Tonnes	% of Reserves
1	United States	8,133.5	74.8
2	Germany	3,369.7	70.2
3	Italy	2,451.8	66.1
4	France	2,436.0	60.7
5	Russian Federation	2,168.3	18.5
6	China, P.R., Mainland	1,885.5	2.5
7	Switzerland	1,040.0	5.5
8	Japan	765.2	2.5
9	Netherlands	612.5	65.4
10	India	608.8	6.3

*As of May 2019.

Data does not include the IMF, which holds the third largest percentage of gold, but does not provide a percentage of total reserves.

Source: IMF, World Gold Council

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