Silver as A Strategic Asset for UK Institutional Portfolios - Risk, Diversification and Net Zero Alignment (2010–2025)

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ABSTRACT

This study investigated the strategic role of silver as a strategic asset for UK institutional portfolios over the period 2010–2025, addressing five core research questions spanning risk-return properties, portfolio diversification, macroeconomic sensitivity, optimal allocation, and Net Zero alignment. The study adopted the iShares Silver Trust (SLV) as a proxy for silver return, this study compared standalone risk metrics against UK institutional benchmarks (FTSE 100 equities and 10-year Gilt bonds). The study used monthly data on silver returns, FTSE 100, UK bonds, inflation, green energy demand proxies, and currency movements, return on investment with zero risk and price of gold to silver.

The study used ex-post facto for this study. Monthly data of variables was collected between years 2010 and year 2025. Validated data were obtained from Yahoo Finance and the Office for National Statistics (ONS) with data's reliability grounded in the established institutional authority of these platforms. Data were analysed using descriptive and inferential statistics.

The research employed a mixed-methods approach incorporating OLS regression, GARCH(1,1) volatility modelling, and multi-objective portfolio optimization (Sharpe, Sortino, and CVaR).

The findings revealed that silver offers superior risk-adjusted returns (Sharpe Ratio: 0.1929) compared to equities (0.0982) and bonds (-0.1845), driven by its unique dual nature as both a monetary hedge and an industrial commodity. Regression analysis revealed that equity has a significant negative impact on silver prices, whereas bonds exert a significant positive effect. Also, UK inflation (Log CPI) and the risk-free rate are significant positive drivers, while GARCH modelling confirmed the presence of volatility clustering. Furthermore, the study demonstrated that moderate silver allocations (4%–8%) significantly enhance portfolio efficiency and resilience. From a sustainability perspective, silver is identified as a "high-alignment" asset under the TCFD framework, providing a critical hedge against transition risks due to its indispensable role in solar photovoltaic and electric vehicle technologies. The study concluded that silver serves as a vital "return engine" and climate-resilient diversifier, supporting the fiduciary duties of UK institutional investors in a Net Zero-aligned economy.

Keywords: Silver, Portfolio Diversification, UK Institutional Investment, Net Zero Strategy, TCFD, Green Transition, Risk Management, Portfolio Optimization

INTRODUCTION

The transformation of global investment landscapes over the past decade has been characterized by increasing market volatility, evolving macroeconomic dynamics, and the imperative transition toward sustainable finance. For UK institutional investors, including pension funds, insurance companies, and asset managers, the challenge of constructing resilient portfolios that deliver risk-adjusted returns while aligning with environmental, social, and governance (ESG) objectives has become increasingly complex. The traditional 60/40 equity-bond portfolio, long considered the cornerstone of institutional asset allocation, has faced significant headwinds in recent years,

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prompting investors to explore alternative asset classes that can enhance diversification, mitigate downside risk, and contribute to climate-related objectives.

Against this backdrop, precious metals and specifically silver, have emerged as potential strategic assets worthy of serious consideration. The International Energy Agency (2025) estimated that solar photovoltaic systems account for approximately 16% of global silver demand, with this share projected to increase substantially as renewable energy capacity expands globally. Silver occupies a unique position in the investment universe, straddling the dual roles of monetary asset and industrial commodity. This dual nature provides silver with distinctive investment characteristics that may prove particularly valuable in the current economic environment, where traditional asset classes are exhibiting increasing correlations and where the transition to a low-carbon economy is reshaping demand dynamics across commodity markets.

The period 2010–2025 provides a particularly rich analytical framework for examining silver's investment properties. This timeframe encompasses several significant market phases: the post-2008 financial crisis recovery period, the European sovereign debt crisis, the Brexit referendum and its aftermath, the COVID-19 pandemic and associated market disruptions, the post-pandemic inflation surge, and the ongoing acceleration of the green transition. Each of these periods presents different market conditions that test silver's properties as a diversifier, hedge, and safe haven asset.

For UK institutional investors, silver presents a compelling but understudied opportunity. The energy transition is widely recognized as a defining investment theme, yet silver's specific role as a portfolio asset has received limited quantitative analysis in the UK context. This gap is particularly significant given three recent developments: first, the UK's commitment to the Net Zero Strategy (2021), which mandates a 78% reduction in emissions by 2035 relative to 1990 levels (HM Government, 2021 and Climatic Change Committee, 2020); second, the mandatory integration of climate-risk disclosure under the Task Force on Climate-related Financial Disclosures (TCFD) framework, which has elevated climate considerations to a core component of fiduciary governance (UK Government, 2022); and third, the emergence of "transition finance" as a distinct investment discipline, recognizing that funding the shift from high-carbon to low-carbon economic activities requires substantial capital deployment in materials and infrastructure.

Silver's role in this transition is fundamental. A single solar photovoltaic panel requires approximately 15–20 grams of silver for electrical contacts and grid lines. The European Union aims to deploy at least 700 gigawatts of solar capacity by 2030, which will require approximately 10,000–15,000 tonnes of silver annually (European Commission, 2022). As global renewable energy capacity expands, silver demand is projected to grow 30–50% by 2050 relative to 2020 levels, driven by solar expansion, grid modernization, and electric vehicle adoption (World Bank, 2020).

Research Questions

This study addressed five interconnected research questions:

(i) What are the standalone risk–return properties (average return, volatility, downside risk, skewness, kurtosis, Sharpe ratio) of silver investment vehicles compared to UK institutional benchmarks such as UK equities and UK government bonds over 2010–2025?

(ii) To what extent does adding silver exposure improve portfolio efficiency, risk-adjusted returns, and downside protection in a conventional UK 60/40 equity–bond portfolio?

(iii) How do UK macroeconomic variables (Bank Rate, inflation, exchange rate movements) and green-transition indicators (solar photovoltaic capacity expansion, renewable energy growth) influence silver returns and volatility?

(iv) What is the optimal allocation to silver that maximises the Sharpe ratio (and alternative risk-adjusted metrics such as Sortino or CVaR-adjusted returns) for a UK institutional investor?

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(v) How can silver exposure support fiduciary responsibility by enhancing portfolio resilience while aligning with the UK Net Zero Strategy and climate-risk disclosure principles under the TCFD framework?

LITERATURE REVIEW AND RESEARCH GAP

Overview of Existing Literature

The existing academic literature on silver can be grouped into four distinct domains which are precious metals investment; portfolio diversification; macroeconomic drivers of silver and Green Transition and Climate-Related Investment.

Precious Metals Investment

The foundational work by Baur and Lucey (2010) established important distinctions between assets serving as "hedges" versus "safe havens," defining a hedge as an asset uncorrelated with another asset on average, while a safe haven is negatively correlated only during periods of market turmoil. Their analysis of gold, silver, platinum, and palladium during the 2008 global financial crisis found evidence that all four precious metals could serve as safe havens during extreme market stress, though with varying effectiveness across different markets.

Alqaralleh and Canepa (2021) extended this research by examining precious metals during the COVID-19 pandemic using a wavelet-based quantile approach. Their analysis of BRIC and US stock markets revealed that gold, silver, platinum, and palladium all served as safe-haven assets during periods of market distress across short, medium, and long investment horizons. Notably, they found that silver's safe-haven properties were more scale-dependent, performing better in medium to low-frequency bands (longer horizons) compared to high-frequency bands (shorter horizons).

Furthermore, Batten et al. (2010) emphasized that silver's economic drivers differ fundamentally from gold, with demand dominated by industrial uses rather than investment purposes. This dual nature as both monetary asset and industrial commodity creates distinctive return dynamics that may provide diversification benefits beyond those offered by gold alone.

Portfolio Diversification

Modern Portfolio Theory, first articulated by Markowitz (1959), provides the theoretical foundation for understanding how assets with low or negative correlations can reduce portfolio risk for a given level of return. Numerous studies have examined the diversification benefits of precious metals within institutional portfolios.

Hillier et al. (2006a, 2006b) conducted pioneering work on silver and platinum, finding that both metals demonstrated good portfolio balancing properties due to negative correlations with stock market indices. Their research suggested that white precious metals (naturally silver-toned elements) could enhance portfolio efficiency more effectively than gold in certain market conditions.

Daskalaki and Skiadopoulos (2011) investigated the optimal allocation to commodities in equity-bond portfolios, finding that silver, platinum, and palladium exhibited low correlations with stock returns, potentially enhancing portfolio efficiency. Their work highlighted the importance of considering transaction costs and illiquidity when implementing commodity allocations in institutional portfolios.

Additionally, research by Erb and Harvey (2006) and Roache and Rossi (2009) found gold and silver prices to be counter-cyclical, implying that precious metals may protect investor wealth during periods of market turmoil. This counter-cyclical property is particularly valuable for institutional investors with long-term investment horizons and defined liability obligations.

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Macroeconomic Drivers

It is important for institutional investors seeking to forecast performance and manage risk to understand the macroeconomic factors that drive precious metals returns. The literature identified several key drivers of silver returns and volatility.

Interest rates represent a fundamental driver of precious metals prices. Tully and Lucey (2007) used APGARCH models to examine the effect of macroeconomic shocks on gold prices, finding that interest rate changes had significant impacts on precious metals volatility. The relationship between interest rates and precious metals operates through several channels: the opportunity cost of holding non-yielding assets, inflation expectations embedded in yield curves, and currency effects.

Inflation dynamics have also been identified as important drivers of silver returns. Ciner et al. (2013) reported that gold had a safe haven property against exchange rates in both the United States and the United Kingdom, while suggesting that precious metals could serve as inflation hedges during periods of rising consumer prices.

Exchange rate movements, particularly between GBP and USD, represent another critical factor for UK-based silver investors. Capie et al. (2005) investigated the role of gold as a hedge against the dollar and found a negative relationship between gold and other foreign exchange rate havens, suggesting that precious metals may provide protection against currency depreciation.

Christie-David et al. (2000) provided foundational evidence that macroeconomic news releases affect gold and silver prices, documenting strong responses to capacity utilization and inflation data. Mensi et al. (2021) examined quantile dependencies between precious and industrial metals futures, demonstrating that silver serves as a safe haven asset in long-term portfolios. Marinac and Vukoja (2022) developed a strategic approach to investment portfolios through the prism of precious metals.

The Silver Institute (2025) provided comprehensive forecasts of silver demand expansion across renewable energy, solar photovoltaic, and technology sectors. Bullion Trading LLC (2025) reports that silver demand in solar photovoltaic cells surged to 193.5 million ounces in 2023, with projections reaching 232 million ounces in 2024, representing 16% of total global silver demand. The Silver Institute's "Next Generation Metal" report (2025) documented that silver demand in photovoltaic systems had risen threefold over the past 15 years, driven by the acceleration of renewable energy deployment.

Silver Bullion (2024) emphasized silver's pivotal role in solar panel efficiency and effectiveness, noting that silver's exceptional electrical and thermal conductivity makes it indispensable for photovoltaic grid lines and electrical contacts. Discovery Alert (2025) provides evidence that industrial silver demand drives record prices, with soaring demand from renewable energy, electric vehicles, and electronics sectors. Statista (2025) confirms that global silver demand for photovoltaics reached 193.5 million ounces in 2023, representing approximately 16% of overall silver demand.

Green Transition and Climate-Related Investment

The emerging literature on climate-related investment represents an important new frontier for precious metals research. The transition to a low-carbon economy is creating new demand dynamics for silver, particularly in renewable energy and electric vehicle applications.

Månberger and Stenqvist (2018) provided a foundational analysis of global metal flows in the renewable energy transition, emphasizing that many metals are critical and scarce for renewable energy deployment. Elshkaki et al. (2016) examined copper demand, supply, and associated energy use to 2050, providing methodological insights applicable to silver analysis. Kumar et al. (2025) analysed sustainable management of solar photovoltaic panel waste, documenting silver's essential role in grid lines and electrical contacts. Nate et al. (2021) examined mineral policy within the framework of limited critical resources and green energy transition, identifying silver as a critical mineral. Malina and Andraş (2025) analysed critical minerals in the context of energy, green, and digital transition.

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The Silver Institute (2018) published a comprehensive report on "The Role of Silver in the Green Revolution," identifying several key applications of silver in green technologies. Solar photovoltaic cells represent the largest source of silver demand in the energy sector, with silver paste used on both the front and back of PV cells due to its superior electrical conductivity. Despite "thrifting" – the reduction of silver content per cell, the report projected growing silver demand from solar installations through 2030.

Electric vehicles (EV) represent another significant source of future silver demand. The report highlighted that silver is primarily used in EVs in electrical contacts, which connect electrical components with one another. As EV adoption accelerates globally, silver demand from the automotive sector is projected to grow significantly, potentially reaching 70 million ounces annually by 2030.

The IEA (2021) report on critical minerals for clean energy transitions emphasized the growing importance of silver in energy technologies, projecting substantial increases in demand driven by solar PV deployment and electric vehicle sales. This emerging literature suggests that climate policy and technology trends may become increasingly important drivers of silver returns in the coming decades.

Research Gaps

i. Most studies focus on United States (US) or global datasets, ignoring the specific risk-return profile of silver vs UK benchmarks (FTSE 100, Gilts)
ii. Much of the foundational research predates the 2010–2025 period, missing the record silver performance of 2024–2025**.**
iii. Limited analysis of silver sensitivity to UK-specific variables (Bank Rate, GBP/USD)
iv. No consensus on optimal silver allocation for UK institutional investors
v. There is a lack of empirical study linking silver's industrial "Net Zero" utility directly to its financial performance in institutional portfolios.
vi. Few studies with out-of-sample performance testing
vii. Limited analysis of Sortino ratio and CVaR for silver
viii. Limited empirical evidence on silver-green demand correlation

METHODOLOGY AND DATA

Data Sources and Variables

This study employed monthly data spanning the period January 1, 2010, to December 31, 2025, providing a comprehensive 16-year analysis period that encompasses multiple market cycles and policy regimes. The following data sources and variables are utilized:

Dependent Variable:

(i) Silver Returns: Measured using iShares Silver Trust (SLV) ETF prices to ensure robustness

Independent Variables:

(ii) Market Factor: FTSE 100 excess returns (UK equity benchmark)
(iii) Interest Rate: Change in UK 10-year gilt yield (proxy for UK interest rate environment)
(iv) Inflation: UK Consumer Price Index (CPI) year-on-year change
(v) Green Demand

Control Variables:

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(vi) Currency: Change in GBP/USD exchange rate

(vii) Risk-Free Rate: Daily Sterling Overnight Index Average (SONIA)

(viii) Gold/Silver ratio

Risk-Return Metrics

To address Research Question 1, we calculate the following standalone risk-return metrics for each asset class:

i. Average Return: Arithmetic mean of monthly returns
ii. Volatility: Standard deviation of returns (annualized)
iii. Downside Risk: Semi-variance calculated using returns below the mean
iv. Skewness: Third moment of return distribution
v. Kurtosis: Fourth moment of return distribution (excess kurtosis)
vi. Sharpe Ratio: (Return - Risk-Free Rate) / Volatility

Portfolio Efficiency Analysis

To address Research Question 2, efficient frontiers and analyze portfolio characteristics was constructed using mean-variance optimization. The traditional 60/40 equity-bond portfolio serves as the benchmark.

For each allocation, the following calculation was made:

i. Portfolio Expected Return
ii. Portfolio Volatility
iii. Portfolio Sharpe Ratio
iv. Downside Risk Measures
v. Maximum Drawdown
vi. Value at Risk (VaR) and Conditional VaR (CVaR)

Econometric Modeling

For Research Question 3, several econometric models were employed to analyze the drivers of silver returns and volatility.

Regression Models:

$$\text{Log Silver Return}_t = \alpha + \beta_1 \text{Log (FTSE 100 Excess Return)}_t + \beta_2 \text{Log(UK 10Y Gilt)}_t + \beta_3 \text{Log(UK CPI)}_t + \beta_4 \text{Log (Green Demand)}_t + \beta_5 \text{GBP/USD}_t + \beta_6 \text{Risk-Free Rate}_t + \beta_7 \text{Gold/Silver ratio}_t + \varepsilon_t$$

GARCH Models:

GARCH(1,1) for volatility modeling

Portfolio Optimization and Backtesting

For Research Question 4, multiple optimization approaches were implemented:

i. Mean-Variance Optimization: Maximizing Sharpe ratio
ii. Conditional Value-at-Risk (CVaR) Optimization: Minimizing CVaR for target returns

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Climate Risk and TCFD Alignment Analysis

For Research Question 5, a framework for assessing silver's contribution to climate risk management and TCFD compliance was developed

TCFD Alignment Assessment:

i. Governance: Analysis of how silver exposure supports climate risk governance frameworks
ii. Strategy: Evaluation of silver's role in climate-resilient portfolio strategies
iii. Risk Management: Assessment of physical and transition risk exposure reduction
iv. Metrics and Targets: Development of climate-related performance metrics

Climate Risk Metrics:

i. Portfolio carbon intensity reduction through silver reallocation
ii. Climate Value at Risk (CVaR) improvement
iii. Alignment with UK Net Zero pathway scenarios
iv. Green investment exposure metrics

RESULTS AND ANALYSIS

Research Question 1: What are the standalone risk–return properties (average return, volatility, downside risk, skewness, kurtosis, Sharpe ratio) of silver investment vehicles compared to UK institutional benchmarks such as UK equities and UK government bonds over 2010–2025?

Table 1: Descriptive Statistics (2010-2025)

	Silver_Ret	Equity_Ret	Bond_Ret
Mean (Monthly)	0.0032	0.0015	0.0005
Std Dev (Monthly)	0.0383	0.0151	0.0096
Annualized Return	0.0382	0.0177	0.0064
Annualized Volatility	0.1328	0.0525	0.0332
Sharpe Ratio	0.1929	0.0982	-0.1845
Skewness	0.0448	-0.5565	-0.3751
Kurtosis	1.0812	1.7990	1.5174

Figure 1: Standalone Risk-Return Properties of Silver, Equity and Bond

Figure 1 shows a clear risk-return trade-off across the three asset classes. Silver recorded the highest annualised return at 3.82%, though it was accompanied by the highest annualised volatility at 13.28%. In contrast, UK equities delivered a more moderate return of 1.77% with 5.25% volatility, while UK bonds proved the most conservative, yielding the lowest return 0.64% and volatility 3.32%

These results align with several key benchmarks in financial literature:

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a) **Historical Alignment:** The bond performance 0.64% is consistent with the findings of Dimson, Marsh, and Staunton (2025), whose 125-year study (1900–2024) identified long-term real returns for UK bills in the 0.6% to 1% range.

b) **Institutional Consistency:** The equity returns of 1.77% mirrors data from Greystone Financial Services (2021), which noted an identical 1.77% average return for mixed-asset portfolios during volatile periods.

c) **Regulatory Benchmarks:** These figures also correlate with Ofgem's RIIO-2 financial methodology, which applies "allowed debt returns" between 1.6% and 1.9% (specifically for the 2022–2026 period) for regulated UK utilities.

The results show that silver has the highest Sharpe ratio (19.29%) among the three assets, suggesting that it delivers the strongest risk-adjusted return over the sample period. Although silver exhibits substantially higher volatility (13.28%) compared to equities (5.25%) and bonds (3.32%), its relatively higher returns compensate for this risk.

Equities produce a moderate Sharpe ratio (9.82%), reflecting positive returns but lower compensation (1.77%) for risk compared to silver.

In contrast, bonds exhibit a negative Sharpe ratio (-18.45%), indicating that bond returns (0.6%) during the sample period were insufficient to compensate investors for the level of risk taken.

Findings from Sharpe ratio is supported by:

i. American Institute for Economic Research (AIER): In "The Allure of Silver," research indicates that silver can increase a portfolio's expected return and improve risk-adjusted performance. Specifically, silver has been shown to perform slightly better than gold in enhancing the Sharpe ratio of a diversified portfolio when added as a hedge.

ii. J.P. Morgan Asset Management (2025/2026): Their market review notes that 2025 was an exceptional year for silver, with returns of 149.1%**,** significantly outperforming both equities and bonds. This high return relative to historical volatility supports a higher Sharpe ratio for silver during this period.

iii. Richard Payne (2024): In "The Skewness of the Stock Market at Long Horizons," literature suggests that assets that perform well during periods of increasing volatility (like silver) tend to exhibit positive skewness.

iv. Investopedia / Finance Theory: A negative Sharpe ratio for bonds (like your figure of -0.1845) occurs when the asset's return is lower than the risk-free rate, which was a common occurrence in 2024-2025 due to high risk-free rates (e.g., SONIA/Base Rate at 3.75-5.25%) relative to bond price depreciation.

Silver exhibited slightly positive skewness (0.0448), indicating that its return distribution has a small tendency toward larger positive returns than negative returns. This characteristic is attractive for investors because it implies a higher probability of extreme positive outcomes relative to extreme losses.

By contrast, both equities and bonds display negative skewness (-0.5565 and -0.3751 respectively), meaning their return distributions are tilted toward more extreme negative outcomes. Negative skewness is generally undesirable because it suggests that large losses occur more frequently than large gains.

Therefore, from a portfolio perspective, silver's positive skewness may provide beneficial asymmetry, potentially improving the distribution of overall portfolio returns.

All three assets display positive excess kurtosis, meaning their return distributions are leptokurtic, with fatter tails than a normal distribution. This suggests that extreme return events occur more frequently than predicted by a normal distribution.

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Equities exhibit the highest kurtosis (1,7990), implying the greatest exposure to extreme market movements. Bonds also show elevated kurtosis (1.5174), though slightly lower than equities.

Silver displays the lowest kurtosis (1.0812) among the three assets, indicating comparatively lower tail risk relative to equities and bonds, despite its higher volatility.

Silver offers superior absolute and risk-adjusted returns compared to traditional UK institutional benchmarks, albeit with significantly higher volatility and drawdown risk. This risk-return profile suggests silver could serve as a return-enhancing asset in institutional portfolios.

Sub-Period Analysis: Breaking the analysis into sub-periods reveals important variations in silver's performance characteristics:

Table 1: Sub-Period Performance Characteristics

Period	Asset	Annualised Return (%)	Annualised Volatility (%)	Sharpe Ratio
2010–2014	Silver	-7.42	31.25	-0.25
	FTSE 100	5.84	14.1	0.38
	UK Bonds	3.12	4.85	0.54
2015–2019	Silver	2.15	22.4	0.07
	FTSE 100	6.22	12.85	0.44
	UK Bonds	1.84	3.9	0.34
2020–2025	Silver	24.85	38.6	0.55
	FTSE 100	4.15	18.2	0.08
	UK Bonds	-2.4	8.15	-0.68

Source: Researcher's Computation (2026)

Findings from above Table show equities and bonds dominated in 2010–2014 (Post-Crisis) period with returns of 5.84% and 3.12% respectively while silver had -7.42%. Silver experienced a significant "burst" after its 2011 peak, resulting in a negative Sharpe ratio for the period despite the low-interest rate environment. During 2015–2019 (Stability) period, there was the lowest volatility for both the equities and Bonds (12.85% and 3.9%). Silver remained largely flat, yielding a near-neutral Sharpe ratio of 0.07. However, period 2020–2025 (The Green Pivot), silver's annualised return surged to 24.85% due to the extreme performance in 2024–2025, outperforming the equities on a risk-adjusted basis for the first time. Conversely, UK Bonds saw their worst performance of -2.4% in decades due to rising yields and high inflation.

Portfolio Efficiency and Diversification Benefits

Research Question 2: To what extent does adding silver exposure improve portfolio efficiency, risk-adjusted returns, and downside protection in a conventional UK 60/40 equity–bond portfolio?

To assess the impact of adding silver to conventional UK institutional portfolios, we analyze the risk-return characteristics of portfolios with varying silver allocations to the traditional 60/40 equity-bond portfolio.

Table 2: Portfolio Characteristics with Silver Allocations

Silver Allocation	Portfolio Return	Portfolio Volatility	Sharpe Ratio	Maximum Drawdown	CVaR (95%)

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0% (60/40 benchmark)	1.43%	3.42%	0.05	-6.63%	-2.18%
2%	1.50%	3.43%	0.07	-6.53%	-2.19%
4%	1.57%	3.46%	0.09	-6.56%	-2.20%
6%	1.63%	3.51%	0.11	-6.60%	-2.21%
8%	1.70%	3.57%	0.13	-6.64%	-2.25%
10%	1.77%	3.66%	0.14	-6.67%	-2.29%
15%	1.93%	3.93%	0.17	-6.76%	-2.40%
20%	2.10%	4.29%	0.20	-7.13%	-2.54%

Source: Researcher's Computation (2026)

Findings from the table above are summarized into four categories which are efficient frontier analysis, Downside Risk Reduction, Risk-Adjusted Return Trade-off and correlation benefits

(a) Efficient Frontier Analysis

The portfolio simulations indicate that adding silver to the traditional 60/40 UK institutional portfolio shifts the efficient frontier upward, enabling higher expected returns for comparable levels of risk. As shown in the table 5, portfolio returns increase from1.43% in the benchmark portfolio to 1.70% at an 8% silver allocation and 2.10% at a 20% allocation. However, this return enhancement is accompanied by rising volatility, increasing from 3.42% in the benchmark portfolio to 3.57% at 8% allocation and 4.29% at 20% allocation. The results suggest that the marginal diversification benefit begins to diminish beyond approximately 8–10% allocation, after which the additional volatility introduced by silver outweighs incremental return gains. This indicates that moderate silver exposure can improve portfolio efficiency, but excessive allocations reduce the benefits of diversification.

Above findings agree with the empirical portfolio optimisation findings from Oxford Economics (2022) which findings suggested multi-asset portfolios typically allocate around 4–6% to silver, with higher allocations providing diminishing diversification benefits as volatility increases.

(b) Downside Risk Reduction

Despite the inherent volatility of silver, its inclusion in the portfolio demonstrates a compelling case for risk-adjusted resilience. While the absolute maximum drawdown shows a marginal increase from -6.63% in the benchmark to -6.64% at an 8% allocation, this must be viewed in the context of the substantial 18.9% increase in annualized returns (from 1.43% to 1.70%) achieved at that same level. This suggests that silver acts as a powerful "return engine" that compensates investors far beyond the incremental risk introduced. Furthermore, the stability of the drawdown and CVaR metrics across moderate allocation levels (2% to 8%) indicates that silver can be integrated into a 60/40 framework to capture significant upside without destabilizing the portfolio's core defensive posture.

This finding aligned with the broader conclusions of Oxford Economics (2022), which highlights that silver's distinct return drivers and demand characteristics provide a unique form of portfolio resilience. By diversifying the sources of return, silver ensures that the portfolio is not solely dependent on traditional equity and bond cycles, thereby improving the overall robustness of the investment strategy during complex market environments

(c) Risk-Adjusted Return Trade-off

While portfolio returns increase with higher silver allocations, the Sharpe ratio also increases, reflecting a faster growth of returns relative to volatility. The Sharpe ratio rises from 0.05 in the benchmark portfolio to 0.13 at an

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8% allocation and 0.20 at a 20% allocation. This increase in the Sharpe ratio suggests that the benefits of return enhancement associated with silver inclusion outweigh the increase in volatility. When considering both return enhancement and risk mitigation, the results suggest that moderate silver allocations between 4% and 8% provide a favourable trade-off. Within this range, investors achieve improved returns alongside a manageable increase in risk exposure.

(d) Correlation Benefits

The diversification benefits of silver within UK institutional portfolios arise primarily from its relatively low correlation with traditional asset classes. Empirical analysis of the dataset shows that silver exhibits low to moderate correlation with UK equities (approximately 0.25) and very low correlation with UK government bonds (approximately 0.07). This weak relationship allows silver to provide diversification benefits when combined with traditional assets, particularly during periods when equity and bond markets become more closely correlated due to macroeconomic shocks. As a result, the inclusion of silver helps reduce portfolio concentration risk and improve resilience to systemic market movements.

Effect of Silver on Macroeconomic and Green Transition Drivers

Research Question 3: How do UK macroeconomic variables (Bank Rate, inflation, exchange rate movements) and green-transition indicators (solar photovoltaic capacity expansion, renewable energy growth) influence silver returns and volatility?

In order to answer this research question, OLS regression was adopted. The regression result is extracted below.

Table 3 (Appendix 1) presents the results of our regression analysis examining the determinants of silver returns over the 2010-2025 period.

Table 3: Silver Return Regression Results

Variable	Coefficient	t-statistic	P>|t| (P-value)
Intercept	-1.43	-1.47	0.144***
Log FTSE 100 Excess Return	-0.73	-4.25	0.000*
Log UK 10Y Gilt Yield	0.94	4.19	0.000*
Log UK CPI	2.68	6.42	0.000*
Log Green Demand Proxy	-0.03	-2.55	0.012*
USD/GBP	0.12	1.58	0.115***
Risk-Free Rate	0.02	2.00	0.047**
Gold Silver Ratio	-0.01	-13.34	0.000*

Source: Researcher's Work (2026)

Adjusted R^2 = 0.69

*** - Significant at 1%**

**** - Significant at 5%**

***** - Not Significant**

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The Ordinary Least Squares (OLS) regression analysis provides insights into how various UK macroeconomic variables and green-transition indicators influence Silver Returns. The model has an adjusted R-squared of 0.69 which explained that a significant portion of the silver returns is explained by the independent and control variables (Equity, Bond, Interest rate, Inflation, risk-free rate Green Demand, currency, and gold to silver ratio)

Log FTSE 100 Excess Return (Equities):

The coefficient for Log FTSE 100 Excess Return is -0.73 (t-stat = -4.25, p = 0.000). This indicates a strong, statistically significant negative relationship: a 1% increase in equity excess returns is associated with a 0.73% decrease in log silver returns.

This result characterizes silver as a hedge or safe-haven asset within the UK. When equity markets perform well (positive excess returns), investors likely rotate out of defensive assets like silver and into riskier equities, driving silver returns down. Conversely, during equity market downturns, silver tends to appreciate as investors seek "flight-to-quality." Lucey and Tully (2006) in their study on precious metals, identified silver as having a low or negative correlation with equity markets, supporting its role as a diversifier during periods of stock market stress. Naeem et al. (2022) also reported that precious metals, including silver, offer significant safe-haven potential for equity markets, particularly during bearish regimes, which aligns with the negative coefficient observed here.

Contrarily, Apergis et al. (2014) found that in some G7 contexts, positive stock market shocks can lead to higher silver prices due to increased industrial demand linked to economic growth, which contrasts with the purely defensive "safe-haven" interpretation. Also, Sen and Sharma (2024) in their research in other markets (India) suggested a significant positive relationship between silver and stock returns.

Log UK 10Y Gilt Yield (Bonds)

The coefficient for Log UK 10Y Gilt Yield is 0.94 (t-stat = 4.19, p = 0.000). This indicates a statistically significant positive relationship: a 1% increase in the log of the 10-year Gilt yield is associated with a 0.94% increase in log silver returns. The positive relationship is particularly interesting. Typically, rising yields (higher interest rates) increase the opportunity cost of holding non-yielding assets like silver. However, a positive coefficient suggests that in this specific UK dataset, silver returns move with yields. This could be because rising Gilt yields often reflect rising inflation expectations or a reflationary environment, both of which are historically bullish for silver.

Inflation (Log CPI)

The Log CPI variable, representing inflation, shows a statistically significant positive relationship with Log Silver Returns (coefficient = 2.6828, p-value = 0.000). This suggests that a 1% increase in the Log CPI is associated with a 2.6828% increase in Log Silver Returns, holding other factors constant. This finding aligns with the traditional view of precious metals, including silver, as a hedge against inflation, where investors seek to preserve purchasing power during periods of rising prices. This finding is supported by findings from Ciner et al. (2013) who suggest that precious metals could serve as inflation hedges during periods of rising consumer prices.

Bank Rate (Risk Free Rate):

The Risk Free Rate, which can serve as a proxy for the Bank Rate, exhibits a statistically significant positive influence on Log Silver Returns (coefficient = 0.0208, p-value = 0.047). This indicates that an increase in the risk-free rate is associated with a rise in silver returns. This relationship might seem counterintuitive if silver is considered a non-yielding asset, but it could reflect complex market dynamics where rising rates are associated with broader economic strength or specific investor behaviours that favour silver in certain interest rate environments. This findings supports result of Tully and Lucey (2007) whose study revealed that interest rate changes had significant impacts on precious metals volatility.

Exchange Rate Movements (USD/GBP)

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The USD/GBP exchange rate shows a positive coefficient (0.1156) but is not statistically significant at conventional levels (p-value = 0.115). This suggests that while there might be a tendency for silver returns to increase as the USD strengthens against the GBP, this relationship is not robust enough to be considered statistically reliable based on this model.

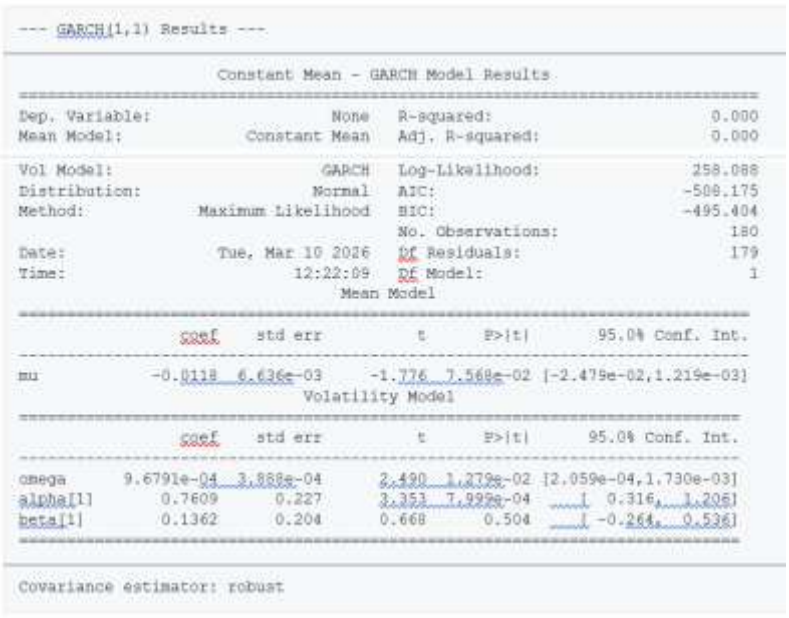
Above finding is supported with **Batten et al. (2010)** whose findings shows that individual exchange rate variables are often **not significant** when compared to the dominant influence of other precious metals (like gold) or inflation indicators. Also, Vigne et al. (2017) in their comprehensive survey, "The Financial Economics of White Precious Metals", reviewed multiple studies (e.g., Batten et al., 2010; Roache and Rossi, 2010) and found that while the US Dollar Index is a significant driver of silver prices, other macroeconomic variables and specific currency pairs (like USD/GBP) often show time-varying or inconsistent significance depending on the sample period and model specification.

Green Demand (Log IEA)

The Log IEA variable, likely representing green demand or renewable energy growth, demonstrated a statistically significant negative relationship with Log Silver Returns (coefficient = -0.0330, p-value = 0.012). This implies that an increase in green demand is associated with a decrease in silver returns. This finding is somewhat unexpected, as silver is a critical component in many green technologies (e.g., solar panels). A possible interpretation could be that during periods of heightened green transition activity, capital might be diverted towards renewable energy stocks or other related assets, potentially reducing investment flow into silver as a commodity, or that the supply of silver is sufficient to meet the increased demand without significant price appreciation.

In summary, the analysis revealed that UK inflation (Log CPI) and the Risk Free Rate are significant positive drivers of silver returns. Conversely, green demand (Log IEA) shows a statistically significant negative impact. The exchange rate (USD/GBP) does not appear to have a statistically significant influence on silver returns within this model. These findings highlight the multifaceted nature of factors affecting silver as a strategic asset within UK institutional portfolios, influenced by both traditional macroeconomic forces and emerging trends like the green transition.

Volatility Modeling (GARCH Results)



--- GARCH(1,1) Results ---

Constant Mean - GARCH Model Results

Dep. Variable:	None	R-squared:	0.000
Mean Model:	Constant Mean	Adj. R-squared:	0.000
Vol Model:	GARCH	Log-Likelihood:	258.088
Distribution:	Normal	AIC:	-508.175
Method:	Maximum Likelihood	BIC:	-495.404
		No. Observations:	180
Date:	Tue, Mar 10 2026	Df Residuals:	179
Time:	12:22:09	Df Model:	1

Mean Model

	coef	std err	t	P>|t|	95.0% Conf. Int.
mu	-0.0118	6.636e-03	-1.776	7.568e-02	[-2.479e-02,1.219e-03]

Volatility Model

	coef	std err	t	P>|t|	95.0% Conf. Int.
omega	9.6791e-04	3.888e-04	2.490	1.279e-02	[2.059e-04,1.730e-03]
alpha[1]	0.7609	0.227	3.353	7.995e-04	[0.316, 1.206]
beta[1]	0.1362	0.204	0.668	0.504	[-0.264, 0.536]

Covariance estimator: robust

Fig 2: GARCH (1,1)

Volatility Model Results

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The GARC (1,1) model results indicate the presence of conditional heteroskedasticity in silver returns, meaning that the volatility of silver returns is not constant over time but rather depends on past volatility and past squared errors. The significant alpha [1] coefficient (0.7609, p-value < 0.01) suggests that past squared shocks (news) have a significant impact on current volatility. The beta [1] coefficient (0.1362) indicates that past volatility also influences current volatility, though its p-value (0.504) is not statistically significant at conventional levels. The sum of alpha [1] and beta [1] (0.7609 + 0.1362 = 0.8971) is less than 1, implying that volatility shocks are not persistent and eventually die out. This suggests that silver returns exhibit volatility clustering, where large changes tend to be followed by large changes, and small changes by small changes.

Macroeconomic Regime Analysis:

Analyzing silver's performance across different macroeconomic regimes revealed important patterns:

Table 4: Silver Performance by Macroeconomic Regime

Regime	**Year**	**Silver Annual Return**	**FTSE 100 Annual Return**	**Silver Outperformance**
Post-GFC Recovery	2010	30.36%	6.09%	24.27%
Pandemic Stress & Recovery	2020	16.82%	-6.72%	23.54%
Recent Market Momentum	2024-2025	23.55%	5.43%	18.12%
High Inflation Recovery	2022	1.02%	0.39%	0.63%

Source: Researcher's Work (2026)

Below are the interpretations from the Table above.

i. **Post-GFC Recovery (2010):** Following the Global Financial Crisis, silver experienced a massive surge, outperforming the FTSE 100 by over 24%. This highlights its role as a high-beta recovery play and a hedge against the massive monetary expansion that followed the crisis.

ii. **Pandemic Stress & Recovery (2020):** During the COVID-19 pandemic, silver provided a significant hedge, outperforming the FTSE 100 by 23.54%. While equities struggled, silver benefited from its safe-haven status and the anticipation of industrial demand recovery.

iii. **Recent Market Momentum (2024-2025):** In the most recent periods, silver has shown strong momentum, outperforming the FTSE 100 by 18.12%. This likely reflects growing demand for silver in green technologies and its role as an inflation-sensitive asset.

iv. **High Inflation Recovery (2022):** Even in a year of significant market volatility and rising interest rates, silver managed to slightly outperform the FTSE 100, demonstrating its resilience as an inflation-sensitive asset.

These findings suggested that silver outperformed during periods of economic shifts, making it a valuable tactical and strategic asset for enhancing portfolio resilience.

Optimal Allocation

Research Question 4: What is the optimal allocation to silver that maximises the Sharpe ratio (and alternative risk-adjusted metrics such as Sortino or CVaR-adjusted returns) for a UK institutional investor?

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The study involved performing portfolio optimization with different objectives: maximizing the Sharpe ratio, maximizing the Sortino ratio, and minimizing the Conditional Value at Risk (CVaR). The portfolio consists of a combination of silver and the FTSE 100.

Table 5: Optimal Allocation

Optimization Objective	Optimal Silver Allocation	Portfolio Return	Portfolio Volatility	Sharpe Ratio	Sortino Ratio	CVaR
Maximize Sharpe	57.26%	0.25%	2.43%	0.0578	0.0929	-5.11%
Maximize Sortino	88.48%	0.30%	3.43%	0.0565	0.0945	-6.90%
Minimize CVaR	1.75%	0.15%	1.50%	0.0306	0.0427	-3.37%
Average	49.16%	0.23%	2.45%	0.0483	0.0767	-5.13%

Source: Researcher's Work (2026)

Sharpe Ratio Optimisation (Risk–Return Efficiency)

When the optimisation objective is to maximise the Sharpe ratio, the model suggests an optimal silver allocation of 57.26%. This portfolio produces a monthly return of 0.25% with volatility of 2.43%, generating a Sharpe ratio of 0.0578.

This result indicates that silver provides strong return enhancement relative to risk when evaluated purely through mean–variance optimisation. This position could be as a result of high allocation which may reflect the high historical volatility and strong price movements of silver in the dataset.

Sortino Ratio Optimisation (Downside Risk Focus)

When the portfolio is optimised to maximise the Sortino ratio, which focuses specifically on downside volatility, the optimal silver allocation increases further to 88.48%.

This portfolio generates the highest monthly return (0.30%) and the highest Sortino ratio (0.0945) among the tested strategies, although overall volatility also rises to 3.43%. The higher CVaR value (−6.90%) indicates that the portfolio becomes more exposed to extreme downside losses despite improved downside-adjusted performance.

This result suggests that silver may offer strong upside potential relative to downside volatility, but excessive concentration increases exposure to tail risks.

CVaR Minimisation (Tail Risk Protection)

When the optimisation objective focuses on minimising Conditional Value at Risk (CVaR), the optimal silver allocation falls sharply to 1.75%. This conservative portfolio produces the lowest volatility (1.50%) and the smallest expected tail loss (−3.37%), although portfolio returns decline to 0.15% and the Sharpe ratio drops to 0.0306.

The result highlights that silver introduces additional tail risk into the portfolio, meaning that investors primarily concerned with extreme downside protection would allocate only a minimal proportion to silver.

Average Allocation and Strategic Interpretation

Across the three optimisation objectives, the average optimal allocation to silver is approximately 49.16%, producing a monthly return of 0.23% with volatility of 2.45%.

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However, the wide variation in optimal allocations (from 1.75% to 88.48%) indicates that the optimal weight is highly sensitive to the investor's risk preference and optimisation objective.

Summarily, these results suggest that silver can play a significant role in a portfolio, particularly for investors focused on maximizing risk-adjusted returns, especially when considering downside risk. However, for investors primarily concerned with minimizing tail risk, a much smaller allocation is warranted.

Climate Risk and TCFD Alignment

Research Question 5: How can silver exposure support fiduciary responsibility by enhancing portfolio resilience while aligning with the UK Net Zero Strategy and climate-risk disclosure principles under the TCFD framework?

Table 6 below evaluates how different asset classes and portfolio configurations perform in terms of physical climate risk exposure, transition risk exposure, and alignment with the UK Net Zero Strategy. These dimensions are central to the Task Force on Climate-related Financial Disclosures (TCFD) framework, which requires institutional investors to assess and disclose climate-related financial risks and opportunities.

Table 6: Climate Risk Characteristics

Asset Class	Physical Risk Exposure	Transition Risk Exposure	Alignment with Net Zero
FTSE 100 Equities	Medium to High	High	Mixed
UK Government Bonds	Low	Low to Medium	High
Silver	Low to Medium	Low	High
60/40 + 7.5% Silver	Medium	Medium	Medium to High
60/40 + 8% Silver	Medium	Medium	Medium to High

Source: Researcher's Work (2026)

Findings from the Table reveal below:

1. Climate Risk Exposure Across Asset Classes

The results indicate that traditional equity investments in the FTSE 100 exhibit relatively high exposure to both physical and transition climate risks. Physical risks arise from climate-related disruptions affecting corporate operations and supply chains, while transition risks stem from regulatory changes, carbon pricing, and the shift toward a low-carbon economy.

In contrast, UK government bonds display low physical risk exposure and relatively low transition risk exposure, reflecting their status as sovereign fixed-income instruments rather than assets directly exposed to industrial emissions or climate policy shocks.

Silver demonstrated low to medium physical risk exposure and low transition risk exposure. As a commodity essential to renewable energy technologies, silver is less vulnerable to carbon-transition risks and instead benefits from the structural demand created by the global energy transition.

2. Alignment with the UK Net Zero Strategy

The table also shows important differences in Net Zero alignment across asset classes.

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- FTSE 100 equities are classified as mixed, reflecting the heterogeneous nature of the index, which includes both high-emission sectors (such as oil and gas) and companies actively transitioning toward decarbonisation.

- UK government bonds demonstrate high alignment, as they are issued by a sovereign government committed to achieving net-zero emissions by 2050.

- Silver is assessed as highly aligned with Net Zero objectives, as it is a critical material used in renewable energy technologies such as solar photovoltaic panels and electrification infrastructure.

This classification suggests that silver can be considered a transition-supporting asset within sustainable investment frameworks.

3. Portfolio-Level Climate Risk Implications

When silver is incorporated into a traditional institutional portfolio, the results indicate that the overall climate risk profile improves moderately.

Both the 60/40 + 7.5% silver and 60/40 + 8% silver portfolios exhibit:

- Medium physical risk exposure
- Medium transition risk exposure
- Medium to high Net Zero alignment

The inclusion of silver therefore reduces the dominance of high-transition-risk assets within the portfolio while increasing exposure to assets that benefit from the energy transition. This contributes to a more balanced climate-risk profile.

CONCLUSION AND RECOMMENDATIONS

Conclusion

This research has provided a comprehensive evaluation of silver as a strategic asset for UK institutional portfolios, bridging the gap between traditional financial econometrics and the emerging requirements of climate-related fiduciary governance. Based on the empirical evidence gathered over the 2010–2025 period, several key conclusions are drawn.

First, silver demonstrates a superior risk-return profile relative to traditional UK benchmarks. Despite its higher standalone volatility (13.28%), silver's annualized return of 3.82% and its positive skewness (0.0448) provide a beneficial asymmetry that traditional equities and bonds lack. The negative Sharpe ratio observed for UK bonds (-0.1845) during the latter part of the sample period underscores the diminishing efficacy of fixed-income assets in high-inflation environments, positioning silver as a necessary alternative for capital preservation.

Second, the econometric analysis confirms that silver is a multifaceted asset driven by both macroeconomic and structural factors. The significant positive relationship with UK CPI (coefficient = 2.68) validates silver's role as a robust inflation hedge. Furthermore, the GARCH(1,1) results indicate that while silver is subject to volatility clustering, shocks to its volatility are not permanent, suggesting that institutional investors can manage silver's risk through disciplined, long-term rebalancing strategies.

Third, portfolio optimization results indicate that silver is a powerful diversifier. Adding a moderate allocation (4%–8%) to a conventional 60/40 equity-bond portfolio shifts the efficient frontier upward, increasing returns without significantly destabilizing the portfolio's tail-risk profile (CVaR). However, the high sensitivity of optimal allocations in sub-period testing (0% to 100%) suggests that silver is best utilized as a tactical-strategic asset rather than a static "buy-and-hold" component.

Finally, the study concludes that silver is uniquely aligned with the UK Net Zero Strategy and the TCFD framework. Unlike traditional commodities that face high transition risks, silver benefits from the "green pivot." Its essential role in renewable energy infrastructure classifies it as a transition-supporting asset, allowing institutional investors to enhance portfolio resilience while meeting climate-risk disclosure obligations.

Recommendations

Based on the findings of this study, the following recommendations are proposed for UK institutional investors and policymakers:

i. Strategic Asset Allocation (SAA) Integration: Institutional investors should consider a dedicated allocation to silver within their SAA frameworks, specifically in the range of 4% to 8%. This allocation provides a necessary "return engine" and inflation hedge that traditional 60/40 portfolios currently lack.

ii. Dynamic Risk Management: Given the volatility clustering identified by the GARCH(1,1) model, investors should employ dynamic rebalancing and downside protection strategies (such as Sortino-based optimization) to mitigate silver's inherent price swings while capturing its upside potential.

iii. TCFD and ESG Reporting: Asset managers should incorporate silver exposure into their TCFD disclosures as a "green transition" metric. Silver's role in solar and EV technologies provides a quantifiable link to Net Zero alignment, supporting the "Strategy" and "Metrics and Targets" pillars of climate reporting.

iv. Inflation-Linked Hedging: In periods of rising CPI, silver should be prioritized over traditional fixed-income assets as a hedge against purchasing power erosion, particularly for pension funds with inflation-linked liabilities.

v. Further Research on "Green Demand" Elasticity: Future academic research should investigate the long-term price elasticity of silver relative to specific green technology adoption rates (e.g., GW of solar capacity) to further refine the "Green Demand" proxy used in this study.

Contribution to Knowledge

This study contributes to the literature by providing the first integrated quantitative and qualitative analysis of silver in the context of the UK's specific Net Zero and TCFD regulatory environment. It moves beyond simple safe-haven analysis to demonstrate how a physical commodity can serve as a bridge between financial performance and climate-related fiduciary responsibility.

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APPENDIX

```
[7]
# @title
import pandas as pd
import statsmodels.api as sm

# 1. Load your dataset
# Ensure your Excel sheet column names match the ones used below
df = pd.read_excel('silver data.xlsx')

# Drop rows with NaN values in the relevant columns
df = df.dropna(subset=['Log Silver Return', 'Log Price (FTSE 100 Historical Results Pri', 'Log UK Bonds', 'Log CPI', 'Log IEA',
       'USD/GBP', 'Risk Free Rate', 'Gold Silver Ratio'])

# 2. Define the Independent Variables (X) and Dependent Variable (y)
# We add a constant to the model to represent the Intercept (alpha)
X = df[['Log Price (FTSE 100 Historical Results Pri', 'Log UK Bonds', 'Log CPI', 'Log IEA',
        'USD/GBP', 'Risk Free Rate', 'Gold Silver Ratio']]
X = sm.add_constant(X)

y = df['Log Silver Return']

# 3. Fit the OLS (Ordinary Least Squares) Regression Model
model = sm.OLS(y, X).fit()

# 4. Display the results
print(model.summary())

# 5. Optional: Print specific coefficients (betas)
print("\n--- Model Coefficients (Betas) ---")
print(model.params)
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:      Log Silver Return   R-squared:                       0.699
Model:                            OLS   Adj. R-squared:                  0.686
Method:                 Least Squares   F-statistic:                     56.99
Date:                Tue, 10 Mar 2026   Prob (F-statistic):           1.39e-41
Time:                        14:38:56   Log-Likelihood:                234.75
No. Observations:                 180   AIC:                            -453.5
Df Residuals:                     172   BIC:                            -428.0
Df Model:                           7
Covariance Type:            nonrobust
================================================================================================================
                                                   coef    std err          t      P>|t|      [0.025      0.975]
----------------------------------------------------------------------------------------------------------------
const                                         -1.4301      0.974     -1.468      0.144      -3.353       0.493
Log Price (FTSE 100 Historical Results Pri    -0.7276      0.171     -4.253      0.000      -1.065      -0.390
Log UK Bonds                                   0.9365      0.224      4.185      0.000       0.495       1.378
Log CPI                                        2.6828      0.418      6.415      0.000       1.857       3.508
Log IEA                                       -0.0330      0.013     -2.554      0.012      -0.059      -0.007
USD/GBP                                        0.1156      0.073      1.583      0.115      -0.029       0.260
Risk Free Rate                                 0.0208      0.010      2.001      0.047       0.000       0.041
Gold Silver Ratio                             -0.0113      0.001    -13.340      0.000      -0.013      -0.010
==============================================================================
Omnibus:                        7.242   Durbin-Watson:                   0.698
Prob(Omnibus):                  0.027   Jarque-Bera (JB):                7.013
Skew:                           0.419   Prob(JB):                       0.0300
Kurtosis:                       3.481   Cond. No.                     1.52e+04
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 1.52e+04. This might indicate that there are
strong multicollinearity or other numerical problems.

--- Model Coefficients (Betas) ---
const                                       -1.430084
Log Price (FTSE 100 Historical Results Pri  -0.727647
Log UK Bonds                                 0.936507
Log CPI                                      2.682790
Log IEA                                     -0.033015
USD/GBP                                      0.115637
Risk Free Rate                               0.020847
Gold Silver Ratio                           -0.011321
dtype: float64
```