From Fed Funds to Mortgages: An Empirical OLS Study of The Monetary Policy Transmission Mechanism

Eric Leonen

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Abstract

This paper empirically examines the transmission of monetary policy from the Federal Funds Rate to long-term borrowing costs. We focus on links between the policy rate, to short-term rates, to long-term rates, and to mortgage rates. Using historical interest rate data from 1981 to 2025, we estimate three ordinary least squares (OLS) regressions for each stage of the transmission chain. Our results show that changes in the Federal Funds Rate are positively related with short-term rates, which in turn are positively related to long-term rates, which in turn are positively related to mortgage rates. The effect is strongest between the Federal Funds Rate and short-term rates and between long-term rates and mortgage rates, but weaker between short-term rates and long-term rates. Our findings support and quantifies links in the the standard story of the monetary policy transmission mechanism.

1 Introduction

Standard monetary theory says that the Federal Reserve can affect the real economy by lowering or raising the Federal Funds Rate, the overnight rate at which banks lend to each other. The common story goes like this: The Federal Reserve decides to cut rates. This lowers short-term borrowing costs. Short-term Treasury yields, an alternative to overnight borrowing, must also lower. Cheaper short-term borrowing means dealers bid up the prices of long-term assets like long-term Treasuries, thereby lowering long-term rates as well. Finally, long-term interest rates determine the cost of borrowing for households, such as in mortgages.

This story makes sense logically, but does it hold empirically? If so, how much effect does the Federal Funds Rate really have on the increasing longer rates in the chain? Formally, we consider three empirical linkages in the transmission from monetary policy to mortgage markets: (1) the Federal Funds Rate and short-term rates; (2) short-term rates and long-term rates; (3) long-term rates and mortgage rates. Our research questions are: (i) Are these relationships statistically significant and positive? and (ii) Is the strength of the relationship greater for linkages closer to the Federal Reserve in the transmission chain?

2 Data

We use four interest rate series from the Federal Reserve Economic Data (FRED) database spanning 1981–2025. Each series is expressed in annualized percentage terms and is not seasonally adjusted. Specifically:

- **Federal Funds Effective Rate**: Series `FEDFUNDS`, the monthly effective Federal Funds Rate set by the Federal Reserve Board (Board of Governors of the Federal Reserve System (US), 2025a). This rate represents the overnight unsecured lending rate between depository institutions.

- **3-Month Treasury Yield**: Series `GS3M`, the monthly average yield on 3-month Treasury securities (Board of Governors of the Federal Reserve System (US), 2025c). This series is used as a proxy for the short-term risk-free rate.

- **10-Year Treasury Yield**: Series `GS10`, the monthly average yield on 10-year Treasury securities (Board of Governors of the Federal Reserve System (US), 2025b). This series is used as a proxy for the long-term risk-free rate.

- **30-Year Fixed-Rate Mortgage Rate**: Series `MORTGAGE30US`, the weekly average interest rate for a 30-year fixed-rate mortgage in the United States (Freddie Mac, 2025). This series reflects the cost of long-term borrowing faced by potential homeowners.

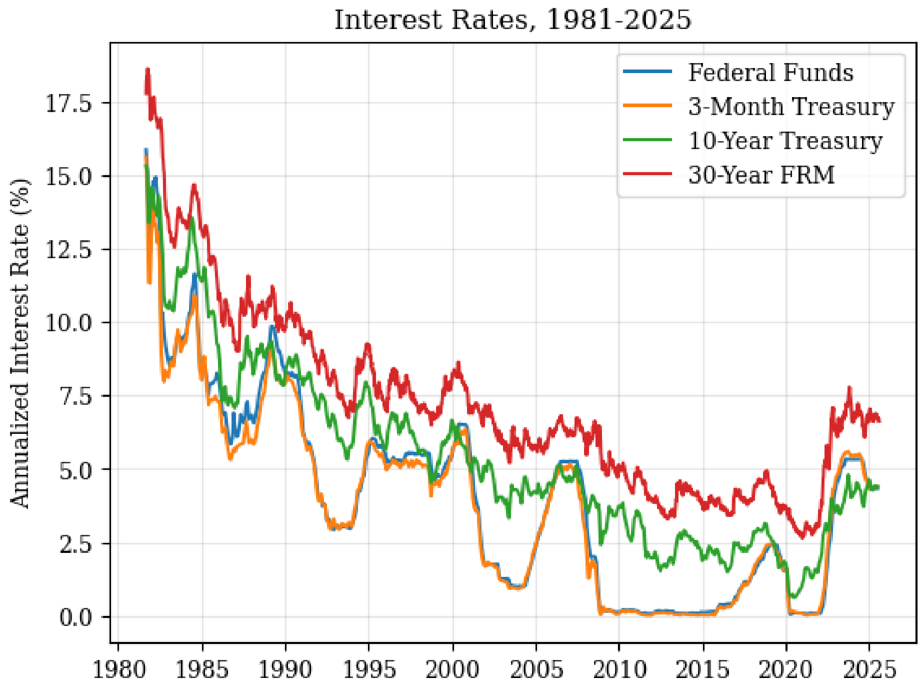


Figure 1: The Federal Funds Rate, 3-month Treasury yield, 10-year Treasury yield, and 30-year fixed-rate mortgage rate. Source: FRED.

For notational convenience, we denote each series by the symbols in Table 1. When referring to a generic rate, we use r without a superscript.

Table 1: Shorthand Notation for Interest Rates

Interest Rate	**Symbol**
Federal Funds Rate	r^{FFR}
3-Month Treasury Yield (Short-Term Rate)	r^{STR}
10-Year Treasury Yield (Long-Term Rate)	r^{LTR}
30-Year Fixed-Rate Mortgage Rate	r^{FRM}

3 Methodology

3.1 Preprocessing

For each interest rate series, we seek to reduce the noise and negative trend visible in Figure 1. Instead of working directly with monthly or weekly interest rate levels, we use year-over-year differences in annual averages.

Let r_t denote the annual average interest rate in year t for a given interest rate series. Missing monthly or weekly observations are linearly interpolated. Annual averages were computed as the arithmetic mean of monthly or weekly observations. Finally, the year-over-year differences were computed as $\Delta r_t = r_t - r_{t-1}$.

These transformations yield roughly stationary series shown in Figure 2. These series are suitable for OLS estimation.

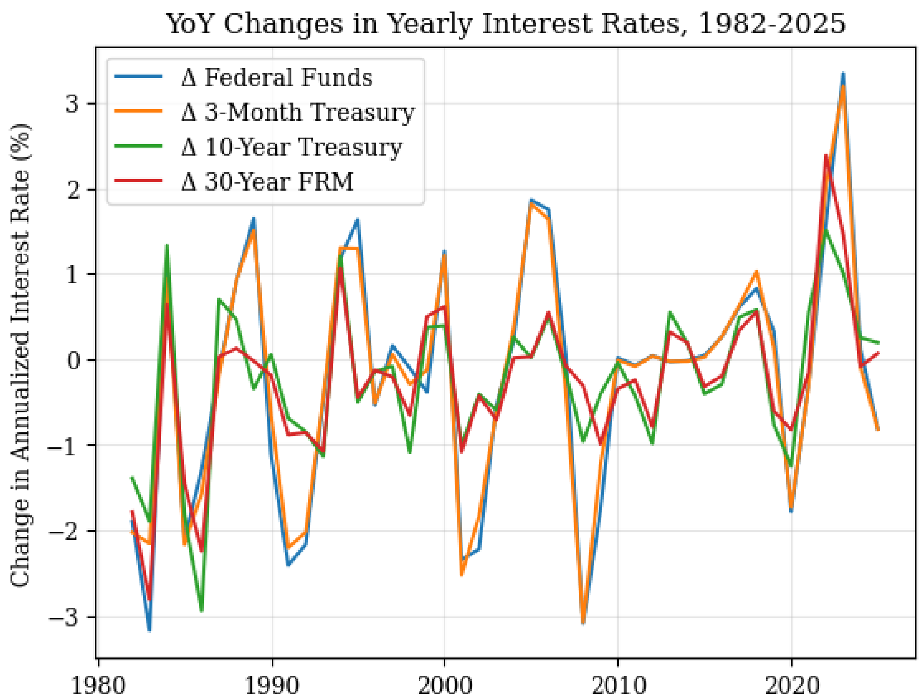


Figure 2: Year-over-year differences in annual average Federal Funds Rates, 3-month Treasury yields, 10-year Treasury yields, and fixed-rate mortgage rates.

3.2 Modeling

We use three linear models to model the three empirical linkages on the transmission from monetary policy to mortgage markets. Specifically, we estimate the following linear regression specifications with $t \in \{1982, \ldots, 2025\}$:

$$\Delta r_t^{\text{STR}} = \alpha_1 + \beta_1 \Delta r_t^{\text{FFR}} + \epsilon_{1,t} \tag{1}$$

$$\Delta r_t^{\text{LTR}} = \alpha_2 + \beta_2 \Delta r_t^{\text{STR}} + \epsilon_{2,t} \tag{2}$$

$$\Delta r_t^{\text{FRM}} = \alpha_3 + \beta_3 \Delta r_t^{\text{LTR}} + \epsilon_{3,t} \tag{3}$$

Here, for all linkages $l \in \{1, 2, 3\}$, α_l captures the mean change in the dependent rate when there is no change in the independent rate, β_l captures the marginal effect of a one percent change in the independent rate on the dependent rate, and $\epsilon_{l,t}$ is an i.i.d. error term with zero mean and constant variance.

For each β_l, we test the null hypothesis $H_0 : \beta_l = 0$ against the alternative $H_1 : \beta_l \neq 0$ using a two-sided t-test. We use a significance level of $\alpha = 0.05$. The test statistic is calculated as $t = \frac{\hat{\beta}_l}{\mathrm{SE}(\hat{\beta}_l)}$ and reported p-values indicate the smallest significance level at which H_0 can be rejected.

4 Results

Table 2 provides OLS estimates for the three linear models of interest rate linkages. Across the transmission chain, each slope coefficient is positive and significant. This suggests that increases or decreases in the Federal Funds Rate lead to increases or decreases in short-term yields, then long-term yields, and then finally fixed-rate mortgage rates.

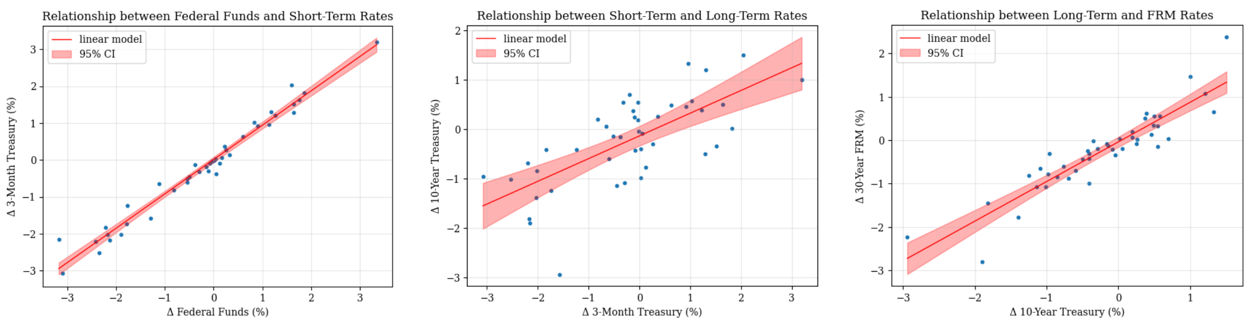
Table 2: OLS Regression Estimates for Interest Rate Transmission Linkages

Interest Rate Link	$\hat{\alpha}_l$	$\hat{\beta}_l$	R^2
$r^{\text{FFR}} \to r^{\text{STR}}$ $(l = 1)$	0.0089 (0.036)	0.9322 (0.025)*	0.971
$r^{\text{STR}} \to r^{\text{LTR}}$ $(l = 2)$	-0.1353 (0.099)	0.4606 (0.072)*	0.491
$r^{\text{LTR}} \to r^{\text{FRM}}$ $(l = 3)$	-0.0436 (0.058)	0.9133 (0.063)*	0.833

Standard errors in parentheses; * $p < 0.05$

We see that the first linkage, $r^{\text{FFR}} \to r^{\text{STR}}$ $(l = 1)$, is the strongest, with an estimated coefficient of 0.9322 and a R^2 of 0.971. This indicates almost all variation in changes in short-term yields can be explained by changes in the Federal Funds Rate. The second linkage, $r^{\text{STR}} \to r^{\text{LTR}}$ $(l = 2)$, is quite weak, with an estimated coefficient of 0.4606 and R^2 down to 0.491. This indicates other factors, like expectations and GDP growth, affect changes in long-term yields. Finally, the third linkage, $r^{\text{LTR}} \to r^{\text{FRM}}$ $(l = 3)$, is very strong, with an estimated coefficient of 0.133 and an R^2 of 0.833. Like in the first linkage, this indicates most of the variation in the changes in fixed-rate mortgage rates can be explained by changes in long-term yields.

The following Figure 3 visualize these regression fits with 95% confidence intervals.



(a) FFR → STR (b) STR → LTR (c) LTR → FRM

Figure 3: Regression fits for the three transmission linkages with 95% confidence intervals.

5 Conclusion

This study provides strong evidence that changes in the Federal Funds Rate propagate through the yield curve to affect mortgage rates. Specifically, a one percentage-point increase in the Federal Funds Rate is associated with an approximate 0.9322 point increase in short-term Treasury yields; short-term yields, in turn, lead to a 0.4606 point rise in long-term yields; and long-term yields closely track mortgage rates, with a one-to-one pass-through of about 0.9133 points. These results confirm that all three linkages are positive and statistically significant, with the strongest effects observed closer to the Federal Reserve and at the mortgage stage, and a weaker effect in the intermediate short to long-term link.

The findings support the standard monetary policy transmission mechanism: policy rate adjustments influence longer-term interest rates and ultimately borrowing costs for households. However, several limitations should be noted. First, omitted variables such as GDP growth, inflation expectations, or consumer confidence may partially drive observed changes, particularly in the mortgage rate link. Second, the models do not capture potential lagged effects, even though rate adjustments propagate over time. Future research could incorporate additional macroeconomic variables and explore dynamic or lagged regression models to better quantify the timing and magnitude of transmission.

References

Board of Governors of the Federal Reserve System (US) (2025a). Federal funds effective rate [fedfunds]. `https://fred.stlouisfed.org/series/FEDFUNDS`. Retrieved August 13, 2025, from FRED, Federal Reserve Bank of St. Louis.

Board of Governors of the Federal Reserve System (US) (2025b). Market yield on u.s. treasury securities at 10-year constant maturity, quoted on an investment basis [gs10]. `https://fred.stlouisfed.org/series/GS10`. Retrieved August 13, 2025, from FRED, Federal Reserve Bank of St. Louis.

Board of Governors of the Federal Reserve System (US) (2025c). Market yield on u.s. treasury securities at 3-month constant maturity, quoted on an investment basis [gs3m]. `https://fred.stlouisfed.org/series/GS3M`. Retrieved August 13, 2025, from FRED, Federal Reserve Bank of St. Louis.

Freddie Mac (2025). 30-year fixed rate mortgage average in the united states [mortgage30us]. `https://fred.stlouisfed.org/series/MORTGAGE30US`. Retrieved August 13, 2025, from FRED, Federal Reserve Bank of St. Louis.