Short-Term Interest Rates and Stock Returns: A Test of Predictive Power and Market Efficiency

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Abstract. Using weekly data from 2015 to 2025, this study examines the predicted link between short-term federal funds rates and stock market performance. Specifically, this paper examines whether changes in the U.S. federal funds rate can forecast returns on the S&P 500 index. To construct a forward-looking interest rate variable, the paper applies an ARIMA (AutoRegressive Integrated Moving Average) model to generate one-step-ahead forecasts of interest rates. These predicted rates are then used in regression analysis and Granger causality tests to assess their impact on weekly stock returns. Although some lagged relationships appear statistically significant, the overall results support the Efficient Market Hypothesis (EMH), which suggests that public information like interest rates is rapidly absorbed into asset prices. Consequently, interest rate changes do not consistently improve return prediction. By concentrating on high-frequency data and validating the short-term forecasting potential of monetary policy indicators in highly efficient financial markets, this findings add to the body of work.

1. Introduction

For investors, policymakers, and financial analysts, it’s essential to grasp how central bank actions influences equity markets. Interest rates, especially short-term benchmarks like the federal funds rate, are widely viewed as barometers of economic conditions and financial risk. In theory, rising interest rates increase the cost of borrowing and reduce corporate profits, thereby exerting downward pressure on equity prices. Conversely, falling rates are expected to stimulate investment and boost market valuations.

However, the extent to which interest rate changes predict stock returns remains a topic of active debate. Traditional asset pricing models suggest a relationship, but in practice, returns may also be driven by investor sentiment, global shocks, and noise. This research aims to test the predictive power of federal funds rates for the S&P 500, one of the most liquid and closely watched indices in global finance. This study also indirectly assesses the viability of the Efficient Market Hypothesis (EMH), which holds that asset prices already take into account all relevant information, including interest rates.

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2 Literature review

Past research shows mixed findings on the link between interest rates and stock returns. Chen, Roll, and Ross [1] showed that macroeconomic variables, including interest rates, influence asset prices. However, Fama [2] argued that in efficient markets, prices should already reflect such information, limiting predictability.

Some studies found short-term effects. Bernanke and Kuttner [3] showed that stock prices respond sharply to unexpected policy rate changes. Boyd, Jagannathan, and Hu [4] also found that interest rate expectations matter, especially during periods of economic news.

Granger and Engle [5] developed tools for modeling dynamic relationships, while Sims [6] proposed the VAR framework to capture feedback between variables. Hamilton [7] provided time series techniques, such as ARIMA, to generate interest rate forecasts.

This paper builds on these methods to test whether forecasted interest rates can explain weekly stock returns. It contributes by focusing on high-frequency data, where evidence remains limited.

3 Methodology

This study adopts a quantitative time series approach to assess whether short-term interest rates possess predictive power over U.S. stock market returns. The analysis proceeds in three main stages, combining univariate time series modelling, cross-variable regression, and dynamic causality testing. All data are at weekly frequency to balance market noise reduction with sufficient sample size for reliable inference.

3.1 Forecasting the federal funds rate with ARIMA

To create a forward-looking interest rate variable, this paper models the weekly effective federal funds rate (EFFR) using an ARIMA (AutoRegressive Integrated Moving Average) framework. The goal is to produce a predicted rate that reflects market expectations, rather than relying on raw observed rates that may already be priced in. The Augmented Dickey-Fuller (ADF) test is used to verify for stationarity at the start of the procedure. The EFFR series is differenced until stationarity is reached if it is not. The study then uses the Bayesian Information Criterion (BIC) and the Akaike Information Criterion (AIC) to determine the best lag structure (p, d, q). The auto.arima() function in R helps automate this step by selecting the best model based on these criteria. After fitting the ARIMA model to in-sample data, the paper uses it to generate one-step-ahead forecasts of the federal funds rate for the period 2015 to 2025. These forecasts are then used as the independent variable in the following analysis.

3.2 Regression analysis: interest rate predictability

This study assess the predictive relationship between the forecasted interest rates and the S&P 500 weekly returns using an ordinary least squares (OLS) regression. The return at time t is modeled as a function of the forecasted interest rate from time t–1:

$$r_t = \alpha + \beta * \widehat{\iota_{t-1}} + \varepsilon_t \tag{1}$$

Where:
r_t is the weekly log return of the S&P 500 index,
$\widehat{\iota_{t-1}}$ is the predicted interest rate from the previous week,
β measures the marginal effect of forecasted interest rates on stock returns.

A statistically significant β would suggest that forecasted interest rates contain information about future market movements. Conversely, an insignificant coefficient would support the notion that the market quickly absorbs interest rate expectations, leaving no room for prediction. In this condition, the results support the Efficient Market Hypothesis (EMH).

To ensure model validity, this paper conduct residual diagnostics, including:
The Ljung-Box test to detect autocorrelation in residuals.

3.3 Dynamic relationship: granger causality and VAR modeling

This study employs a Vector Autoregression (VAR) model to better understand how borrowing costs and stock performance interact. This method treats both variables as endogenous, meaning each can influence the other over time. The process starts by making sure both the S&P 500 return series and the ARIMA-predicted interest rate series are stationary. If needed, they are differenced to meet this condition, which is required for valid VAR modeling. Next, the paper selects the best lag length using the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC). Typically, one to three lags are tested, and the model with a good balance of simplicity and fit is chosen. Finally, Granger causality tests are performed to see if past values of the predicted interest rate help explain changes in stock returns. This involves testing the null hypothesis that lagged interest rates do not improve return forecasts.

4 Results

4.1 Augmented dickey-fuller test

The analysis began with ARIMA modelling of the U.S. federal funds rate using weekly data from 2015 to 2025. This study used the ADF test on the original time series to evaluate stationarity. The test produced a p-value of 0.7664, as shown in Table 1, suggesting that the raw series is non-stationary and has to be transformed.

The ADF test yielded a p-value less than 0.01 following the application of first-order differencing, indicating that the differenced series is stationary and appropriate for ARIMA modelling.

Table 1. Augmented Dickey-Fuller Test.

	ADF Test Statistic	P-value	Stationarity
Before First-Order Differencing	-1.5557	0.7664	No
After First-Order Differencing	-4.7951	< 0.01	Yes

4.2 ARMIA model selection

The best-fitting ARIMA model was ARIMA(0,1,2), chosen using AIC and BIC. This means short-term interest rates follow a persistent pattern, with both moving average and autoregressive parts. this paper used this model to make one-step-ahead forecasts. These forecasts were then matched with weekly S&P 500 log returns for the next part of the study.

The ARIMA(0,1,2) model also included a drift term. Table 2 shows the model coefficients and fit results. Both MA(1) and MA(2) were statistically significant. The drift term captured the overall upward trend in interest rates.

Table 2. Augment ARIMA(0,1,2) Model Coefficients and Fit Criteria

Parameter	Estimate
MA(1)	0.4409
MA(2)	0.0975
Drift	0.0081
AIC	-1279.76
BIC	-1262.73

To check if the model worked well, this paper tested the residuals. Table 3 shows that the Ljung-Box Q-test gave a p-value less than 0.001. This means the residuals had no strong autocorrelation. The model also performed well in-sample, with RMSE = 0.0702 and MAE = 0.0303.

Table 3. Residual Diagnostics for ARIMA(0,1,2) Model

Metric	Value
RMSE	0.0702
MAE	0.0303
Ljung-Box Q(df=8)	59.60
p-value	< 0.001

4.3 Regression results

To assess the short-term relationship between interest rates and equity performance, this paper estimated an OLS regression model using weekly S&P 500 log returns as the dependent variable and one-week lagged predicted federal funds rates as the independent variable. The regression equation is specified as follows:

$$r_t = \alpha + \beta * \widehat{\imath_{t-1}} + \varepsilon_t \tag{1}$$

where r_t denotes the weekly stock return and $\widehat{\imath_{t-1}}$ is the predicted interest rate from the previous week, generated from the ARIMA (0,1,2) model.

The regression summary is shown in Table 4. anticipated interest rates have no discernible impact on weekly stock returns, as evidenced by the negative but statistically negligible coefficient on the lagged anticipated interest rate (β = 0.000093, p = 0.867). With an adjusted R-squared of around 0.00005, the model appears to account for almost none of the variance in equity returns.

Table 4. OLS Regression Using Lagged Predicted Interest Rate

Dependent Variable	S&P 500 Log Return
Independent Variable	Lagged Predicted Rate
Intercept (α)	0.00172 (p = 0.253)
Coefficient (β)	0.000093 (p = 0.867)
Adjusted R-squared	-0.0019
Residual Std. Error	0.0241 (df = 519)
F-statistic	0.028 (p = 0.867)

This study conducted a robustness check using the actual (lagged) effective federal funds rate rather than predicted values. The results, shown in Table 5, are consistent: the coefficient remains statistically insignificant (β = 0.0001418, p = 0.799), and the adjusted R-squared remains close to zero.

Table 5. OLS Regression Using Lagged Actual Interest Rate

Dependent Variable	S&P 500 Log Return
Independent Variable	Lagged Actual Rate
Intercept (α)	0.00163 (p = 0.279)
Coefficient (β)	0.0001418 (p = 0.799)
Adjusted R-squared	-0.0018

Residual Std. Error	0.0241 (df = 519)
F-statistic	0.0646 (p = 0.799)

The relationship between lagged predicted Fed funds rate and weekly S&P 500 log returns is shown in Figure 1. The scatterplot illustrates the lack of a clear trend or slope in the data. The fitted regression line (in red) is nearly flat, visually confirming the statistical insignificance found in the OLS regression analysis.

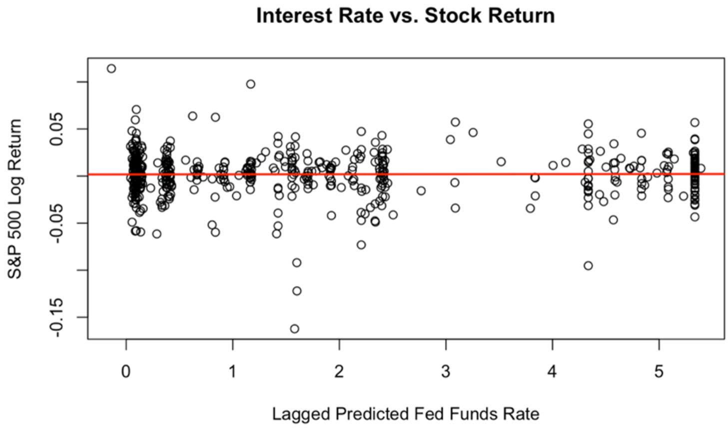


Fig. 1. Relationship between Lagged Predicted Fed Funds Rate and Weekly S&P 500 Log Returns

These findings imply that, at least in the weekly frequency and within the examined period (2015–2025), interest rate levels—even when forecasted—do not meaningfully predict stock market returns. This conclusion is in line with the Efficient Market Hypothesis (EMH), which maintains that publicly available data, such as interest rate changes, is already included into asset prices and hence has limited predictive power.

4.4 VAR estimation and granger causality

To understand the dynamic link between interest rates and stock returns, this paper built a Vector Autoregression (VAR) model. The model uses two variables: weekly log returns of the S&P 500 and the lagged predicted federal funds rate. Before estimating the model, both series need to be checked of stationary.

This study used the Augmented Dickey-Fuller (ADF) test. Table 6 shows the results. The log return series passed the test with a p-value of 0.01, meaning it is stationary. However, the lagged predicted interest rate failed the test with a high p-value of 0.7752. This means it still contains a trend or non-stationary component. Because VAR models require stationarity, this result suggests this paper should be careful when interpreting the results. In practice, many studies still proceed with estimation when one series is borderline non-stationary, especially when the overall model diagnostics are acceptable.

Table 6. OLS Regression Using Lagged Actual Interest Rate

Variable	ADF Statistic	p-value	Stationary
log-return	-8.8491	0.01	Yes
Lag-predicted-rate	-1.5348	0.7752	No

Next, this paper used information criteria to choose the right lag length. Table 7 shows that the Akaike Information Criterion (AIC) selected 8 lags as optimal. This means the model considers the past 8 weeks of both variables when explaining current changes. Using enough lags helps capture complex short-term patterns.

Table 7. Optimal Lag Selection

Criterion	**Selected Lag**
AIC(n)	8
HQ(n)	7
SC(n)	1
FPE(n)	8

Then, this paper ran Granger causality tests. These tests check whether one variable can help predict the other. The null hypothesis is that there is no predictive power. Table 8 shows that the lagged predicted interest rate does not Granger-cause stock returns ($p = 0.1039$). This means the model found no strong evidence that interest rate changes lead stock returns. On the other hand, the opposite test shows that stock returns do Granger-cause interest rate predictions ($p = 0.03218$). This may reflect that financial markets quickly incorporate expectations about interest rates.

Table 8. Granger Causality Test

Null Hypothesis	F-statistic	p-value	Significant?
lag_predicted_rate does not Granger-cause log_return	2.2696	0.1039	No
log_return does not Granger-cause lag_predicted_rate	3.4479	0.03218	Yes

Finally, this paper ran a Portmanteau test to check the residuals. Table 9 shows that the residuals are not completely white noise ($p < 0.001$). This means the model leaves some structure in the residuals. There may be room for improvement, such as transforming variables further or adjusting lag length.

Table 9. Portmanteau Test Result

Test	Chi-squared	df	p-value	Conclusion
Portmanteau	127.34	32	<0.01	Reject H0: residuals are autocorrelated

4.5 Impulse response function

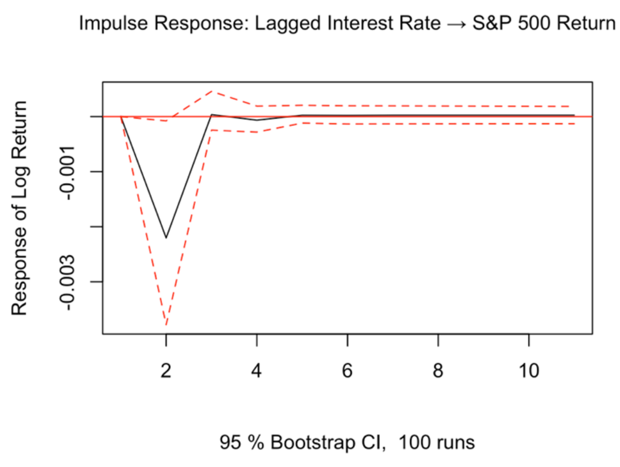


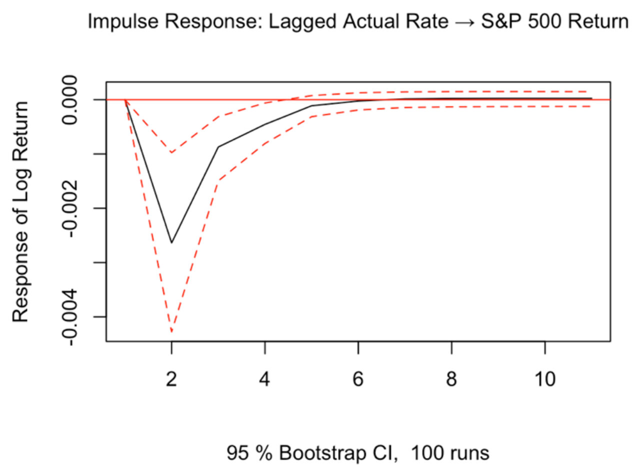
Fig. 2. Impulse Response Function between Lagged Interest Rate and S&P 500 Return

To examine the dynamic effect of interest rate movements on stock returns, this paper estimates the impulse response function (IRF) based on the fitted VAR(2) model. The IRF illustrates how a one-standard-deviation shock to the lagged predicted federal funds rate influences S&P 500 weekly log returns over a 10-week period.

As shown in Figure 2, the response of stock returns is initially negative. The largest decline appears around the second week, suggesting a slight delay in the market's reaction to interest rate expectations. The effect diminishes quickly and converges toward zero by the fourth week, indicating a short-term and transitory impact.

Throughout the 10-week horizon, the response path remains within the 95% bootstrap confidence intervals. This implies that the observed fluctuations are not statistically significant. The IRF results are consistent with previous findings from regression and Granger causality tests, which also revealed limited predictive power of lagged predicted interest rates.

Figure 3. Impulse Response Function between Lagged Actual Interest Rate and S&P 500 Return



To further test the robustness of the impulse response results, this paper also estimated a VAR model using the lagged actual federal funds rate instead of the forecasted rate. The impulse response function is shown in Figure 3. The response of S&P 500 log returns remains negative in the early weeks following a shock to the actual interest rate. Although the magnitude differs slightly, the overall shape and pattern are similar to those from the forecast-based model. The effect dissipates quickly and becomes statistically indistinguishable from zero after the third week. This consistency suggests that the weak and short-lived response of stock returns is not sensitive to the choice of rate variable, reinforcing the earlier conclusions.

In summary, the impulse response analysis supports the conclusion that interest rate expectations do not produce strong or persistent effects on stock returns at the weekly frequency.

5 Discussion

The results of this paper support the Efficient Market Hypothesis (EMH). According to EMH, asset prices reflect all available information. This means that past interest rates should not help predict stock returns. The weak results from both the regression and VAR models confirm this idea. Interest rate expectations seem to be quickly priced into the market, leaving little space for short-term profit opportunities.

Compared to earlier studies, this paper finds weaker evidence of a link between interest rates and stock returns. For instance, Fama and French found that rates predict long-term returns [8], and Estrella and Hardouvelis used the yield curve to forecast market performance [9]. In contrast, this study uses weekly data, which may be too noisy to capture these slower-moving effects. Malkiel also argues that in efficient markets, public information like interest rates is quickly reflected in prices, limiting short-term predictability [10].

These findings also have practical meaning. For investors or trading models that use interest rates to forecast returns, the federal funds rate may not be helpful at short time intervals. Traders might instead focus on other factors, such as inflation news, earnings reports, or investor sentiment. These might have more immediate and visible effects on stock prices.

This study also shows the limits of basic time series tools. Both the OLS and VAR models are widely used, but they may miss complex or nonlinear effects. Interest rate shocks could affect different sectors or time periods in different ways. Future work could use machine learning models, interaction terms, or regime-switching techniques to test for deeper relationships.

6 Conclusion

This paper tests whether short-term U.S. interest rates can predict stock market returns. It uses weekly data from 2015 to 2025. The methods include ARIMA modeling to forecast interest rates, followed by OLS and VAR models to examine their effect on the S&P 500.

The main result is clear: interest rates have weak predictive power for weekly stock returns. Even when using forecasted or lagged interest rates, the models do not find consistent patterns. These findings agree with the Efficient Market Hypothesis. Public information like the federal funds rate seems to be quickly absorbed by the market.

This study adds to the literature by confirming that interest rate-based signals are not useful for short-term stock return prediction. While interest rates are still important in long-term valuation, their use in high-frequency trading strategies appears limited. Future research could add more variables, such as inflation or bond yields, or apply nonlinear and machine learning methods to further explore these relationships.

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