

THE RELEVANCE OF SILVER IN A GLOBAL MULTI-ASSET PORTFOLIO

SEPTEMBER 2022

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EXECUTIVE SUMMARY

Portfolio diversification aims to reduce the overall impact of risk when investing. Silver is often overlooked in these asset allocation decisions in favour of gold, however, despite having its own unique return characteristics. This study examines whether silver should be viewed as a distinct asset class that warrants a strategic investment allocation within an efficient multi-asset portfolio. We find that the optimal allocation to silver is significantly higher than holdings in most institutional investor portfolios.

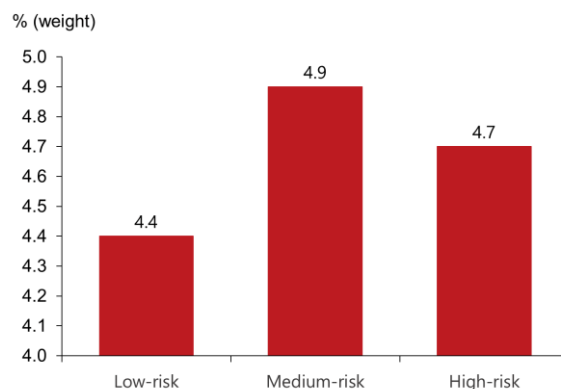
The price of silver is often benchmarked against the price of gold, but there are important distinctions between the two precious metals that can affect their risk/return profiles. In particular, over half of demand for silver originates from industrial applications, meaning the price of silver tends to be more sensitive than gold to trends in the global industrial cycle, which also contributes to its higher volatility.

In order to examine the potential long-run benefits of holding silver in a portfolio, we compared its historic performance with a range of traditional asset classes, including stocks, bonds, commodities and gold for the period January 1999 to June 2022. We found that silver has relatively low historical correlations with asset classes other than gold, which suggests that silver should have valuable diversification potential.

As a more rigorous test of whether silver should have a consistent allocation in a multi-asset portfolio alongside gold, we also ran a series of dynamic portfolio optimisation simulations. The optimisation simulations were run with the aim of maximising the risk-adjusted returns of a mixed-asset portfolio under varying constraints designed to reflect differing investor risk preferences.

Average optimal silver weightings in a portfolio (history)

Average optimal allocation to Silver



Source: Oxford Economics/Haver Analytics

Across our historic sample period (Jan 1999 – Jun 2022), we found the average optimal allocation to silver for a five-year holding period ranges from 4.4% in a low-risk portfolio to 4.9% in a medium-risk portfolio, with the high-risk portfolio having

an average 4.7% allocation. This reflects the characteristics of silver, having some of the properties of a safe-haven instrument, but also higher volatility (risk) than other defensive assets such as gold and bonds.

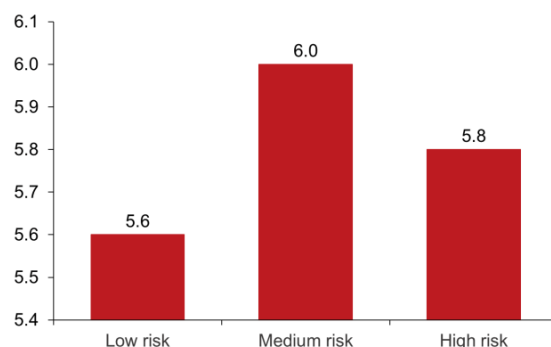
In order to better understand the investment implications of the rapidly shifting market environment, we also use the Oxford Global Economic Model to investigate the potential behaviour of silver relative to other asset classes over the next ten years. Using these projections, we examined the potential future role of silver in an efficient mixed asset portfolio.

Our results indicate that the optimal allocation to silver over the next decade ranges from 5.6% for a low-risk portfolio to 6% for a medium-risk portfolio, with a 5.8% weighting for a high-risk portfolio. These allocations are somewhat higher than the average optimal allocations estimated using historic data, in part reflecting the more positive outlook for silver compared to recent history.

Average optimal silver weightings in a portfolio (forecast)

Average optimal allocation to Silver

% (weight)



Source: Oxford Economics calculations

While the outlook for the global economy and asset prices over the next ten years is subject to considerable uncertainty, our analysis indicates that a medium-risk investor would benefit from a dedicated allocation to silver of around 4-6% (the range of our historic and forecast estimates). This is considerably higher than most institutional investment portfolios, where exposures to silver generally amount to no more than 0.2% and are mainly achieved indirectly through commodity indices.

1. INTRODUCTION

In recent years, institutional investors have shifted substantial parts of their portfolios outside of core holdings of equities and bonds, with many now having exposure to non-traditional asset classes including commodities and gold. Silver is often overlooked in these asset allocation decisions in favour of gold, however, despite its return characteristics being sufficiently different from gold to possibly warrant investing in it separately.

This report analyses the investment performance of silver to determine whether it could play a role as a portfolio diversifier that provides value to investors. Building on this analysis, we examine whether silver should be viewed as a distinct asset class that warrants a strategic investment allocation within an efficient multi-asset portfolio.

The report is organised as follows:

- **Section 2** describes the historic performance of silver relative a range of traditional asset classes.
- **Section 3** evaluates silver's role in an efficient multi-asset portfolio over the past two decades.
- **Section 4** estimates optimal portfolio allocations to silver over the next ten years.

Detail on data sources is presented in Appendix I, while Appendix II provides a description of the Oxford Global Economic Model.

2. HISTORIC PERFORMANCE OF SILVER AS AN ASSET CLASS

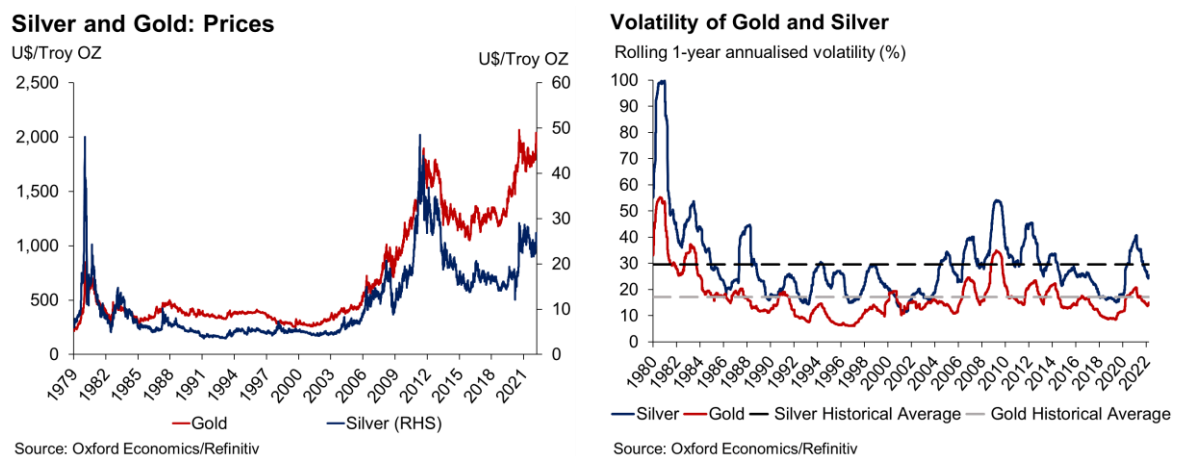
Modern portfolio theory states that maximising expected return for a given level of risk can be achieved through portfolio diversification. On this basis, in addition to traditional assets such as equities and bonds, many institutional investors already include a modest allocation to gold in their portfolios due to its properties as a safe-haven instrument.

While gold and silver are often viewed as being interchangeable, we examined whether silver also deserves a strategic allocation in investor portfolios — both as a cheaper alternative to gold and to benefit from its own intrinsic qualities.

2.1 HISTORIC PERFORMANCE OF SILVER AND GOLD PRICES

The price of silver is often benchmarked against the price of gold. Both gold and silver are utilized by investors as a store of value and source of portfolio diversification, but there are important distinctions between the two precious metals that can affect their risk/return profiles. As shown in Figure 1, silver prices have tended to be more volatile than gold historically, but prices have generally moved together, notwithstanding some periods of divergence.

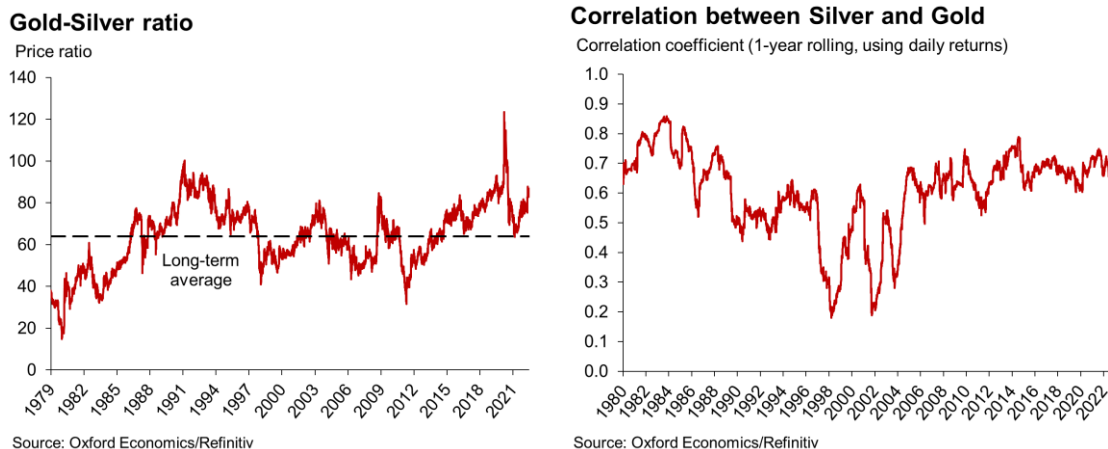
Fig. 1: Silver and gold – price levels and volatility



Viewed over the past forty years, the gold/silver price ratio has averaged around 65, although it has swung from a low of 16 in January 1980 to a high of 126 in March 2020 (Figure 2). More recently, the ratio has fallen back significantly, although it remains above its long-run average. Notwithstanding these divergences in price levels over the past decade, however, the correlation between gold and silver prices has remained remarkably high over this period – indeed, higher on average than during the preceding thirty years. Although price movements

between the two metals may be similar, however, silver as an asset class does clearly have properties that distinguish it from gold.

Fig. 2: Gold/silver ratio and correlation



As with most real assets, price movements of gold and silver reflect their unique sources of supply and demand. While the annual supply of gold is much smaller than silver on a tonnage basis (reflected in the large price difference between the two metals), the lower price of silver means the *value* of annual supply is much smaller than gold¹. This helps to explain why silver is more volatile than gold, as smaller inflows/outflows of money can significantly impact its price.

In terms of demand dynamics, although silver is classified as a precious metal, over half of demand (55%) originated from industrial applications in 2019², compared to just 8% for gold (Figure 3). In part, this reflects the unique properties of silver, including being a strong thermal and electrical conductor. It means the price of silver tends to be more sensitive to trends in the global industrial cycle, which also contributes to its higher volatility.

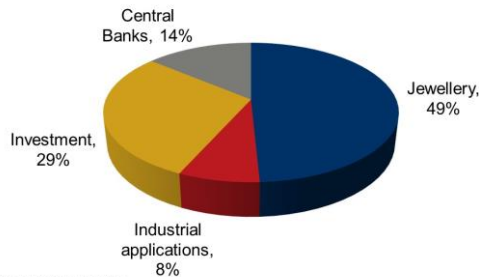
Silver's use in industry can also leave it exposed to shifts in technology. One development that weighed upon silver's performance since the turn of the century has been the advent of digital photography, which drove a decline in the use of silver to develop conventional photographs. Demand from photography accounted for over a quarter of total supply in the late 1990s, but this had fallen to just 3% by 2019. With photography now accounting for a relatively small share of demand, however, its influence on silver prices will be more muted in coming years. In fact, the structural demand story may now be turning more positive for silver, as it will benefit from long-term growth of end use in various green energy applications, including electric vehicles (which have a much higher silver loading than conventional vehicles) and energy storage, as well as 5G devices and networks.

¹ On a tonnage basis, the total supply of new silver each year is around eight-times higher than gold, yet the market value of the annual supply of silver is less than 10% of gold supply (based on 2019 prices).

² We use 2019 as a (pre-crisis) reference year to avoid potential distortions associated with the pandemic.

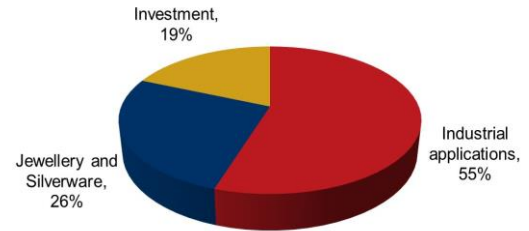
Fig. 3: Silver and gold demand breakdown, 2019

Breakdown of Gold demand, 2019



Source: Metals Focus

Breakdown of Silver demand, 2019



Source: Metals Focus

In contrast to silver, the demand for gold is dominated by its role as a monetary asset and commodity. While 49% of gold supply was used for jewellery in 2019, for example, jewellery accounted for only 26% of total demand for silver. And whereas investment demand for silver represented 19% of demand, 43% of demand from gold was for investment, of which 29% from private investors and 14% from central banks. An important development that has helped to support gold prices over the past two decades has been that central banks in emerging markets have been net buyers of gold since 2009. Conversely, central banks hold virtually no silver in their reserves.


Overall, this analysis suggests that silver's return characteristics are sufficiently different from gold to possibly warrant investing in it separately. In order to examine the long-term benefits of holding silver as an asset class in more depth, the next section compares its historic performance with a range of more 'traditional' asset classes including stocks, bonds and other commodities.

2.2 SILVER'S POTENTIAL ROLE AS A PORTFOLIO DIVERSIFIER

In order to examine the potential long-run benefits of holding silver in a portfolio, we compared its historic performance with a range of traditional asset classes, including stocks, bonds, commodities and gold for the period January 1999 to June 2022. As shown in Figure 4, the Sharpe ratio (which measures risk-adjusted returns) for silver over this period is the same as emerging market equities and also similar in magnitude to both developed market equities and a diversified basket of commodities. On this metric, it therefore appears that silver's performance is comparable to these core investment assets.

Fig. 4: Summary statistics on performance of asset classes (full sample)

Total Returns by Asset Class, Jan 1999 - June 2022								
	Silver	Gold	Commodities – broad basket	Developed market equities – large/mid cap	Developed market equities – small cap	Emerging market equities	Developed market bonds	Emerging market bonds
Compound Annual Growth rate	5.3	7.2	3.8	5.8	7.7	8.2	2.9	9.1
Arithmetic Average growth rate	9.9	9.5	7.9	8.0	8.7	9.2	8.5	8.8
Standard Deviation	31.2	15.6	19.8	18.1	21.4	27.9	5.7	14.2
Sharpe Ratio	0.21	0.40	0.24	0.26	0.25	0.21	0.91	0.39
Correlation between annual returns								
	Silver	Gold	Commodities – broad basket	Developed market equities – large/mid cap	Developed market equities – small cap	Emerging market equities	Developed market bonds	Emerging market bonds
Silver	1.00							
Gold	0.77	1.00						
Commodities – broad basket	0.45	0.29	1.00					
Developed market equities – large/mid cap	0.40	0.07	0.47	1.00				
Developed market equities – small cap	0.43	0.07	0.53	0.96	1.00			
Emerging market equities	0.54	0.39	0.51	0.82	0.83	1.00		
Developed market bonds	0.44	0.56	0.21	0.04	0.09	0.27	1.00	
Emerging market bonds	-0.08	0.02	-0.12	-0.40	-0.35	-0.30	0.01	1.00



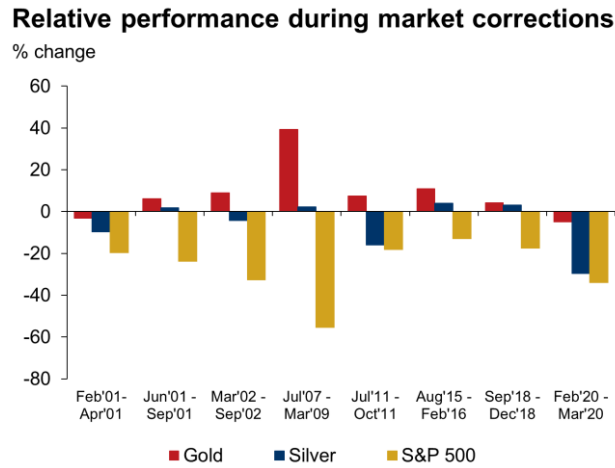
 Negative Positive

Modern portfolio theory highlights how improved risk-adjusted performance in an investment portfolio can be achieved by selecting a combination of assets that have low correlations. The goal of strategic asset allocation is therefore to select a combination of assets that are less likely to lose value at the same time. A portfolio can also then be constructed to target an expected return for a given pre-determined risk preference, by strategically allocating to asset classes that have different return and volatility characteristics.

Evaluating whether silver adds value to a well-diversified portfolio therefore requires looking at its correlation with other asset classes to understand whether it responds differently to shifts in market conditions, tempering the portfolio’s overall volatility and minimising its downside. The correlation matrix in Figure 4 shows that silver has relatively low historical correlations with asset classes other than gold. In particular, the correlation with developed market equities (both large and small cap) and bonds is low at 0.4, the correlation with emerging market equities and commodities is moderate at 0.5, while the correlation with emerging market bonds is slightly negative. Overall, this suggests that silver should have valuable diversification potential.

The investment case for silver is often based on its role as a ‘safe-haven’ asset during periods of market uncertainty. These properties of silver as a risk-management tool are illustrated by Figure 5, which demonstrates how silver has historically proved resilient during periods of turmoil in equity markets. The price of silver has risen during four of the eight stock market corrections experienced over the past 20 years, while its price fell by less than equities during the other four episodes. Although silver underperforms gold as a ‘safe haven’ asset, it can still help to reduce losses in times of market stress.

Fig. 5: Performance of gold and silver during equity market corrections

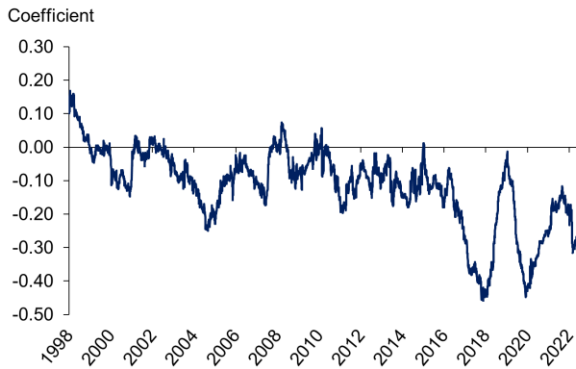


Source : Oxford Economics/Haver Analytics

Precious metals such as silver are non-yielding assets – they do not pay any dividends or income to investors. When real interest rates rise, this means the opportunity cost of holding silver increases, which tends to put downward pressure on its price (Figure 6). This helps to explain the positive correlation between total returns on silver and developed market bonds, as the price of bonds falls when yields rise. That said, the magnitude of the correlation is fairly low on average and varies over time, reflecting how there are multiple influences on the price of silver.

Fig. 6: Silver correlations with real interest rates and US dollar

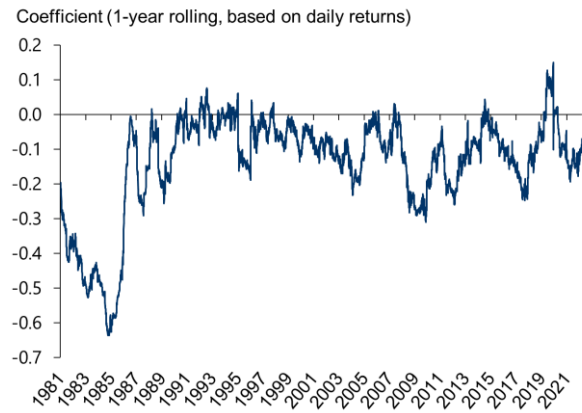
Correlation between Silver & real interest rate*



Source: Oxford Economics/Refinitiv

*Real interest rate defined as the market yield on U.S. Treasury Securities at 10-Year Constant Maturity, Inflation-Indexed

Correlation between Silver and US dollar index



Source: Oxford Economics/Haver Analytics


Similarly, the fact that silver is priced in US dollars means that it tends to be negatively correlated with the dollar exchange rate – this can provide a useful hedge for an investment portfolio denominated in US dollars. But Figure 6 shows that this relationship is rather weaker than often assumed and also varies significantly over time.

Investment returns for any asset class vary depending on the time period under consideration and correlations between asset classes also fluctuate over time. It is therefore instructive to consider whether our findings regarding silver’s relative performance differ if we examine a different historic sub-period. With this in mind, Figure 7 presents equivalent summary statistics for January 2010 to June 2022, representing the period after the global financial crisis (GFC).

These statistics show that average annual investment returns across most asset classes in this post-GFC sub-period are not substantially different from returns over the full sample. Silver also still exhibits relatively low correlations with asset classes other than gold – in fact, its correlation with equities is somewhat reduced. Although the Sharpe ratio for silver is somewhat lower in this sub-period, the level is very similar to gold, indicating comparable risk-adjusted returns for these two precious metals in this sub-period.

Fig. 7: Summary statistics on performance of asset classes (post GFC)

Total Returns by Asset Class, Jan 2010 - Jun 2022								
	Silver	Gold	Commodities – broad basket	Developed market equities – large/mid cap	Developed market equities – small cap	Emerging market equities	Developed market bonds	Emerging market bonds
Compound Annual Growth rate	5.1	7.5	3.0	5.0	7.1	6.1	3.3	10.6
Arithmetic Average growth rate	7.2	5.5	1.1	12.9	13.9	9.0	2.6	8.5
Standard Deviation	34.1	15.7	18.4	13.5	18.4	20.8	4.9	9.5
Sharpe Ratio	0.12	0.14	-0.12	0.71	0.57	0.27	-0.14	0.55
Correlation between annual returns								
	Silver	Gold	Commodities – broad basket	Developed market equities – large/mid cap	Developed market equities – small cap	Emerging market equities	Developed market bonds	Emerging market bonds
Silver	1.00							
Gold	0.76	1.00						
Commodities – broad basket	0.48	0.21	1.00					
Developed market equities – large/mid cap	0.27	-0.07	0.57	1.00				
Developed market equities – small cap	0.33	-0.08	0.56	0.96	1.00			
Emerging market equities	0.43	0.24	0.51	0.85	0.83	1.00		
Developed market bonds	0.61	0.69	0.07	0.23	0.23	0.44	1.00	
Emerging market bonds	0.00	0.11	-0.07	-0.11	-0.12	0.07	-0.08	1.00



 Negative Positive

3. SILVER WITHIN AN OPTIMAL PORTFOLIO

The previous chapter presented evidence that silver could perform a potentially valuable diversifying role in an efficient portfolio of assets held over the long run. In this section, we run a series of dynamic portfolio optimisation simulations to undertake a more rigorous assessment of whether silver should have a consistent allocation in a multi-asset portfolio. The optimisation simulations are run with the aim of maximising the risk-adjusted returns of the portfolio under varying constraints designed to reflect differing investor risk preferences.

The asset classes we consider for this portfolio optimisation exercise are the same as we analysed in Chapter 2 – gold, commodities (broad basket), equities (developed market large/mid cap, developed market small cap and emerging market) and bonds (developed market and emerging market).

In order to ensure that the portfolio optimisation simulations do not result in all holdings being concentrated in a single asset during periods when it outperforms and to ensure that the portfolio remains sufficiently diversified, we impose limits (upper and lower bounds) on the share of individual assets in the optimum portfolios. These limits also reflect that investors are unable to pursue perfect-foresight asset allocation strategies in the real world. The constraints placed on the portfolio are set out in Figure 8.

Fig. 8: Portfolio weight limits by asset class

Asset class	Minimum	Maximum
Silver	0%	10%
Gold	0%	10%
Commodities – broad basket	0%	10%
Developed market equities – large/mid cap	30%	70%
Developed market equities – small cap	0%	25%
Emerging market equities	0%	25%
Developed market bonds	10%	50%
Emerging market bonds	0%	20%

Optimal asset allocations are re-estimated on a rolling one-month basis for five-year holding periods across the entire data sample. The five-year holding period was chosen as this is the minimum generally recommended by financial advisors. Re-estimating the portfolio allocations on a rolling basis then ensures that we are gauging performance across a variety of market conditions over the sample period.

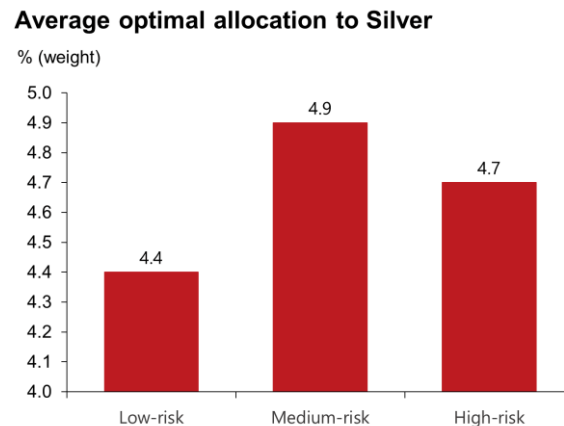
We estimate three portfolios representative of low, medium and high levels of risk-tolerance, for each 5-year rolling window. These risk levels reflect different percentiles in the distribution of standard deviations across the entire efficient

frontier (which is an allocation resulting from maximising the returns for a given level of risk) for each estimated portfolio. The three risk levels we examine are:

- Low risk: 25% percentile of standard deviations
- Medium risk: 50% percentile of standard deviations
- High risk: 75% percentile of standard deviations

Based on each of these levels of investment risk tolerance, the average weights allocated to silver across the rolling five-year efficient investment portfolios are set out in Figure 9. Across our historic sample period (January 1999 – June 2022), the average optimal allocation to silver for a five-year holding period ranges from 4.4% in a low-risk portfolio to 4.9% in a medium risk portfolio, with the high-risk portfolio having an average 4.7% allocation. This reflects the characteristics of silver, having some of the properties of a safe-haven instrument, but also higher volatility (risk) than other defensive assets such as gold and bonds.

Fig. 9: Optimal allocations to silver by risk threshold (Jan 1999 – Jun 2022)



Source: Oxford Economics/Haver Analytics

Figure 10 provides a full breakdown of weightings for all asset classes. As may be expected, we find that low-risk investors tend to have a higher portfolio weighting towards bonds and gold, while high-risk investors have a relatively higher weighting towards equities. Notably, our estimates for the optimal allocation to silver appear significantly higher than holdings in most institutional investor portfolios, which we estimate amount to no more than 0.2%³ on average.

³ This estimate is based on the fact that most institutional investors allocate no more than 5% of their portfolios to commodities, with these exposures mainly gained through an index that tracks the price of a basket of commodities. A representative index of commodities has a 4.75% silver allocation (<https://www.bloomberg.com/company/press/bloomberg-commodity-index-2022-target-weights-announced>) implying an average exposure to silver in their portfolios of no more than 0.2%, on average.

Fig. 10: Optimal portfolio weights (Jan 1999 – Jun 2022)

Low risk investor	Low risk	Medium risk	High risk
Silver	4.4%	4.9%	4.7%
Gold	5.8%	3.7%	3.4%
Commodities	1.2%	0.9%	0.6%
Equities (Developed – Large & Mid cap)	42.8%	44.9%	45.1%
Equities (Developed – Small cap)	10.1%	14.0%	14.7%
Equities (Emerging – Broad market)	6.8%	13.4%	13.4%
Bonds (Global aggregate)	14.7%	10.3%	10.3%
Bonds (Emerging diversified)	14.1%	8.1%	7.7%

Note: Average weights may not sum to 100 owing to rounding

Source: Oxford Economics calculations

4. OPTIMAL PORTFOLIOS OVER THE NEXT DECADE

At the time of writing, markets have been experiencing a broad-based rout as investor sentiment has been battered by a multitude of concerns including economic slowdown in China, the Russia/Ukraine war, surging inflation and central-bank policy tightening. But the lesson from previous market corrections is that these periods of uncertainty can provide valuable opportunities for longer-term investors. In order to better understand the investment implications of this rapidly shifting market environment, we used the Oxford Global Economic Model to investigate the potential behaviour of silver relative to other asset classes over the next ten years to 2032 (Appendix II provides a description of the structure of the Oxford Model).

As described in Box 1, our baseline scenario is that the global economy will avoid a severe downturn over the coming year, with pressures on central banks to tighten policy easing as we move into 2023 and the rate of inflation falls back. With major equity markets having already experienced double-digit declines, we do not expect further significant falls. Bond prices are also now more evenly balanced, so they should be able to offer improved portfolio diversification qualities. But commodity prices are likely to fall back in the near term as transitory supply chain disruptions subside.

We believe the price of gold will also come under pressure in the near term as safe-haven flows fall back and uncertainty subsides. Although movements in the price of silver are likely to remain correlated with gold, the silver price should be somewhat insulated from this market correction given that it has not been inflated to the same extent as gold (as reflected in the gold-silver ratio). Silver will also benefit from strengthening industrial demand. Indeed, as mentioned in Chapter 2, silver is also likely to benefit from a more positive structural demand outlook over the medium term, given its use in many green technologies, indicating that we may be entering a period where the gold-silver price ratio shifts back in favour of silver.

Using our baseline assumptions for asset returns (calibrated to include a market cycle over the next ten years) together with a consistent variance-covariance matrix, we investigate the potential behaviour of silver relative to other asset classes and its role in an optimal portfolio under our baseline forecast outlook for the next decade. We impose the same minimum and maximum weight constraints by asset class as in the portfolio optimisation simulations for the historic period. Optimal asset allocations are then re-estimated on a rolling one-month basis for 5-year holding periods over the next decade.

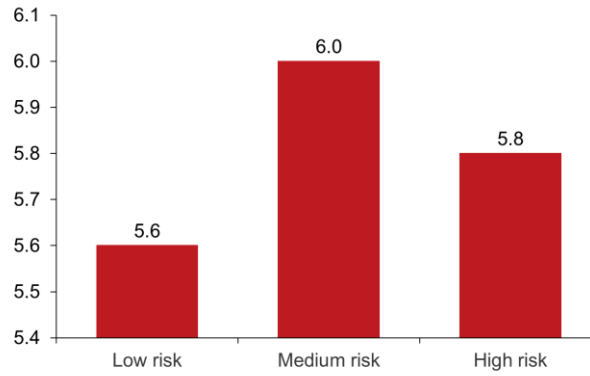
As shown in Figure 11, this exercise indicates that the optimal allocation to silver ranges from 5.6% for a low-risk portfolio to 6% for a medium-risk and 5.8% for a high-risk portfolio. These allocations are somewhat higher than the average

optimal allocations estimated using historic data, which reflects the more positive outlook for silver compared to recent history.

Fig. 11: Optimal allocations to silver by risk threshold (2022 – 2032)

Average optimal allocation to Silver

% (weight)



Source: Oxford Economics calculations

BOX 1: OXFORD ECONOMICS BASELINE OUTLOOK

Oxford Economics' latest baseline forecast assumes a soft landing for the global economy in the near term (the next 12 months), which should support profits growth and returns. The OE global GDP forecast for 2022 stands at 3%, following which we expect growth to average about 2.7% over the next decade.

At an asset level, our baseline forecasts point to average annual developed-market equity earnings growth in the mid-single digits over the next decade -- this would be slower than the growth witnessed over the past five years although not significantly lower. Strong developed equity markets are likely to also support higher returns for EMs.

Although global bond markets have suffered one of the worst starts to the year on record in 2022, we expect the forces driving these declines to be temporary. A key feature of this cycle has been the broad synchronisation of monetary policy – largely absent in the recent past. Although the rout in fixed income has been painful, higher yields render bonds more attractive from a medium-term perspective due to the carry and diversifications benefits that have been particularly meagre in the low-yield environment of the past.

We think the disinflationary forces over past decades will still prove to be alive as we exit the pandemic and the fallout from the Russia-Ukraine conflict. We see global inflation peaking in 2022 and typically, bond returns have been decent following peak inflation. EMs will still offer superior returns, but convergence with AEs will resume over the medium term as demographics and still-conservative macro policies will start to deliver lower yields and volatility.

In comparison to other assets considered in our portfolio, the outlook for commodities is relatively muted. Strong growth in commodity prices over 2021-22 due to supply disruptions, the war in Ukraine and the post pandemic surge in demand, is expected to be followed by a fallback in commodity prices as supply conditions normalise and demand eases. We expect price declines out to 2025 following which the longer-term trend will be more positive driven in particular by increased metal demand for the clean energy transition globally.

5. CONCLUSION

Silver encompasses the investment attributes of a precious metal while simultaneously boasting a wide array of active industrial applications. While silver's price movements are closely correlated with gold, our analysis indicates that its return characteristics are sufficiently different to make it a valuable diversification tool that warrants its own portfolio commitment.

Based on analysis of over 20 years of historic market data our simulations indicate that an efficient investment portfolio would have had a 4.9% allocation to silver for a medium-risk investor. Moreover, looking forward to the next decade, our baseline economic projections and the strengthening structural demand outlook for silver indicates an even higher medium-risk optimal portfolio allocation to silver of 6%. With the average investment portfolio having only indirect exposure to silver of around 0.2% through a basket of commodities, this suggests that investment managers should consider the case for a more significant allocation to silver.

APPENDIX I: DATA SOURCES

DATA SOURCES

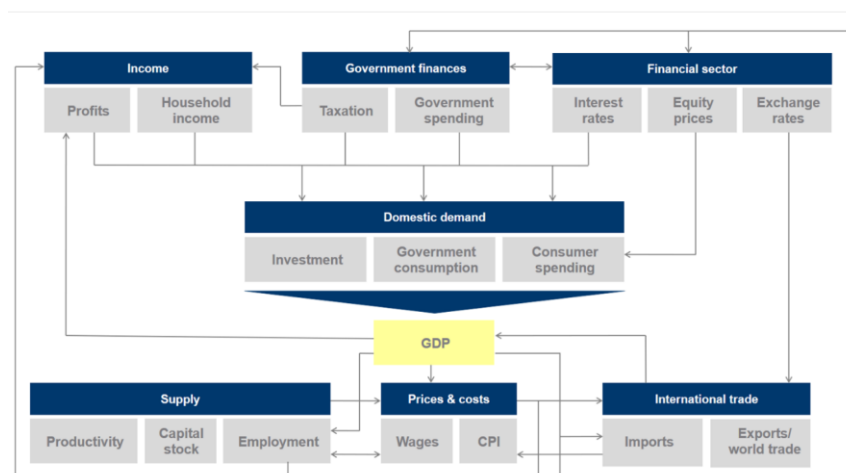
The historic analysis presented in this report was based upon total return indices denominated in US dollars and sourced from Refinitiv:

- Silver: S&P GSCI Silver Total Return
- Gold: S&P GSCI Gold Total Return
- Commodities: Bloomberg - Commodity Total returns index
- Equities (Developed – Large & Mid cap): S&P Dev. Large & Mid cap Total Return index
- Equities (Developed – Small cap): S&P Developed Small cap index
- Equities (Emerging – Broad market): S&P Emerging Broad Market Total Return index
- Bonds (Global aggregate): Bloomberg Global-Aggregate Total Return Index
- Bonds (Emerging diversified): JPMorgan EMBI Global Diversified Total Return index

APPENDIX II: THE OXFORD GLOBAL ECONOMIC MODEL

The key framework in which Oxford Economics' analysis is conducted is its own Global Econometric Model (GEM). The GEM replicates the world economy by interlinking 80 countries, 6 regional trading blocs and the Eurozone. These countries are interlinked through international trade in goods and services, competitiveness (measured by unit labour costs adjusted for the exchange rate), capital markets, interest rates and commodity prices. Historic data and forecasts are updated on a monthly basis by our country economists.

STYLISTED VERSION OF THE GEM



This Model—which is unique among the commercial economic consultancies—provides a rigorous and consistent structure for analysis and forecasting, and allows the implications of alternative global scenarios and policy developments to be readily analysed at both the macro, sectoral and regional level.

Asset prices are embedded in the Global Economic Model. Key financial variables include:

- **Interest rates:** policy rates, money market rates, sovereign yield curves, Swap curves.
- **Equity prices:** main stock market indices covered in each country.
- **Exchange rates:** spot rate against US\$ & € enabling calculation of other cross rates, and nominal/real effective exchange rates.
- **Commodity prices:** oil, natural gas, gold, and other metals.

For this project we also estimated an equation linking the performance of silver with fundamental economic drivers. This was incorporated into the GEM so that future performance of the silver price could be assessed under our baseline economic scenario.



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