



# US Inflation Hedge Strategies

Digital Tools for Finance

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# Agenda

1. Introduction
2. Data
3. Methodology
4. Results
5. Conclusion





## Introduction

- Inflation is a general increase of the prices of goods and services in an economy, typically measured by the Consumer Price Index (CPI).
- During investment activities, the aim of a rational investor is to maximize returns and reduce risk.
- An Inflation hedge is an investment against decreased purchasing power of a currency that results from the loss of its value due to rising prices.

Therefore, looking for a good inflation hedge is meaningful for investors.



## Data

The assets considered in the analysis are the following:

- Gold (London Bullion Market data provided by Nasdaq)
- Securities (^GSPC, TIP, VNQ)
- Consumer Price Index (CPI data provided by US Bureau of Labor Statistics)



# Methodology

## Theoretical Model

Based on the Fisher hypothesis, the nominal interest rate is expressed as the sum of real returns and inflation rate.

The definition of hedging against inflation is that the expected nominal interest rate should move in sync with expected inflation.

- simple linear regression model
- assumptions



# Methodology

## Theoretical Model

$$r_t = \alpha + \beta\pi_t + \epsilon_t; \quad \epsilon_t \sim N(0, \sigma_\epsilon^2)$$

where  $r_t$  is the asset return at period t computed as  $100 * \log \left( \frac{p_t}{p_{t-1}} \right)$  (note that p is the monthly price of the asset in question), and  $\pi_t$  is the inflation rate at period t computed as  $100 * \log \left( \frac{cpi_t}{cpi_{t-1}} \right)$

The coefficient  $\beta$  is a measurement of the inflation hedge,  $\beta = 0$  means no inflation hedging potential;  $0 < \beta < 1$  means partial hedge;  $\beta=1$  means full hedge;  $\beta > 1$  means superior hedging performance.



# Methodology

Theoretical Model

- Assumption 1: Symmetry
- Assumption 2: No time-variance



# Methodology

## Implementation

- the data mentioned above is pulled from the different websites with web APIs
- a regression model is implemented in Python to analyze the data
- two robustness checks are performed to ensure the reliability and validity of the inflation hedging analysis
- the results of the analysis are analyzed to find the best hedging strategy

The data analyzed in this research is for the period 01/01/2004 to 31/10/2023. We provide our instruction and fully replicable code.



# Results

## Regression

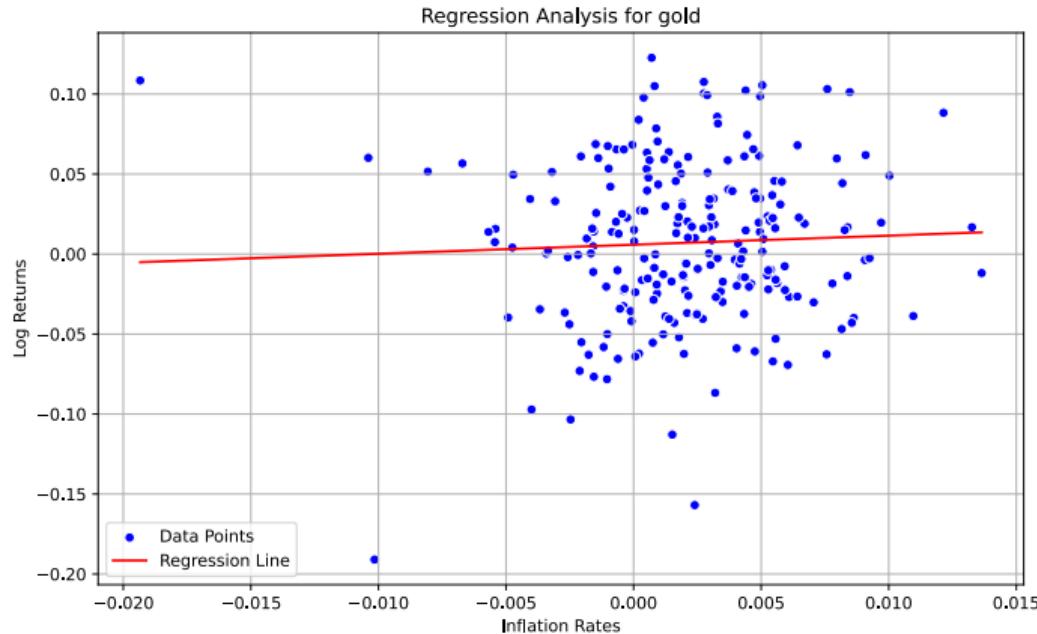
In the table below are reported the results of the linear regression, with the respective hedging capabilities of the assets considered.

Asset Name	$\beta$ Coefficient	Hedging Potential
Gold	0.5658	Partial Hedge
TIP	-0.0985	No hedge
VNQ	1.1018	Superior
$^{\wedge}$ GSPC	0.5291	Partial Hedge



# Results

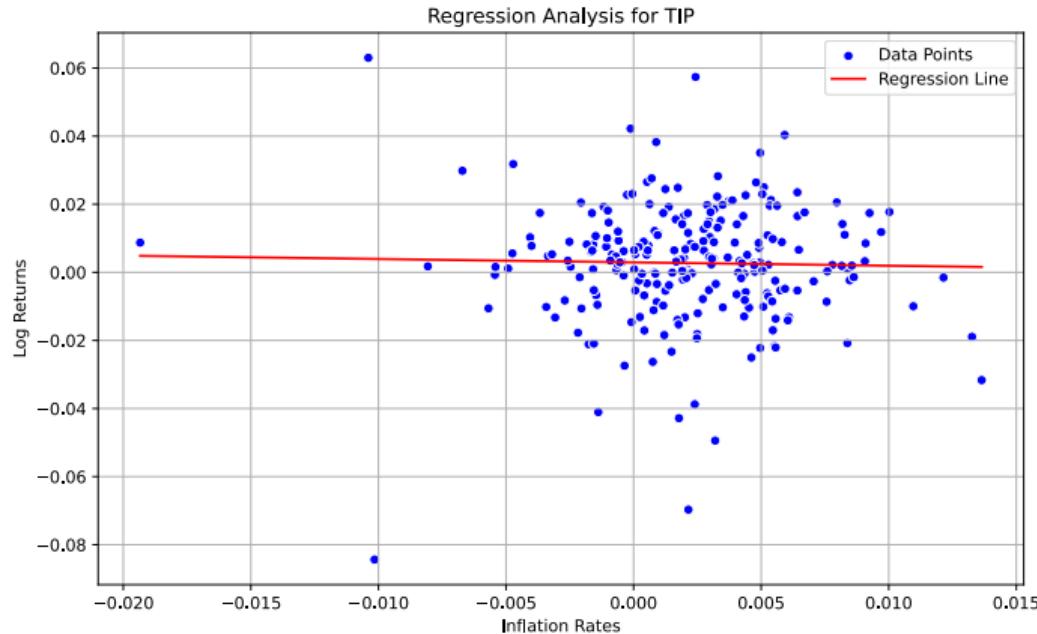
## Regression Results for Gold





# Results

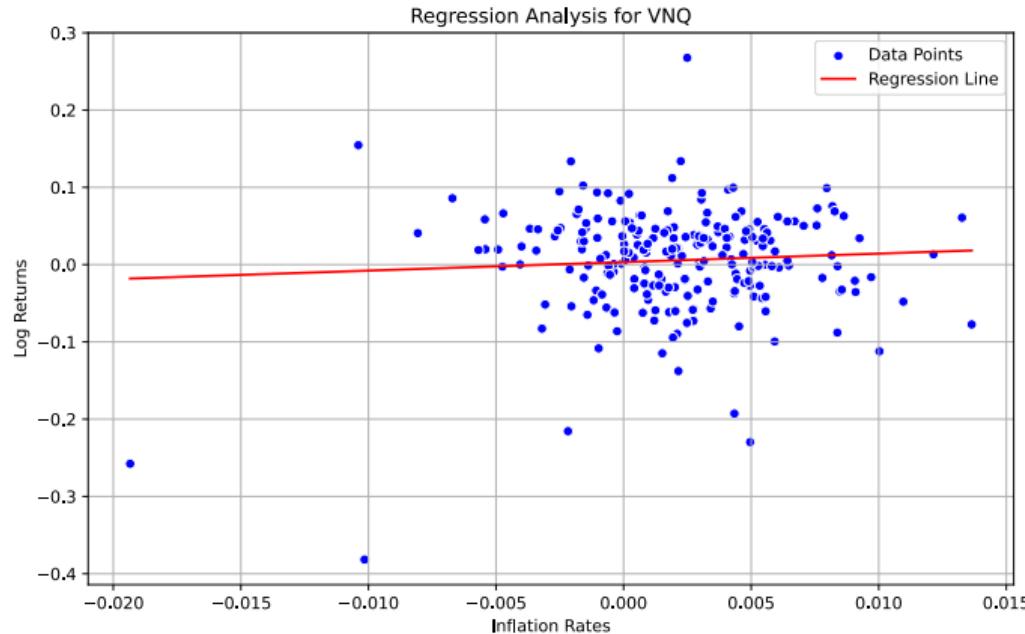
Regression Results for iShares TIPS Bond returns





# Results

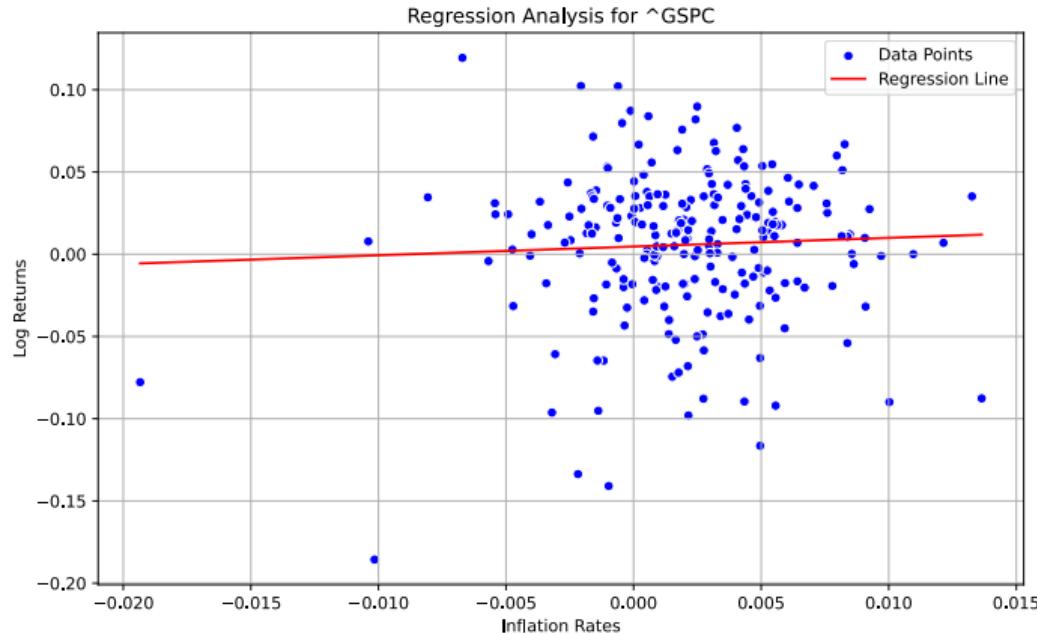
Regression Results for Vanguard Real Estate Index Fund returns





# Results

## Regression Results for S&P500 Index returns





# Results

## Cross Validation Results

The average  $R^2$  scores for four assets are all negative, which implies the model is not appropriate for the data. This is mainly because we only use simple linear regression model to analyze the relation between inflation and returns of assets, relying on strong assumptions that are not observed in reality.

Asset Name	CV Average $R^2$	CV $R^2$ Scores
Gold	-0.0219	[-0.0090, -0.0028, 0.0033, -0.0040, -0.0968]
TIP	-0.0574	[-0.0151, -0.1226, 0.0008, -0.1230, -0.0272]
VNQ	-0.0260	[-0.0687, -0.0253, -0.0436, 0.0065, 0.0009]
$^{\wedge}$ GSPC	-0.1228	[-0.2961, -0.0841, -0.0276, -0.0710, -0.1354]



# Results

## Huber regression Results

The beta coefficients for gold, TIP, and VNQ are all negative, showing no hedging potential. The coefficient for  $^{\text{G}}\text{SPC}$  is 0.0006, which is very close to zero, indicating a very weak hedging potential.

Asset Name	Robust $\beta$ Coefficient	Robust Intercept
Gold	-0.2691	0.0076
TIP	-0.1579	0.0038
VNQ	-1.1747	0.0138
$^{\text{G}}\text{SPC}$	0.0006	0.0101



## Conclusion

The results obtained by running the model have highlighted different levels of inflation hedging among the strategies analyzed. VNQ (Real Estate ETF) has a superior hedge performance and making it the best strategy among the ones considered. Both Gold and ^GSPC are partial hedges, and TIPs are the worse instrument to hedge inflation.