

Can Diversified Investment Portfolios Hedge Against Inflation and Market Volatility?

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

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Abstract

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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**

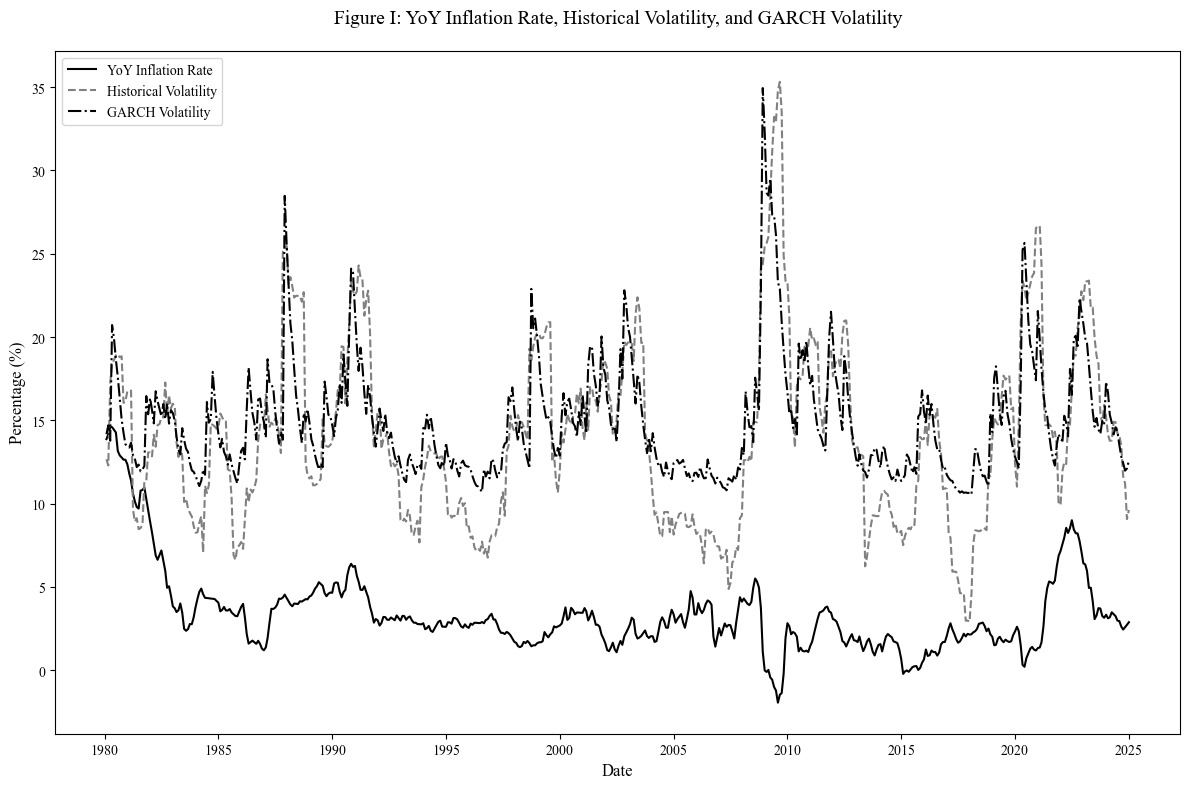
1. **Data**

**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**

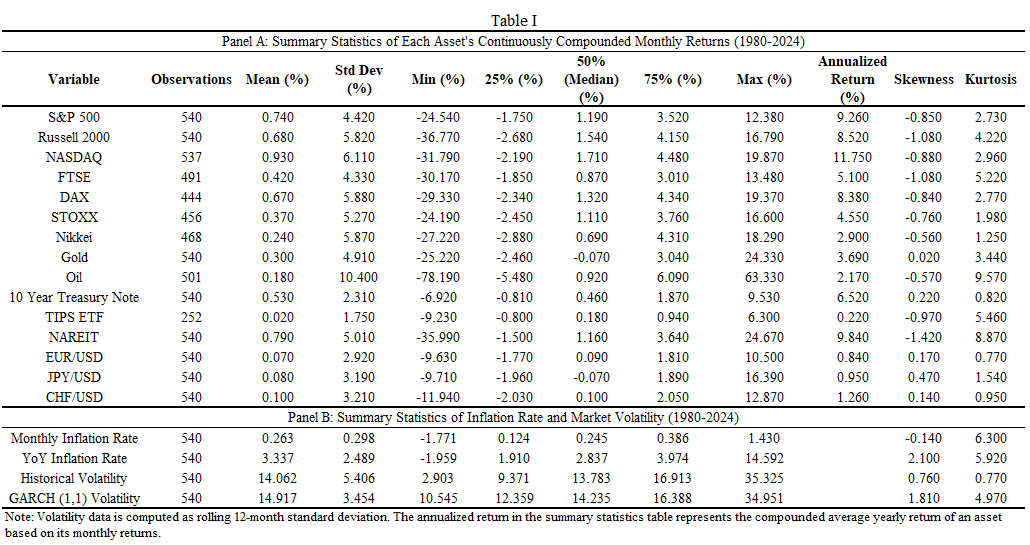


Table I presents the summary statistics for all the assets selected for portfolio construction and for the two macroeconomic variables this paper studies. The study is conducted on 540 months of data and most assets have observable data on all these months, in fact, 15 of the 16 assets have data on more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

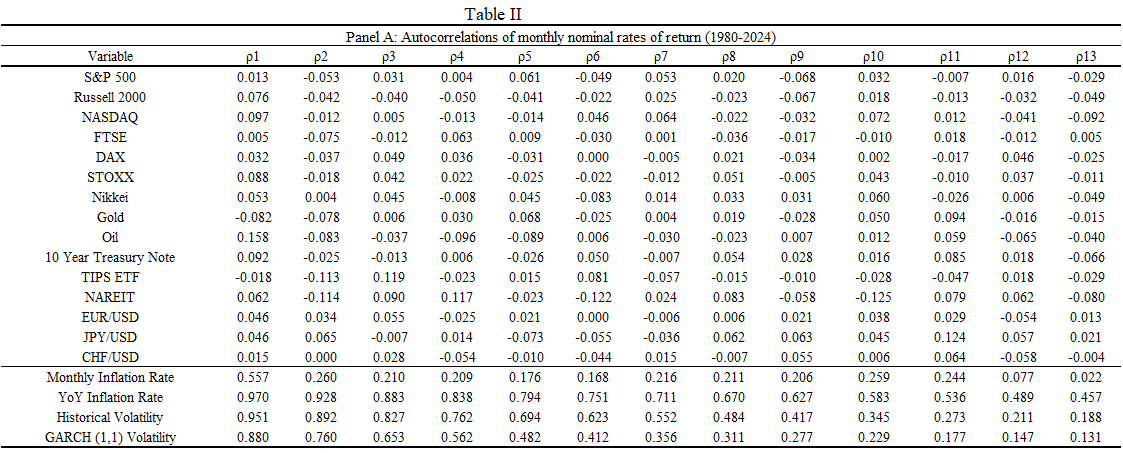
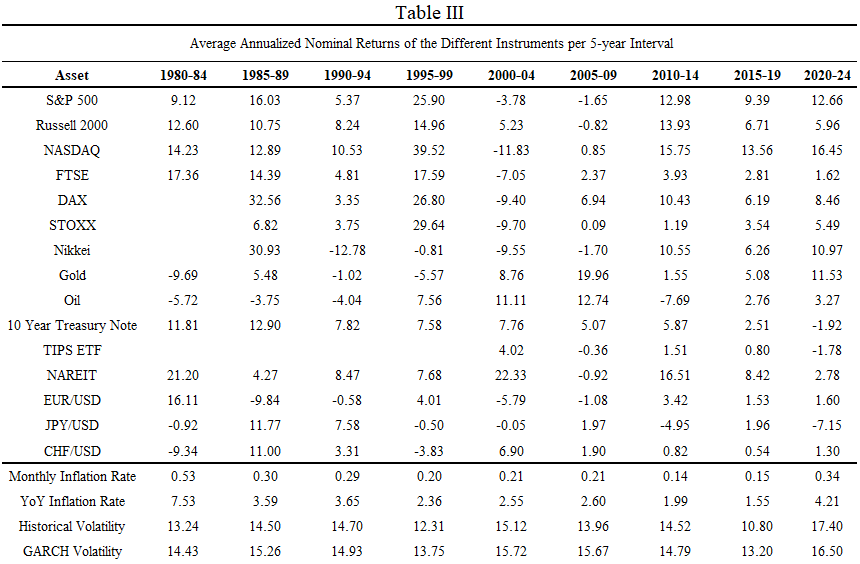
From this Table, the reader can infer that the best performing assets, in this universe, in the period from 1980 through 2024, based on the Annualized Return Data, were the Equity Indexes from the United States and Germany and the NAREIT Index. Whilst the ones that exhibited the lowest level of returns 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 beyond 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 between both variables: correlation analysis and Granger causality testing. These two approaches are, in a way, complimentary. For instance, two variables can have a significantly low correlation or even be totally uncorrelated, and causality can still detect the predictive relationship between the variables that correlation fail to capture.

The correlation analysis was done to assess the power and path of the linear relationship between inflation rate and volatility rate. This would test if changes in the rate of inflation are associated with simultaneous changes in the volatility rate. The assessment was done to the variable YoY Inflation Rate with both measurements of volatility. For Historical Volatility the result was -0.0063, whilst for GARCH Volatility the result was -0.0287. Actually, the number of months that exhibit positive rolling 12-month correlation, on average for both volatility estimates, is 225, whilst the number of the ones with negative is 304. The pattern is quite clear, a negligible and very weak negative relationship between the inflation rate and volatility rates. Figure 2 helps us visualize this. It tells us that the correlation levels fluctuate significantly over time, oscillating between strong positive and negative values. Which may indicate some degree of influence from exogenous factors. Even though, there is not a perfect alignment between both measures of volatility, they tend to move in similar directions, capturing similar dynamics of correlation. Essentially, changes in the Inflation Rate do not have a meaningful impact on A graph of a graph

AI-generated content may be incorrect.volatility, which highlights the fact that they are pretty much independent from each other on our data sample. We can therefore conclude that these variables are orthogonal.

It is now required to address the causality that can be exhibited by the variables, in other words, whether one of the variables leads or is able to predict the behaviour of the other. To achieve this, the Granger Causality test was used to assess the potential of past values of one of the time series to provide statistically significant information to predict future values of another time series. Before proceeding, it is worth noting that Granger-Causality tests are dependent on the fact that both Inflation and Volatility Data are stationary. This stationarity of our variables was verified through an Augmented Dickey-Fuller (ADF) test. The null hypotheses tested here is if any of the variables contains a unit root, i.e., is non-stationary. The p-values for all variables tests are all smaller than 0.05, meaning that we reject the null hypothesis, and confirms that all variables are, therefore, stationary. [Granger (1969)](#Granger_Causality) proposed a statistical framework to test whether a time series past values may be able to predict another time series’ future values. In this study, the test was conducted on both directions of our variables, that is, if inflation’s past values can predict future values of volatility and vice-versa. The application consisted of performing the Granger-causality test at four lags and through all of them, the p-values are high, and well above the 0.05 threshold, and confirm that we fail to reject the null hypotheses of “inflation does not Granger-cause volatility”. Meaning that there is no statistically significant evidence that sustains the null hypothesis. It is worth mentioning that the p-values decrease as the lags increase. More perplexing are the results for the other hypothesis tested. While we would expect some degree of forecasting in inflation data towards volatility, it is actually the other way around on our sample data, as can be seen on Table IV, which displays the results of the conducted tests. It does appear that on longer lags, historical volatility, is Granger-causing inflation, and with past volatility data, one may be able to predict future levels of inflation. However, the exact opposite is verified for GARCH Volatility, which indicates that on the short-term lag it rejects the null hypothesis but on the long-term lags it fails to reject it. It is because of this incongruence between both “Volatilities” that the further study of our hypotheses makes sense. Furthermore, portfolios that provide shelter for investors against both A table with numbers and a number of test results

AI-generated content may be incorrect.volatility estimates will underscore the robustness of our results.

1. **Methodology**

**3.1 Measuring a Hedge**

Model Framework: Present the theoretical model that you use to develop the testable

hypotheses. Specify the hypothesis and explain your expectations in what to find based

on the model framework.

Econometric Techniques: Explain the empirical model that you use to test your

hypothesis and the statistical techniques used to estimate parameters and address

issues like endogeneity, heteroskedasticity, or autocorrelation.

**10. References**

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