

Can Diversified Investment Portfolios Hedge Against Inflation and Market Volatility?

"Do Diversified Portfolios Effectively Hedge Inflation and Volatility Risks?”

Luís Peixoto

Dissertation written under the supervision of Professor Eva Schliephake

Dissertation submitted in partial fulfilment of requirements for the MSc in Finance, at the Universidade Católica Portuguesa, June 2nd 2025.

Can Diversified Investment Portfolios Hedge Against Inflation and Market Volatility?

Luís Peixoto

Abstract

Can Diversified Investment Portfolios Hedge Against Inflation and Market Volatility?

Luís Peixoto

Resumo

Table of Contents

1. **Introduction**

Inflation and Market Volatility are at the core of every investment manager’s decision-making process, capital allocation and in every retail investor’s concerns. Inflation will diminish the purchasing-power of your income and the real value of your portfolio’s returns, while market volatility will introduce uncertainty and a degree of risk that may not be adjusted to your risk aversion. Innovations in any of these macroeconomic variables are in the top tier of the concern scale of money managers and retail investors. Protection against these variables is often measured and named in the form of a hedge. Following [Bodie (1976)](#Bodie1), an effective hedge, against both inflation and market volatility, is defined to the extent that they can be used to diminish or eliminate the risk of the portfolio’s real return in what concerns the future levels of the consumer price index (CPI) and the future levels of market uncertainty. Over the past century, the world has experienced periods of high inflation, such as the German hyperinflation post-World War I, the “Great Inflation” of the 1970s and the post-COVID inflation surge. The periods on which high volatility was observed have not been less significative than those we have seen, most of these periods are and will be remembered for decades to come, namely, the Great Depression of 1929, the Black Monday on October 1987, the Dot-com crash, the Global Financial Crisis and the latest, the COVID-19 crash. However, there are multiple periods on which both phenomena were observed. The most remarkable have been the 1970s Stagflation and the post-COVID period. It is with the latest period of the aforementioned events still in mind, and with the latest market turmoil caused by the reciprocal tariffs that the relevance of the topic addressed in this thesis becomes increasingly relevant. Many studies have been conducted regarding the effectiveness of certain asset classes in hedging inflation, but this paper aims to include different asset classes, including alternative assets, with different geographies. Concerning the study of market volatility hedges, most of past studies conducted use complex and structured derivative products focusing on short-term hedging.

This paper focuses on addressing a topic that has not been addressed in past literature, creating a strategic asset allocation by buying and holding the same assets for the same investment horizon, fixing weights for the whole holding period and trying to hedge against inflation and market volatility risk, while building on geographical diversification. By trying to hedge both risks, the paper contributes to the vast literature on inflation hedging and the not so sizable literature on market risk hedging without complex financial products. Nonetheless, a natural answer may arise for the reader, one that aims to question the orthogonality of inflation and volatility and whether it is meaningful to study the hypotheses proposed in this paper. This will also be discussed further in the paper, but, in a nutshell, it seems that the orthogonality is existent and it does make sense to do this split both variables and test the hypotheses proposed.

**What the paper finds**.

**Extensions/heterogeneity analyses/mechanisms (“extensions+”)**

**Paragraphs X+1/X+2: Literature contributions.**

**Structure of the Paper**

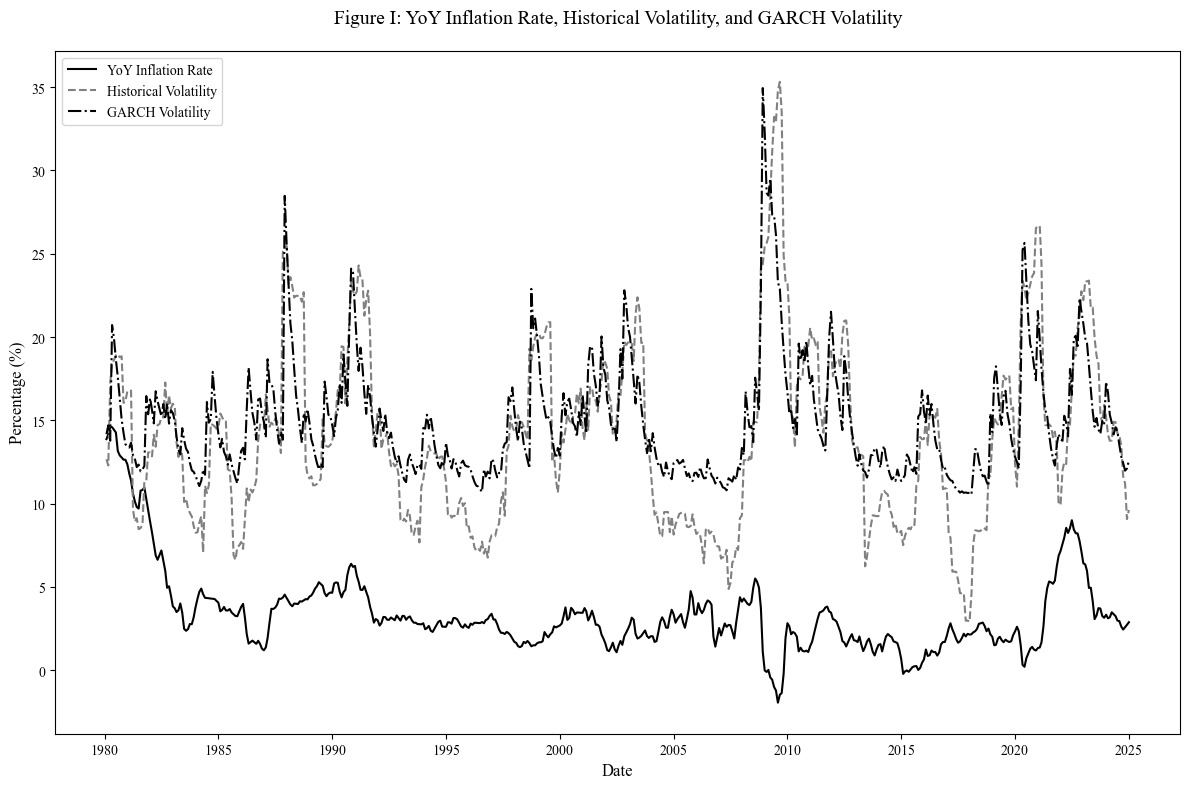
1. **Data**

**2.1 Data Description**

The data used in this paper is fetched from different sources and databases. The period that serves as input is the start of 1980 until the last trading day of December 2024, and data is . Wi Inflation rates are estimated using the log difference of monthly values, either in a one-month interval or a twelve-month interval, in the series US Consumer Price Index for All Urban Consumers from FRED. Inflation rate in the whole paper will be addressed at on a Year-over-Year basis mainly and its evolution throughout the studied period from 1980 until 2024 can be seen on Figure I.

Volatility data is calculated from the monthly returns on MSCI World Index, with data from Refinitiv Eikon/LSEG Workspace, the returns for this series are calculated as the log differential from the monthly closing prices of the index. From the previously mentioned data, two volatility estimates were calculated, an Historical Volatility Variable, computed from a rolling twelve-month standard deviation of the index continuously compounded monthly returns, and a GARCH Volatility variable, using a GARCH (1,1) model, meaning, an order one autoregressive term and an order one moving average term. The GARCH (1,1) model is used to capture and forecast the volatility of the MSCI World Index returns, representing the model's estimate of the volatility at each month, to capture the volatility clustering we are expecting to find on this study. This variable will be mainly used for robustness. On Figure I, the reader can observe the small amplitude between both measurements of volatility.

To build the diversified investment portfolios several assets were selected. This selection was done to have as much diversification as possible, on the one hand to have as much exposure to different asset classes as possible, on the other hand, this diversification also happens geographically. For all assets, continuously compounded returns were calculated, allowing an easier computation of cumulative returns, through its additive properties, whilst its statistical properties allow greater symmetry and its approximation to normal distribution, catalysing a increasingly reliable regression analysis and hypothesis testing. The equity indexes chosen are the S&P 500 Index, the Russell 2000 Index, the tech heavy NASDAQ Composite Index, the FTSE 100 Index, the DAX 40 Index, the Euro Stoxx 50 Index, and the Nikkei 225 Index. These indices’ data was obtained mainly from LSEG Workspace, whilst the S&P 500 data was extracted from CRSP and the Nikkei 225 data was retrieved from Compustat in WRDS. For Real Estate Investment Trusts (REITs), the selection was the FTSE Nareit U.S. Real Estate Index Series, from National Association of Real Estate Investment Trusts database.

Gold, commonly regarded by the average investor as the obvious hedge against inflation risk, is one of the key assets in this paper, its spot price in US Dollars is also extracted from LSEG Workspace. For Oil, the most traded commodity worldwide, this paper will study the NYMEX Light Sweet Crude Oil (WTI) Electronic Energy Future Continuation 1 (CLc1). On Foreign Exchange pair territory, the EUR/USD, JPY/USD, CHF/USD spot rates were selected for the portfolios construction. The reader may argue that the EURO was only launched in 1999, that’s why Refinitiv uses a synthetic rate, following the European Central Bank’s approach, of a weighted average of the currencies of the eleven countries that originally constituted the Eurozone. Due to limited access to Treasury Inflation-Protected Securities data, as a proxy, for the total return index, the chosen asset was the iShares TIPS Bond ETF which tracks the results of an index composed by Treasury Inflation-Protected Securities bonds with different maturities. Finally, for the 10-Year Treasury Bond, we selected the data from CRSP on the Total Return Index.

* 1. **Summary Statistics**

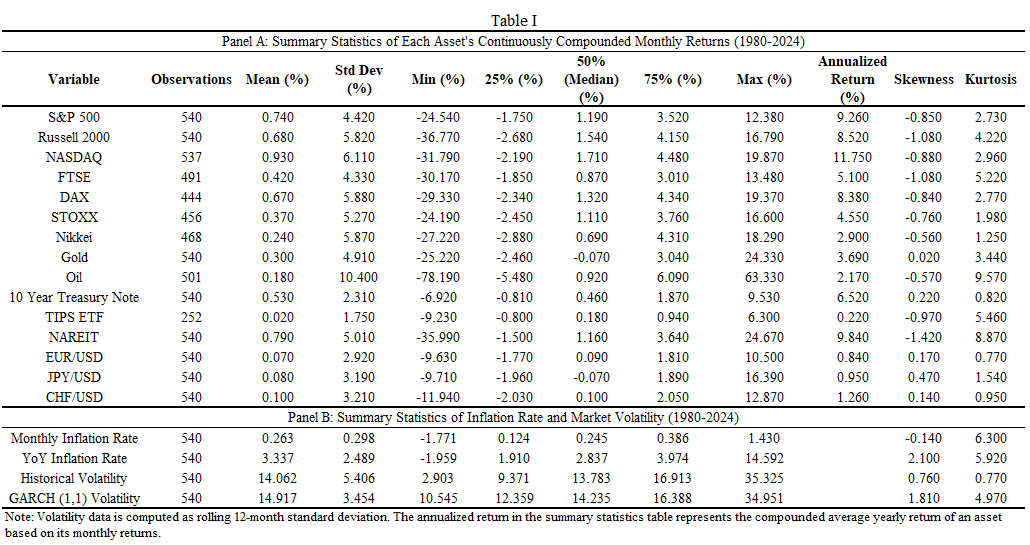


Table I presents the summary statistics for all the assets selected for portfolio construction and for the two macroeconomic variables this paper studies. The study is conducted on 540 months of data and most assets have observable data on all these months, in fact, 15 of the 16 assets have data on more than 82% of the period’s months.

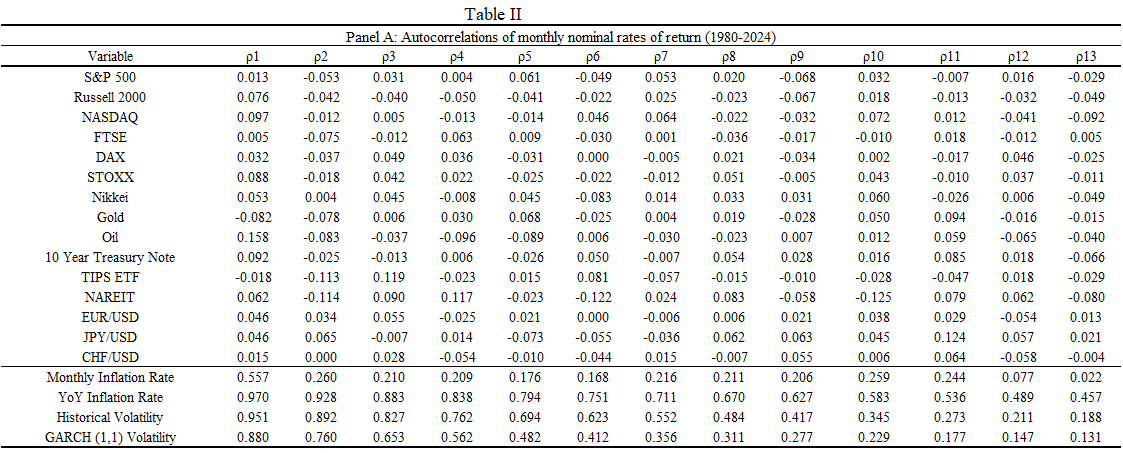
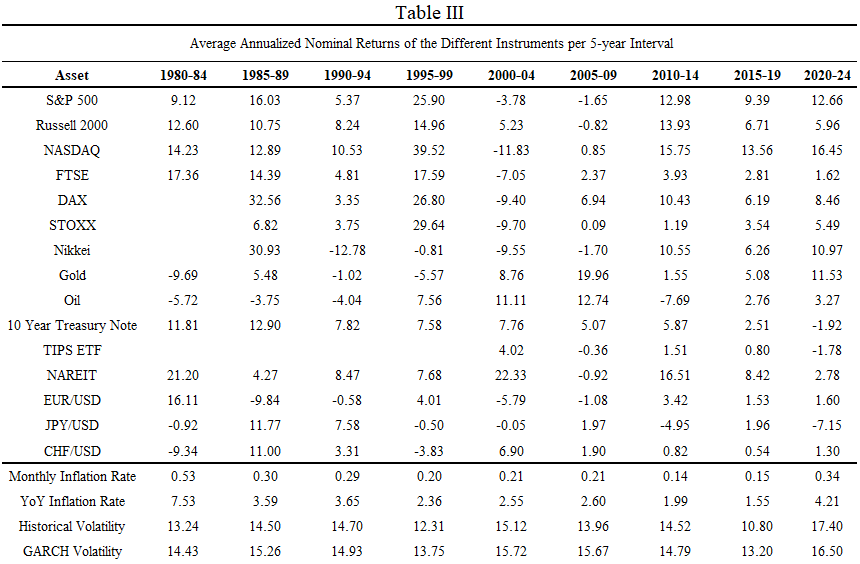
From this Table, the reader can infer that the best performing assets, in this universe, in the period from 1980 through 2024, based on the Annualized Return Data, were the Equity Indexes from the United States and Germany and the NAREIT Index. Whilst the ones that exhibited the lowest level of returns were the currencies and the iShares TIPS Bond ETF. In what concerns volatility of these assets, one can immediately observe that the instruments with lowest performance throughout this period are also the ones with the lowest volatility.

Table II displays the estimation of the first thirteen autocorrelations of the CPI Year-over-Year Inflation Rate, estimates of the rolling 12-month standard deviation of returns of the MSCI World Index and the monthly nominal rates of return of the different assets.

It is evident to the unaided eye that for all lags of the assets, except for Oil in the first lag, are low and very close to zero, indicating that most Equity Indexes confirm and are in line the efficient market hypothesis. Small-cap index Russell 2000 exhibits some short-term mean reversion, since its first order autocorrelation lags are mildly negative. Commodities on the other hand, vary slightly, whilst Oil, has positive and high (when compared to other asset classes) first order autocorrelation, which indicates that its returns gain from momentum from supply or demand shocks. Gold has negative autocorrelation, which may suggest a slight tendency towards mean-reversion over short horizons. The analysis for the 10-year treasury note demonstrates that there is a modest positive autocorrelation, which tends to decay over 1 or 2 lags, meaning that yields usually change gradually and its ability to reflect policy changes.

Currencies experience a random walk throughout the 13 order lags reflecting its random-walk behaviour. Finaly, the results for the NAREIT Index infer that it shows some cyclicality throughout the period under analysis. Anyhow, the results now discussed do not have much significance since they are all very close to 0. However, the results for Inflation and Volatility are much more interesting to analyse. Monthly Inflation Rate and YoY Inflation rate have very high and significantly different from zero sample autocorrelations, particularly in the short-term ones, suggesting that there is a very significant degree of persistence, with slow movements and small fluctuations, a clear argument that supports the idea that, in the short-term, current inflation influences next month’s inflation, and, in the longer-term and strong memory. The same can be inferred for Historical and GARCH Volatility, high or low levels of volatility tend to stay in that way for months.

Following [Fama and Schwert (1977)](#FamaSchwert) approach, we have created a table, Table III, that contrasts the average annualized continuously compounded nominal rates of return with the average inflation and volatility rates in different subperiods, which, as they suggest, can provide a general picture of the ability of some of these assets to hedge against inflation and market volatility.

From this table, we can immediately conclude that all Equity Indices fail to consistently hedge

inflation and/or volatility. The returns exhibited vary substantially in the different sub-periods and suffer when there are highly inflationary and volatile episodes (e.g. 2000-09, 2020-24), indicating that a somewhat inverse relationship between stocks and inflation and/or volatility is the base case for this sample, which meets our prior expectations for this particular asset class. Gold, however, provides protection against both macroeconomic shocks, performing remarkably in periods of high inflation, such as the period 2000-09. This reinforces its status as a safe-haven and hedge asset, as we had anticipated earlier in the paper. For Oil, though the relationships are not so straightforward, but it points to a positive correlation with inflation, and volatility, again aligned with our forecast of its poor status as an hedge against inflation and its characteristics as a commodity, so when there is a supply side driven increase in the prices, meaning that production costs are then passed on to the consumers, leading to further inflation. Additionally, as we saw in Table I, Oil is the most volatile asset in this universe. The Fixed-income securities on our universe, as we saw earlier, are expected to have different behaviors during inflationary times, due to the increase in interest rates, whilst Treasury Inflation-Protected Securities (TIPS) are designed to naturally hedge inflation. Furthermore, during volatile periods, fixed-income securities are considered natural safe-havens and hedges. Real Estate, commonly regarded as an inflation hedge, exhibits good and sustained returns in all sub-sample periods except for the turbulent period of the subprime crisis, as expected. Finally, currencies, display inconsistent behaviors during volatile and inflationary periods, albeit the Swiss Franc is commonly regarded also as a safe-haven asset during these periods. These inconsistencies may be related to some idiosyncratic and/or country specific risks that are out of the scope of this paper.

In the subsequent sections of this paper, the reader will be better informed with enhanced tests and methodologies to better clarify the relationship between the assets in our universe and diversified investment portfolios of these same assets with inflation and market volatility.

* 1. **Inflation and Volatility: Independent Forces?**

Following the brief introduction of this topic in the beginning of the paper, a natural next step is to address the relationship of inflation and market volatility. To do so, we must question whether they evolve independently, and are orthogonal, or if they are correlated or exhibit some degree of causality. In this section we have performed two separate tests to check for correlation and causality.

The correlations between the YoY Inflation Rate and the two measures of volatility (Historical Volatility and GARCH Volatility) are both very close to zero:

1. **Correlation between YoY Inflation Rate and Historical Volatility (-0.0063)**:
   * This indicates an almost negligible negative relationship between inflation and historical volatility. Essentially, changes in the YoY Inflation Rate have no meaningful linear relationship with Historical Volatility.
2. **Correlation between YoY Inflation Rate and GARCH Volatility (-0.0287)**:
   * Similarly, this shows a very weak negative relationship between inflation and GARCH Volatility. The relationship is slightly stronger than with Historical Volatility but still insignificant.

**Interpretation:**

* These low correlation values suggest that inflation and volatility (both Historical and GARCH) are largely independent of each other in this dataset.
* There is no evidence of a strong or consistent linear relationship between inflation and market volatility.

Yes, Granger causality and correlation tests are complementary but serve different purposes:

1. **Correlation Tests**:
   * Measure the **strength and direction** of a linear relationship between two variables.
   * A correlation close to 0 (as in your results) suggests little to no linear relationship, but it does not imply causation.
   * Correlation is symmetric, meaning it does not indicate which variable influences the other.
2. **Granger Causality**:
   * Tests whether **past values** of one variable can predict the future values of another.
   * It is directional, meaning it can indicate whether one variable "Granger-causes" the other.
   * Even if two variables are uncorrelated, Granger causality can still detect predictive relationships.

**Complementarity:**

* Correlation provides a snapshot of the linear relationship, while Granger causality explores the **temporal predictive relationship**.
* For example, two variables might have low correlation but still exhibit Granger causality if one variable's past values help predict the other. Conversely, high correlation does not guarantee causation.

In your case, the weak correlations suggest little linear relationship, but Granger causality tests can reveal whether there is a predictive relationship over time.

Yes, Granger causality and correlation tests are complementary but serve different purposes: \*\*Correlation Tests\*\*: - Measure the \*\*strength and direction\*\* of a linear relationship between two variables. - A correlation close to 0 (as in your results) suggests little to no linear relationship, but it does not imply causation. - Correlation is symmetric, meaning it does not indicate which variable influences the other. \*\*Granger Causality\*\*: - Tests whether \*\*past values\*\* of one variable can predict the future values of another. - It is directional, meaning it can indicate whether one variable "Granger-causes" the other. - Even if two variables are uncorrelated, Granger causality can still detect predictive relationships. Complementarity: Correlation provides a snapshot of the linear relationship, while Granger causality explores the \*\*temporal predictive relationship\*\*. For example, two variables might have low correlation but still exhibit Granger causality if one variable's past values help predict the other. Conversely, high correlation does not guarantee causation. In your case, the weak correlations suggest little linear relationship, but Granger causality tests can reveal whether there is a predictive relationship over time.

The Granger causality test results indicate whether past values of **inflation** can predict future values of **volatility**. Here's how to interpret the results:

**Key Points:**

1. **Null Hypothesis**: Inflation does not Granger-cause volatility.
2. **p-value**: If the p-value is less than 0.05, we reject the null hypothesis, indicating that inflation Granger-causes volatility. Otherwise, we fail to reject the null hypothesis.

**Interpretation by Lags:**

* **Lag 1**:
  + p-values for all tests (e.g., ssr based F test, chi2 test) are greater than 0.05 (e.g., p=0.3344).
  + This means we fail to reject the null hypothesis. There is no evidence that inflation Granger-causes volatility at lag 1.
* **Lag 2**:
  + p-values are still greater than 0.05 (e.g., p=0.2429).
  + Again, we fail to reject the null hypothesis. No evidence of Granger causality at lag 2.
* **Lag 3**:
  + p-values remain greater than 0.05 (e.g., p=0.2109).
  + No evidence of Granger causality at lag 3.
* **Lag 4**:
  + p-values are still greater than 0.05 (e.g., p=0.1289).
  + While the p-values are lower compared to earlier lags, they are still above the 0.05 threshold. Thus, we fail to reject the null hypothesis at lag 4.

**Conclusion:**

For all tested lags (1 to 4), the p-values are greater than 0.05. This means there is **no statistical evidence** that inflation Granger-causes volatility at any of these lag lengths.

**10. References**

Bodie, Zvi. "Common stocks as a hedge against inflation." *The journal of finance* 31.2 (1976): 459-470.

Fama, Eugene F., and G. William Schwert. "Asset returns and inflation." *Journal of financial economics* 5.2 (1977): 115-146.