

Performance of the gold asset class compared to indices since the end of the Bretton Woods system

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Abstract

The article investigates the performance of gold as an asset class compared to major financial indices such as the S&P 500 and DAX since the end of the Bretton Woods system in 1971. The study aims to evaluate gold's role as a hedge against inflation and market volatility, assessing its effectiveness as a stable investment during periods of economic uncertainty. The research uses historical data to examine annual and tax-adjusted returns and cumulative abnormal returns to provide a comprehensive analysis of gold's performance relative to these indices. The findings indicate that gold has generally outperformed the S&P 500 and DAX, particularly in times of financial crises such as the 2008 financial meltdown and the COVID-19 pandemic. The tax-adjusted performance further underscores gold's advantages for long-term investors, highlighting its non-inflationary nature and limited availability. While the statistical significance of gold's abnormal returns varies, its positive cumulative abnormal returns (CAR) emphasize its robustness as an investment. The research involves a two-sample t-test to compare the returns of gold with those of the S&P 500 and DAX. The results reveal that gold offers a significant positive return difference compared to the tax-adjusted index returns of these indices, reinforcing its value for portfolio diversification and performance enhancement.

Keywords

Bretton Woods System, gold, portfolio analysis, hedging, inflation, indices, safe-haven



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Introduction

Since the end of the Bretton Woods system in 1971, the role of gold as an asset class has changed considerably. While the gold standard guaranteed a stable currency peg, the decades that followed led to increasing volatility in the global financial markets. The Bretton Woods System was created by the 1944 Articles of Agreement to design a new international monetary order at a multilateral conference held in Bretton Woods, USA, from July 1 to July 22, 1944. This system departed from the pre-WWI gold standard and the interwar gold exchange standard in four significant ways: controls on capital and current accounts were officially allowed, the International Monetary Fund (IMF) was created to provide short-term liquidity and conduct surveillance of national policies, the pegged exchange rate could be adjusted under IMF authorization in case of fundamental disequilibrium, and gold coinage along with the commitment of central banks to redeem banknotes in gold was abandoned globally (Monnet & Puy, 2020). The system was fully abandoned in 1973. In times of economic uncertainty, such as the 2008 financial crisis or the recent turmoil caused by the Covid-19 pandemic and geopolitical conflicts, investors have always sought safe havens for their capital (Gavurova et al., 2020; Iwu et al., 2023) in an attempt to avoid volatile market conditions (Cera et al., 2024; Tkacova and Gavurova, 2023). Gold, known as a store of value, has proven to be a popular investment. It offers protection against inflation and serves as a diversification tool, as it usually has a low correlation to traditional asset classes such as equities and bonds (Baur and McDermott, 2010; Creti et al., 2013) or real estate (Tahotný et al., 2024). This makes gold an important component in times of crisis when confidence in the conventional banking system wanes (Dimitriou et al., 2020; Setiawa, 2022; Hafner, 2020). The advantages of gold lie in its limited availability and its non-inflationary nature. Unlike paper money, which can be printed at will by governments, the amount of gold on earth remains constant, making it a stable store of value (Eichengreen & Flandreau, 2008; Skrodzka, 2021). Historically, gold has served as a means of payment and has a long tradition as a safe investment (Jones & Podolsky, 2015; Přívara, 2019a, 2019b).

The paper "Foreshock Volatility-Based Metal Hedging Strategy" (Uzik et al., 2023) addresses the need for effective hedging strategies amid various capital market crises experienced over the past decades. It emphasizes the importance of diversifying investment portfolios with precious metals due to significant price increases in raw materials, driven by events like the dot-com bubble, the 2008 financial crisis, and the COVID-19 pandemic. The study introduces a new volatility-based hedging strategy, called the Foreshock-Vola strategy, designed to protect against falling commodity prices. It compares this strategy against the traditional 200-day moving average (MA) strategy. The analysis covers metals such as aluminum, zinc, nickel, lead, tin, and copper over the period from January 2008 to March 2023. The hedging performance is evaluated by examining the return ratios and the statistical significance of the hedging results. The findings suggest that the Foreshock-Vola strategy provides a more reliable and effective way to hedge against falling metal prices than traditional methods. This could be particularly beneficial for industries heavily reliant on metal commodities, such as manufacturing and mining. The study recommends further research to explore the yearly performance and to compare this strategy against other hedging approaches.

The article "Gold as an Alternative Payment and Safe Haven Against Inflation" (Uzik et al., 2023) explores the role of gold in modern financial systems, particularly focusing on its function as a hedge against inflation and its viability as an alternative payment method. The historical context of gold as a stable store of value is revisited, with emphasis on recent economic uncertainties. The study uses historical data analysis and econometric models to assess the relationship between gold prices, inflation rates, and currency fluctuations. The data spans several decades, capturing periods of significant economic upheaval and stability. The analysis includes correlation and regression techniques to determine the hedging effectiveness of gold. The research underscores gold's enduring value as a financial asset capable of mitigating inflation risks and providing a stable store of value during economic turmoil. Financial experts are encouraged to consider gold as a strategic component of diversified investment portfolios, especially in volatile economic environments.

The paper "Portfolio Hedging Strategy - Metals and Commodities" by Uzik et al. (2023) discusses the importance of including metals and other commodities in investment portfolios to hedge against market volatility and economic uncertainties. The article reviews various hedging strategies and their effectiveness in protecting portfolio value. This research employs a comprehensive analysis of historical market data, focusing on the performance of metals and commodities within diversified portfolios. The study compares multiple hedging techniques, including traditional methods like futures contracts and innovative approaches like dynamic hedging based on market indicators. The study highlights the critical role of metals and commodities in portfolio risk management. Financial experts are advised to incorporate these assets into their investment strategies to mitigate risks and enhance returns. The research also suggests the need for ongoing evaluation of hedging strategies to adapt to changing market conditions.

Building on these findings, the next step in this paper is to examine how gold, as a critical component of these hedging strategies, has performed relative to major financial indices since the end of the Bretton Woods system. It analyses how gold has performed compared to major equity and bond indices and the extent to which it acts as a stabilizing element in investment strategies (Bhatia et al., 2020; Jiang et al., 2019). The analysis also includes

the role of gold as a hedge against market volatility and its function as a hedge against inflation (Rehman et al., 2018; Salisu et al., 2021). Given the constant market changes and economic challenges, this research offers valuable insights for investors looking for robust strategies for hedging and value appreciation. It becomes clear that gold can play an important role not only in times of crisis but also as a long-term investment (Hiller et al., 2006; El Hedi Arouri et al., 2015). Looking at historical and current developments shows how gold behaves compared to indices such as the S&P 500 or the MSCI World Index and what lessons can be learned for the future. This comprehensive analysis is intended to help investors make informed decisions and optimally diversify their portfolios (Nguyen et al., 2020; Pierdzioch et al., 2016).

Material and Methods

This article examines the performance of gold compared to selected indices since the end of the Bretton Woods system. The Bretton Woods system was de facto suspended by President Nixon on August 15, 1971 ("Nixon Shock"), when he abolished the nominal gold peg of the dollar. As a result, the US dollar lost value against other currencies. However, the loss only became noticeable slowly. This was due to the fact that individual countries gradually abandoned the peg of their own currencies to the US dollar. At the beginning of 1973, the US dollar continued to depreciate, with Japan and several European countries abandoning the peg to the US dollar. In 1973, the Bretton Woods system was officially dissolved. This period of time leads to the analyses being set to the year 1970. The development of gold prices, the DAX index, and the S&P 500 index are examined up to the year 2023. A performance analysis of the prices is first carried out annually.

The tax-adjusted performance analysis is also presented in the same context. As gold enjoys tax exemption after one year, it is only comparable with investments in the DAX and S&P 500 to a limited extent. A capital gains tax would be due for these. In this context, the gold performance is compared with the tax-adjusted performance of the two selected indices. For the calculation of taxes, the perspective of a German investor was chosen. A capital gains tax of 26.38% is therefore applied. The tax-adjusted prices are calculated according to the following formula, which is then presented in the form of an index for comparison with the gold performance.

$$Price_{Tax\ adjusted,t} = \begin{cases} Price_t - Price_1 > 0; Price_t - (Price_t - Price_1) * Tax\ Rate \\ Price_t - Price_1 < 0; Price_t \end{cases} \quad (1)$$

In addition to this long-term presentation, the question of whether the gold price also offers statistically significant outperformance is also investigated. Unfortunately, this question has only been investigated since 2008 due to a lack of data. On the one hand, it is tested whether the logarithmic returns are different from zero. In addition, a two-sample t-test is carried out between the returns of the gold price, the DAX index, and the S&P 500 index. The final analysis looks at the development of abnormal returns. In order to determine abnormal excess returns, the reference rate of return is calculated according to a market model. The market model is based on Markowitz (1959) and assumes a linear coherence between the return from commercial papers and the market portfolio.

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t} \quad (2)$$

Where $R_{i,t}$ is the return on security i at day t ; α_i , β_i are parameters; $\varepsilon_{i,t}$ is noise, and $R_{m,t}$ is the return on the market on day t .

Alpha and beta parameters are determined using the OLS method in the context of this study. The market return for a day t is determined by calculating the alpha and beta parameters from the regression for the last 253 trading days (corresponding to one year). Based on the available data from January 2, 2008, the first expected return for January 2, 2009, is determined for gold, DAX, and S&P 500 according to the market model. The MSCI World Index is used as the market portfolio. For the period from 02.01.2009 to 31.12.2023, the expected returns are determined on a rolling basis. The difference between a share's effectively realized and theoretically anticipated return expresses the excess return. In the information-efficient market and under the condition of the concurrent validity of the model consulted in order to determine the expected return, there are no systematic deviations between the two return figures.

$$E(AR_{i,t}) = 0 \quad (3)$$

whereby the excess return is calculated as follows:

$$AR_{i,t} = R_{i,t} - E(R_{i,t}) \quad (4)$$

Where $AR_{i,t}$ is the abnormal return of the share i at day t , $R_{i,t}$ is observed return of the share i at the stock exchange on day t , and $E(R_{i,t})$ is the expected return of the share i at day t .

In the literature, the additive and the multiplicative conjunction of the excess returns and the determination of buy-and-hold excess returns are used to determine cumulated excess returns. Empirical studies mainly use the additive determination procedure (see Mitchell & Stafford (2000)) for calculating cumulative excess returns.

The additive approach of determination of cumulated excess returns traces back to the work of Fama et al. (1969) and is determined as follows:

$$CAR_{i,\tau,L} = \sum_{t=\tau}^{t=\tau+L} AR_{i,t} \tag{5}$$

The multiplicative conjunction of the excess returns was produced by Ball & Brown (1968). The result of a cumulated multiplicative compression of excess returns is captured in an Abnormal Performance Index (API). In the present study, it is resorted to the additive capture of the cumulated excess rates (see Wulff (2001), p. 134 ff.).

Results

A look at the performance trend shows that since the end of the Bretton Woods system, gold as an asset class has generally outperformed the indices, with the exception of the millennium years and 2021 for the S&P 500.

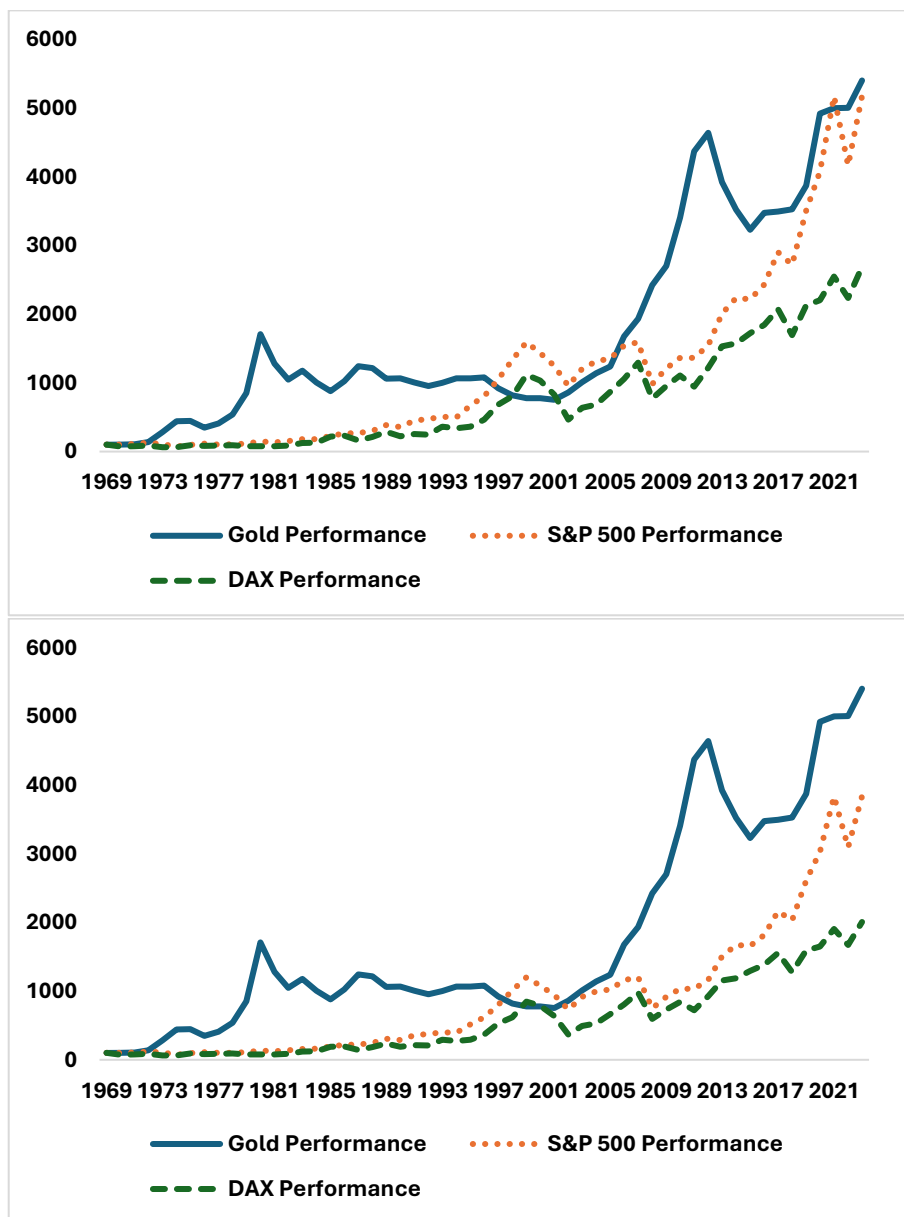


Fig. 1. Performance of gold compared to DAX and S&P 500 (lower is tax-adjusted)

When looking at the tax-adjusted index prices, gold continued to be the outperforming asset class in 2021.

The inductive analysis of returns shows a differentiated picture. The returns of both gold and the indices are positively different from zero, albeit not statistically significant.

With the exception of the S&P 500, which is statistically significantly different from zero, the abnormal returns of gold and the DAX are not significant. Only gold has a positive abnormal return.

The results of the cumulative abnormal returns are statistically significant for all three asset classes but only for gold, at 8.37% in positive territory.

Tab. 1. *t*-Test of asset classes gold, DAX, and S&P 500.

| One-Sample Test | | | | | | |
|-------------------------|----------|-----------|-----------------|-----------------|---|----------|
| Test Value = 0 | | | | | | |
| | <i>t</i> | <i>df</i> | Sig. (2-tailed) | Mean Difference | 95% Confidence Interval of the Difference | |
| | | | | | Lower | Upper |
| Gold Return | 1.279 | 4016 | 0.201 | 0.000222 | -0.00012 | 0.000561 |
| DAX Return | 0.842 | 4016 | 0.4 | 0.000186 | -0.00025 | 0.000618 |
| SandP 500 Return | 1.45 | 4016 | 0.147 | 0.000297 | -0.0001 | 0.000698 |
| Gold AR | 0.27 | 3763 | 0.787 | 4.01E-05 | -0.00025 | 0.000332 |
| DAX AR | -1.109 | 3763 | 0.267 | -4E-05 | -0.00011 | 3.06E-05 |
| SandP 500 AR | -6.262 | 3763 | 0 | -0.00015 | -0.00019 | -0.0001 |
| Gold CAR | 66.105 | 3763 | 0 | 0.083742 | 0.081258 | 0.086225 |
| DAX CAR | -99.194 | 3763 | 0 | -0.18019 | -0.18375 | -0.17663 |
| SandP 500 CAR | -115.368 | 3763 | 0 | -0.30288 | -0.30802 | -0.29773 |
| DAX Return TaxAdj | -5.619 | 4016 | 0 | -0.00109 | -0.00147 | -0.00071 |
| SandP 500 Return TaxAdj | -4.544 | 4016 | 0 | -0.00082 | -0.00118 | -0.00047 |
| DAX AR TaxAdj | 9.248 | 3763 | 0 | 0.000286 | 0.000226 | 0.000347 |
| SandP AR TaxAdj | 0.233 | 3763 | 0.816 | 4.7E-06 | -3.5E-05 | 4.44E-05 |
| DAX CAR TaxAdj | 85.591 | 3763 | 0 | 0.521428 | 0.509484 | 0.533372 |
| SandP CAR TaxAdj | -43.246 | 3763 | 0 | -0.03016 | -0.03153 | -0.02879 |

When comparing the returns of the asset class gold with the other two indices, gold shows a significant positive return difference compared to the tax-adjusted index returns of the DAX and the S&P 500. This is the most important evidence in favor of the asset class gold, which should be included in a portfolio not only for diversification reasons but also for performance reasons.

The significant cumulative abnormal returns between gold and the indices are only of limited informative value, as they positively affect the indices when negative returns are taken into account.

Tab. 2. Two-sample *t*-Test of the asset classes gold, DAX and S&P 500.

| Paired Samples Test | | | | | | | | | |
|---------------------|--------------------------------|--------------------|----------------|-----------------|---|----------|----------|-----------|-----------------|
| | | Paired Differences | | | | | <i>t</i> | <i>df</i> | Sig. (2-tailed) |
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | Gold Return - DAX Return | 0.000036 | 0.017662 | 0.000279 | -0.00051 | 0.000582 | 0.129337 | 4016 | 0.897098 |
| Pair 2 | Gold Return - SandP 500 Return | -0.000075 | 0.016742 | 0.000264 | -0.00059 | 0.000443 | -0.28506 | 4016 | 0.775612 |

| | | | | | | | | | |
|---------|---------------------------------------|----------|----------|----------|----------|----------|----------|------|----------|
| Pair 3 | Gold Return - DAX Return TaxAdj | 0.001312 | 0.016401 | 0.000259 | 0.000804 | 0.001819 | 5.068076 | 4016 | 0.000000 |
| Pair 4 | Gold Return - SandP 500 Return TaxAdj | 0.001044 | 0.015658 | 0.000247 | 0.00056 | 0.001528 | 4.225785 | 4016 | 0.000000 |
| Pair 5 | Gold AR - DAX AR | 0.000080 | 0.009297 | 0.000152 | -0.00022 | 0.000377 | 0.528155 | 3763 | 0.597423 |
| Pair 6 | Gold AR - SandP 500 AR | 0.000187 | 0.009322 | 0.000152 | -0.00011 | 0.000485 | 1.23161 | 3763 | 0.218172 |
| Pair 7 | Gold AR - DAX AR TaxAdj | -0.00025 | 0.00925 | 0.000151 | -0.00054 | 0.000049 | -1.63356 | 3763 | 0.102434 |
| Pair 8 | Gold AR - SandP AR TaxAdj | 0.000035 | 0.009274 | 0.000151 | -0.00026 | 0.000332 | 0.2344 | 3763 | 0.814687 |
| Pair 9 | Gold CAR - DAX CAR | 0.263933 | 0.145132 | 0.002366 | 0.259295 | 0.268571 | 111.5717 | 3763 | 0 |
| Pair 10 | Gold CAR - SandP 500 CAR | 0.386619 | 0.200138 | 0.003262 | 0.380224 | 0.393015 | 118.5164 | 3763 | 0 |
| Pair 11 | Gold CAR - DAX CAR TaxAdj | -0.43769 | 0.352902 | 0.005752 | -0.44896 | -0.42641 | -76.0911 | 3763 | 0 |
| Pair 12 | Gold CAR - SandP CAR TaxAdj | 0.1139 | 0.087158 | 0.001421 | 0.111115 | 0.116685 | 80.17521 | 3763 | 0 |

Discussion

The analysis of gold's performance since the end of the Bretton Woods system reveals significant insights into its role as a financial asset. Gold has demonstrated resilience and often outperformed major indices such as the S&P 500 and DAX, particularly in times of economic uncertainty. This is consistent with gold's historical role as a safe-haven asset, offering protection against inflation and market volatility. Gold's performance relative to the S&P 500 and DAX indices indicates that it not only serves as a hedge but also as a means of value preservation. The tax-adjusted comparisons further underscore gold's advantage, especially for long-term investors. Compared to negative or lower CAR for the indices, the positive cumulative abnormal returns (CAR) for gold highlight its robustness as an investment. However, the statistical analysis presents a mixed picture. While gold's returns and cumulative abnormal returns are significant, its abnormal returns are not consistently statistically significant across different periods. This suggests that while gold can offer protection and add value, its performance can be subject to market conditions and may not always outperform other assets. The performance trends since 2008, especially during financial crises such as the 2008 financial crisis and the COVID-19 pandemic, emphasize the importance of gold in a diversified portfolio. During these periods, gold's role as a safe haven becomes particularly prominent, providing stability when other asset classes experience significant volatility.

Conclusions

This article aimed to research the performance of gold compared to major financial indices such as the S&P 500 and DAX since the end of the Bretton Woods system. By examining historical data and conducting statistical analyses, the study sought to understand gold's role as a hedge against inflation and market volatility. The findings confirm that gold has generally outperformed these indices, especially during periods of economic uncertainty, validating its importance as a safe-haven asset. The tax-adjusted comparisons further highlight gold's advantage for long-term investors. Despite some variations in statistical significance, the overall positive performance trends support the inclusion of gold in diversified investment portfolios. Gold remains a critical component of investment strategies, offering stability and protection against economic instability. Its historical resilience and non-inflationary nature make it an invaluable asset for mitigating risks and enhancing returns, particularly in volatile financial environments. This study underscores the enduring value of gold, affirming its role as a key element in robust investment portfolios.

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