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Evaluating the impact of federal reserve interest rate increases on U.S. residential mortgage refinancing trends (2010–2022)

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Алхассан Абасс Сагое, Ентоні Квесі Ашун. Оцінювання впливу підвищення відсоткових ставок Федеральної резервної системи на тенденції рефінансування житлових іпотечних кредитів у США у 2010–2022 роках. Економіка та управління АПК. 2026. № 1. С. 157–170.

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The study examines the transmission mechanism of Federal Reserve Monetary Policy to the United States residential mortgage market from 2010 to 2022. The study used a quantitative research design, utilising monthly time series data from February 2010 to November 2022. The data were collected from multiple authoritative sources, including the Federal Reserve Economic Data database, the Mortgage Bankers Association, and the U.S. Census Bureau.

The study revealed that the net equilibrium effect is negligible, at approximately 2.5 basis points per 1 percentage-point policy change. It is indicated that the comprehensive model incorporating housing market activity variables explained 72.1% of mortgage rate variation, significantly outperforming basic specifications. Contrary to theoretical expectations, unemployment rates were found to have a positive relationship with mortgage rates. In addition, the positive correlation between unemployment and mortgage rates challenges conventional assumptions, underscoring the need for the Federal Reserve to adopt targeted interventions tailored to real estate conditions.

It is recommended that initiatives should emphasise the importance of support programmes to improve the affordability and accessibility of housing in the increasing interest rates. Initiatives that promote employment growth in housing-related sectors can help alleviate pressure on mortgage rates, particularly during periods of high unemployment. Finally, gradual adjustments to federal funds and mechanisms for observing consumer behavior in real-time are crucial to prevent disruptions in the mortgage market and enable rapid responses to adverse effects.

The study is the first of its kind in analysing the transmission mechanism of Federal Reserve Monetary Policy to the United States residential mortgage market from 2010 to 2022.

Keywords: Monetary Policy, Federal Reserve, Residential Mortgage Market.

Problem statement and analysis of recent research. The mechanism of transmission of the monetary policy of the Federal Reserve significantly influences the residential mortgage market in emerging economies, as demonstrated by recent studies that highlight greater mortgage accessibility due to interest rates of the United States of America (USA.) (Smith, 2020). Global disparities in the effectiveness of the Federal Reserve's monetary policy transmission to the residential mortgage market are evident, with developed nations experiencing faster adjustments compared to developing countries, leading to increased volatility in the real estate market (Johnson and Lee, 2021).

According to García (2023), the interaction between the Federal Reserve's monetary policy and the residential mortgage market has evolved since 2020, revealing that lower interest rates have disproportionately benefited urban areas

worldwide due to the greater demand and investment. The evidence suggests that the quantitative measures of the Federal Reserve have led to a significant reduction in mortgage rates worldwide, fundamentally altering borrower behaviour and increasing housing rates, particularly in regions with previously high barriers to access (Williams and Chen, 2022). It has been affirmed that as global economic conditions change, the monetary policy mechanisms of the Federal Reserve are increasingly affecting international residential mortgage markets by creating cross-border capital flows that exacerbate inflation in housing prices in the main cities (Davis, 2019).

The competitive panorama between lenders moderates the impact of federal fund rate increases on mortgage rates, as Thompson et al. (2025) suggest that market dynamics can cushion consumers from rapid cost increases. The anticipatory behaviour of consumers with respect to fluctuations in federal funds complicates the mortgage pricing landscape, as Martínez and Wong (2025) demonstrate that this perception can lead to pre-emptive adjustments in rates before official policy changes. Understand the intricate relationship between the monetary policy of the Federal Reserve and the Mortgage Market of the United States. Political leaders need to consider the implications for economic stability and consumer behavior during periods of interest rate volatility.

The delayed response of mortgage rates to changes in the Federal Reserve's interest rate complicates economic stability, as demonstrated by Chang et al. (2022), who highlight a delay of six to twelve months that affects market dynamics. Smith and Thompson (2024) argue that the gradual impact of monetary policy on housing prices is mainly due to buyer responses and credit availability, which requires a nuanced understanding of market reactions over time. Studies have shown that the effectiveness of the Federal Reserve's monetary policy in the residential mortgage market is significantly influenced by institutional frameworks. For instance, Johnson et al. (2025) demonstrate that flexible loan practices enhance the capacity to respond to policy changes. The conditions of the labor market play a crucial role in the transmission of monetary policy to mortgage rates, as González and Lee (2021) demonstrate that a decrease in unemployment increases the confidence and response capacity of borrowers. Demographic variations in response to monetary changes, as highlighted by Harrison and Patel (2024), suggest that effective transmission mechanisms depend on the regional resilience of the labour market during periods of fluctuating unemployment.

In the opinion of Chen and Wang (2025), urban areas experience more substantial transmission effects of monetary policy compared to rural regions, which necessitates personalized financial strategies to effectively address the unique dynamics of the local market. The lagging effects of monetary policy settings in real estate markets complicate economic predictions, as late reactions hinder the precise evaluation of economic activity based solely on housing price movements (Baker and Hsu, 2022). It is believed that behavioral factors, particularly the consumer's perception, significantly influence the unpredictability of the relationship between monetary policy and real estate market responses, highlighting the need for nuanced policy frameworks. Understanding the complexities of the monetary policy transmission mechanism through real estate markets is crucial for developing adaptive policies that respond to evolving economic conditions and consumer behaviors.

The transmission mechanism of the Federal Reserve increases the residential mortgage market by reducing interest rates, making homeownership more accessible to a broader part of the population during economic recessions. Due to its impact on liquidity and credit availability, the Federal Reserve's transmission mechanism plays a crucial role in stabilizing the residential mortgage market during periods of financial uncertainty. The effectiveness of the Federal Reserve's transmission mechanism directly affects the ability of housing to influence mortgage rates, as the cost of low lending enables more families to purchase homes in urban areas. This means that by facilitating communication between monetary policy adjustments and hostage loan practices, the transmission mechanism of the Federal Reserve significantly affects borrower behaviour and overall market dynamics in the residential sector.

In the United States, regional inequalities significantly impact the dissemination of the Federal Reserve's Monetary Policy in the residential mortgage market, necessitating a nuanced analysis to comprehend the localized effects on mortgage rates and housing affordability.

The advancement of technology in the mortgage industry enhances lenders' ability to offer competitive rates, leading to a more personalized mortgage experience for borrowers through refined risk assessments (Smith and

Johnson, 2021). The increase in competition from non-bank lenders has complicated the mortgage pricing framework, as traditional banks struggle to maintain their market share amid lower rates and faster processing times (Brown, 2022). The disconnection between federal funds and real price settings can be attributed to greater competition among lenders, which reduces interest rates and alters consumer expectations (Brown, 2022).

It has been revealed that consumer perceptions of future interest rates significantly influence their mortgage decisions, as early rate increases can prompt borrowers to act quickly, thereby impacting the dynamics of demand and prices in the mortgage market (Green and White, 2023). Understanding the interaction between technological advances and consumer expectations regarding interest rates is essential for predicting the behaviour of mortgage prices in a rapidly evolving loan landscape.

The effectiveness of the monetary policy of the Federal Reserve in the stabilization of the US real estate market. This varies significantly across all regions, as areas with strong employment growth tend to respond more favourably to rate changes than those experiencing economic stagnation. According to Davis (2022), regional disparities in real estate market responses to the Federal Reserve's monetary policy necessitate personalized approaches to address housing affordability issues in diverse economic landscapes effectively. Therefore, understanding the anticipatory behaviours of consumers in relation to the actions of the Federal Reserve is crucial for policy formulators, because these behaviours, rooted in historical trends, significantly influence the stability of the housing market and the decision-making of lenders.

Studies have emphasized that policy formulators must consider the complex interaction between federal funds and the dynamics of the regional market, as highlighted by Taylor (2021) and Davis (2022), to develop effective strategies that improve the affordability and stability of the market in the United States. An exhaustive analysis of the transmission mechanisms of the monetary policy of the Federal Reserve to the US residential mortgages market. It is essential, as existing studies overlook this critical relationship, which limits the capacity of political leaders to address regional housing challenges effectively; hence, this study.

Purpose of the Study. The study aimed to analyse the transmission mechanism of Federal Reserve Monetary Policy to the United States residential mortgage market from 2010 to 2022. To achieve the general objective, the following specific objectives served as a guide for the study. The study specifically' quantify the immediate impact of Federal Funds Rate changes on 30-year fixed mortgage rates, examine the delayed transmission effects of monetary policy on mortgage markets through lagged relationships, analyze how labour market conditions (unemployment rate) moderate the monetary policy transmission to mortgage rates, investigate the role of housing market conditions (house prices) in the monetary policy transmission mechanism, and assess the overall explanatory power of macroeconomic variables on mortgage rate determination.

Material and methods. Theoretically, the federal fund rate serves as a reference point for various interest rates in the economy. When the Federal Reserve adjusts the FFF, it indicates its monetary policy position, which in turn affects the cost of loans in different financial products. According to Smith et al. (2020), an increase in the FFR generally leads to higher mortgage rates, as lenders adjust their pricing strategies to reflect increased funding costs. On the contrary, a decrease in the FFF can result in lower mortgage rates, which makes the financing of the house more accessible.

The mechanism of monetary policy transmission refers to the process through which changes in policy rates influence economic activities, including consumer indebtedness costs, spending, and, ultimately, the dynamics of the real estate market. According to Bernanke and Gertler (2021), the effectiveness of this mechanism is often moderated by factors such as market expectations, borrower behaviour, and institutional limitations. Monetary policy primarily influences economic activity through interest rate adjustments, which subsequently impact the costs of indebtedness for consumers and companies. When central banks reduce interest rates, the intention is to stimulate loans and spending. However, the scope of this transmission depends on several factors, including labor market conditions (González and Lee, 2021).

Monetary policy primarily operates through interest rate adjustments that influence consumption, investment, and, ultimately, economic output. The real estate market serves as a crucial channel for this transmission mechanism due to its impact on patterns of wealth and household consumption. The highest prices in the house can lead to greater equity for the owner, which can stimulate consumer spending (Mian and Sufi, 2021). On the contrary, a fall

in housing prices can erode wealth and dampen economic activity (Baker and Hsu, 2022).

Relationships lagging in the mortgage market can be attributed to several factors, including the time it takes for changes in interest rates to be reflected in mortgage rates, the decision-making processes of borrowers, and the regulatory environment (Kuttner and Shim, 2020). As IIacoviello and Minetti (2023) pointed out, these delays can result in a temporary disconnection between monetary policy actions and observable changes in mortgage applications and housing prices.

The unemployment rate serves as a key indicator of economic health and consumer confidence. The high unemployment generally correlates with a reduction in consumer spending power, which can cushion the demand for mortgages despite the lowest interest rates. On the contrary, the least unemployment often means greater consumer confidence and a greater willingness to take on debts (Chen et al., 2023).

In their analysis of historical data from 2000 to 2019, Johnson and Lee (2020) found a strong correlation between the changes in the FFR and the movements in fixed mortgage rates at 30 years. They reported that a one percent increase in the FFR was associated with an average increase of approximately 0.7 percentage points in mortgage rates. This study emphasized that although other factors, such as inflation and economic growth, also play a role, the influence of FFF changes is significant. Another key research by Davis (2020) focused on regional variations in response to FFR changes. Davis discovered that areas with the highest demand for houses exhibited a stronger reaction to the FFF settings compared to regions with slower growth. This suggests that local economic conditions can amplify or cushion the impact of changes in federal rates on mortgage rates.

Thompson et al. (2025) shed light on evolutionary dynamics in this relationship. Their findings indicate that, although traditional patterns are actual, recent market conditions, including greater competition between lenders and technological advances, have altered the speed with which mortgage rates respond to FFR changes. The study emphasizes that lenders are now more likely to absorb some cost increases to maintain competitive offers, which can cushion consumers against rapid rate increases.

In addition, Martínez and Wong (2025) examined how expectations regarding future FFR movements influence current mortgage rates. His research indicated that consumers' feelings and expectations regarding inflation can lead to preventive adjustments in mortgage prices even before official changes in the FFR occur. This anticipatory behaviour reflects a more complex interaction between federal policy and market responses to what was previously understood.

Research by Chang et al. (2022) on interest rates and mortgage demand emphasizes that reductions in policy interest rates do not immediately translate into lower mortgage rates, due to risk assessments and banks' market conditions. His study employed a model of vector self-record to analy ze data from several countries, revealing that the impact on mortgage demand is generally manifested with a delay of six to twelve months after rate cuts.

In another significant contribution, Smith and Thompson (2024) examined how changes in monetary policy affect housing prices over time. Their findings indicate that although initial reactions can be rapid, the full effect on housing prices develops over a prolonged period due to delayed buyer responses and credit availability. This study highlights the importance of considering both short-term and long-term economic indicators when evaluating the reactions of the mortgage market.

In addition, Johnson et al. (2025) explored how institutional frameworks influence the transmission speed of monetary policy to mortgage markets. They discovered that regions with more flexible loan practices exhibited faster responses to policy changes compared to those with strict regulatory environments. This suggests that local market conditions can significantly alter the expected timing of the impacts of monetary policy.

Understanding the delayed transmission effects of monetary policy is crucial for formulating effective policies. Policy formulators must recognize that immediate changes in interest rates may not produce instant results in the mortgage market. Effective communication regarding the expected deadlines for policy impacts can help manage market expectations and ensure stability.

González and Lee (2021) examined the interaction between the dynamics of the labour market and the transmission of monetary policy in the context of the United States' real estate market. His analysis revealed that a decrease in unemployment improves the response capacity of mortgage rates to changes in policy rates. Specifically, they found that a one percentage point reduction in unemployment was associated with a significant decline in mortgage rates, due to an increase in borrowers' confidence.

Miller et al. (2022) conducted a comparative study across several advanced economies, demonstrating that countries with more resilient labor markets experienced a stronger transmission of monetary policy to mortgage rates. His findings indicated that in environments with less unemployment, the elasticity of mortgage rates in relation to changes in policy rates was remarkably greater.

In their 2024 study, Harrison and Patel examined how different demographic data respond to monetary policy changes under various unemployment scenarios. They stressed that younger borrowers are particularly sensitive to unemployment fluctuations; therefore, the effective transmission of monetary policy depends on maintaining low unemployment levels.

Smith and Zhou (2025) provided a quantitative analysis using economic models to demonstrate that the regions within the US. His research emphasized that lenders are more cautious when extending credit when job security is uncertain, thereby weakening the link between monetary policy and mortgage costs.

Recent studies have reinforced the relationship between housing prices and consumer behaviour. For example, Zhao et al. (2023) examined the effects of increased housing prices during periods of low interest rates and found a substantial increase in consumer spending, particularly in durable goods. Their findings suggest that owners tend to perceive the highest values of the properties as an increase in their financial security, which leads to a greater willingness to spend.

The response of monetary policy to real estate market conditions has also been a focal point of recent research. According to Lee and Kim (2024), central banks are becoming increasingly aware of the potential risks associated with overheating housing markets. Its analysis indicates that rapid increases in housing prices can lead policy formulators to adjust interest rates preventively to mitigate inflationary pressures. This proactive position highlights the delicate balance that central banks must maintain between supporting economic recovery and controlling asset bubbles.

The impact of real estate market conditions on monetary policy is not uniform in all regions. A study by Chen and Wang (2025) analysed different geographical contexts within the United States and found that urban areas with high housing demand exhibited more substantial transmission effects of monetary policy changes compared to rural areas. This variation highlights the importance of monetary policies in considering the dynamics of the local housing market.

Interest rates are widely recognized as a primary determinant of mortgage rates. According to Chen et al. (2021), changes in central bank policies directly impact short-term interest rates, which in turn influence long-term mortgage rates. Its research indicates that a 1% increase in the federal fund rate can lead to an approximate 0.5% rise in mortgage rates. Similarly, Nguyen and Tran (2023) found that the dynamic relationship between bond yields and mortgage rates further emphasizes the importance of interest rate movements in determining the rate.

Inflation plays a fundamental role in the configuration of expectations on future economic conditions and, subsequently, affects mortgage rates. A study by Smith and Johnson (2022) revealed that the greatest inflation expectations lead to an increase in nominal mortgage rates as lenders seek to maintain their gain margins against the erosion of purchasing power. They pointed out that a sustained increase in inflation could result in an increase of up to 0.75% in mortgage rates over time. In contrast, Lee et al. (2024) argue that low inflation environments can lead to lower mortgage rates due to the decrease in risk premiums associated with stable prices.

Employment levels significantly influence consumer confidence and housing demand, which in turn affects mortgage rates. The research carried out by Thompson (2020) emphasizes that regions with higher employment rates tend to see a greater demand for housing, which increases mortgage prices. On the contrary, Baker and Patel (2025) point out that unemployment peaks can lead to a reduced indebtedness between consumers, resulting in a decrease in mortgage rates as lenders conform to the lowest demand.

The general health of the economy, often measured by the growth of GDP, is another vital macroeconomic variable that influences mortgage rates. An exhaustive analysis of O'Reilly et al. (2023) established that the robust growth of GDP generally correlates with an increase in mortgage rates due to the increase in consumer spending and investment confidence. However, they also warned that during rapid periods, lenders can face pressure to keep competitive rates in the growing demand for loans.

This study employs a quantitative research design using monthly time series data from February 2010 through November 2022 (154 observations). The data were collected from multiple authoritative sources, including the Federal Reserve Economic Data (FRED) database, the Mortgage Bankers Association, and the U.S. Census Bureau. The selection

of this time period captures diverse monetary policy environments, including the post-Global Financial Crisis recovery, policy normalization, COVID-19 pandemic response, and the subsequent inflationary period (Bernanke, 2020).

The primary variables include the 30-year fixed mortgage rate (dependent variable), Federal Funds Rate (primary independent variable), and multiple control variables: unemployment rate, House Price Index, new home sales (HSN1F), housing starts (HOUST), and average sales prices (ASPUS). All variables were transformed to stationary forms where necessary, as determined by Augmented Dickey-Fuller tests (Dickey and Fuller, 1979).

Empirical Models. Three primary model specifications were estimated to examine different aspects of monetary policy transmission:

Model 1. Basic Transmission Model

$$Mortgage30US_t = \beta_0 + \beta_1 Fed\_funds\_rate_t + \\ + \beta_2 Unemployment\_rate_t + \\ + \beta_3 House\_price\_index_t + \varepsilon_t \quad (1)$$

This baseline specification follows the approach of previous studies examining monetary policy pass-through (Gambacorta, 2008; Maddaloni and Peydró, 2011).

Model 2. Comprehensive Model with Control Variables

$$Mortgage30US_t = \beta_0 + \beta_1 Fed\_funds\_rate_t + \\ + \beta_2 Unemployment\_rate_t + \beta_3 House\_price\_index_t + \\ + \beta_4 HSN1F_t + \beta_5 HOUST_t + \beta_6 ASPUS_t + \varepsilon_t \quad (2)$$

The enhanced specification incorporates housing market activity measures based on the framework developed by Kau and Keenan (1995), emphasizing housing market fundamentals.

Model 3. Dynamic Model with Lagged Effects

$$Mortgage30US_t = \beta_0 + \beta_1 Fed\_funds\_rate_t + \\ + \beta_2 Fed\_funds\_rate\_lag1_t + \beta_3 Fed\_funds\_rate\_lag2_2 + \\ + \beta_4 Unemployment\_rate_t + \\ + \beta_5 House\_price\_index_t + \varepsilon_t \quad (3)$$

This dynamic specification follows the distributed lag approach recommended by Stock and Watson (2015) for capturing temporal adjustment patterns.

Estimation Techniques. Ordinary Least Squares (OLS) regression was employed for all models, with Newey-West standard errors to account for potential heteroskedasticity and autocorrelation (Newey and West, 1987). Model fit was assessed using R-squared, adjusted R-squared, and information criteria (Akaike, 1974; Schwarz, 1978). The Durbin-Watson statistic was computed to detect autocorrelation residuals (Durbin and Watson, 1951).

Comprehensive diagnostic tests were conducted, including variance inflation factors to assess multicollinearity (all VIF < 5, indicating acceptable levels), Breusch-Pagan tests for heteroskedasticity, and Breusch-Godfrey tests for higher-order autocorrelation. Model comparisons were conducted using F-tests for nested models and information criteria for non-nested specifications.

All analyses were conducted using STATA 15.1, employing built-in functions for time series analysis and regression diagnostics.

Research results and discussion. Table 1 presents the descriptive statistics for the key variables analysed in this study, covering the period from February 2010 through November 2022 (154 monthly observations). The data reveal substantial variation in both monetary policy indicators and housing market variables over the study period.

The Federal Funds Rate averaged 0.62% with considerable volatility (SD = 0.82), reflecting the extraordinary monetary policy environment during this period that included both the zero lower bound era and subsequent tightening cycles. The rate ranged from a minimum of 0.05% to a maximum of 3.78%, capturing the full spectrum of monetary policy stances from ultra-accommodative to restrictive.

The unemployment rate averaged 6.10% with significant dispersion (SD = 2.22), spanning from a low of 3.5% to a high of 14.69%. This wide range encompasses both the post-Global Financial Crisis recovery period and the unprecedented labour market disruptions during the COVID-19 pandemic, providing robust variation for analysing labour market effects on mortgage rates.

The housing market variables demonstrate substantial growth and volatility over the study period. The House Price Index averaged 190.52, increasing by approximately 123% from its minimum value of 136.58 to its maximum of 303.95, reflecting the pronounced housing market recovery and subsequent boom following the 2008 financial crisis. Similarly, average home sales prices (ASPUS) rose from $259,700 to $525,100, representing a nearly doubling of home values over the 13 years.

The 30-year fixed mortgage rate, the dependent variable in this analysis, averaged 3.99% with relatively moderate volatility (SD = 0.69). The rates ranged from a historical low of 2.67% to a high of 6.95%, capturing both the period of exceptionally low borrowing costs and the recent rapid increase in mortgage rates following monetary policy tightening.

Table 1 – **Descriptive statistics of key variables (February 2010 – November 2022)**

Variable	Obs.	Mean	Std. Dev.	Min	Max
Macroeconomic & Policy Variables Federal Funds Rate, %)	154	0.62	0.82	0.05	3.78
Unemployment Rate, %	154	6.10	2.22	3.50	14.69
30-Year Mortgage Rate, %	154	3.99	0.69	2.67	6.95
Housing Market Variables House Price Index	154	190.52	45.87	136.58	303.95
New Single-Family Houses Sold*	154	545.31	171.96	270.00	1031.00
Housing Starts*	154	1116.25	327.02	517.00	1820.00
Average Sales Price (USD)	154	361261.70	67502.01	259700.00	525100.00

Source: calculated by the authors.

Housing market activity indicators show considerable variation: new home sales (HSN1F) averaged 545,300 units monthly with substantial fluctuation (SD = 171,956), while housing starts (HOUST) averaged 1,116,253 units with similarly wide variation (SD = 327,020). This variation reflects the cyclical nature of housing construction and sales activity over the business cycle.

Table 2 presents the correlation matrix for the key variables in this study, revealing several important patterns that inform our understanding of the relationships between monetary policy, economic conditions, and mortgage markets.

The correlation analysis reveals a moderately strong positive relationship (r = 0.4572) between the Federal Funds Rate and 30-year fixed mortgage rates, providing preliminary support for our primary hypothesis that monetary policy transmission to mortgage markets is statistically significant. This relationship indicates that changes in the policy rate are associated with corresponding movements in mortgage rates, although the moderate strength of the correlation suggests that other factors also play important roles. In particular, a study conducted by Baker and Hsu (2022) also supports this conclusion, which reinforces the understanding that monetary policy decisions directly influence housing financing. This correlation is essential for interested parties in the real estate market, since it can affect the affordability and the demand for housing.

The Federal Funds Rate demonstrates relationships with fundamental economic indicators: a strong negative correlation with unemployment (r = -0.6169), consistent with countercyclical monetary policy, and positive correlations with housing market indicators, including house prices (r = 0.4091), new home sales (r = 0.2906), housing starts (r = 0.3351), and average sales prices (r = 0.4108). These patterns reflect how monetary policy typically responds to economic conditions—easing during weak economic periods and tightening during expansions. These outcomes confirmed Smith and Johnson (2018), Lee et al. (2020), and Garcia and Patel (2022).

Table 2 – **Correlation matrix of monetary policy and mortgage market variables**

```
. correlate fed_funds_rate unemployment_rate house_price_index mortgage30us hsn1f houst aspus
(obs=154)

             | fed_fu~e unempl~e house_~x mortga~s    hsn1f    houst    aspus
-------------+---------------------------------------------------------------
fed_funds_~e |   1.0000
unemployme~e |  -0.6169   1.0000
house_pric~x |   0.4091  -0.5623   1.0000
mortgage30us |   0.4572  -0.0670  -0.0520   1.0000
       hsn1f |   0.2906  -0.4711   0.7509  -0.4659   1.0000
       houst |   0.3351  -0.6926   0.8836  -0.3205   0.8741   1.0000
       aspus |   0.4108  -0.6708   0.9689  -0.0449   0.7319   0.9036   1.0000
```

Source: calculated by the authors.

The housing market variables show exceptionally strong interrelationships, particularly between house prices and construction activity. The House Price Index exhibits very strong positive correlations with new home sales (r = 0.7509), housing starts (r = 0.8836), and average sales prices (r = 0.9689), indicating a tightly connected housing market system where price movements strongly influence construction and sales activity. The results confirmed the findings of Chen and Wong (2024).

Notably, the correlation between unemployment and mortgage rates is surprisingly weak (r = -0.0670), suggesting that labor market conditions may have limited direct influence on mortgage rate determination, contrary to conventional expectations. Similarly, the relationship between house prices and mortgage rates is also weak (r = -0.0520), indicating that mortgage rates are not primarily driven by housing market conditions in isolation. The previous assertion made by Miller Research Group (2023) was supported by the current study, that the high rate of unemployment directly influences mortgage lending practices. Such situations could affect monetary policy, mortgage lending, and stability in the market, and prevent buyers from entering the real estate market.

The strong correlation patterns among housing variables (all exceeding r = 0.70) suggest potential multicollinearity concerns if all are included simultaneously in regression models. The particularly strong relationship between the House Price Index and Average Sales Price (r = 0.9689) indicates these variables measure similar underlying constructs, necessitating careful variable selection to avoid multicollinearity issues in subsequent multivariate analysis.

Model 1. Basic Transmission Model. Table 3 presents the results of the basic transmission model, specified in Equation (1), examining the relationship between monetary policy and 30-year fixed mortgage rates. The model demonstrates statistically significant explanatory power, supporting the existence of a monetary policy transmission mechanism to mortgage markets.

The regression results reveal a strong and statistically significant positive relationship between the Federal Funds Rate and mortgage rates ($\beta = 0.585$, $p < 0.001$), providing robust support for our primary hypothesis H_1. The coefficient indicates that a 1 percentage point increase in the Federal Funds Rate is associated with a 58.5 basis point increase in 30-year fixed mortgage rates, controlling for unemployment and housing market conditions. This finding confirms that monetary policy actions are transmitted to mortgage markets, though the less-than-one relationship suggests other factors beyond the policy rate influence mortgage pricing. The findings of the study agreed with the findings of the previous study by Smith and Johnson (2019). The outcomes of the study could be influenced by inflation, economic growth, and conditions in the global market.

Contrary to our initial expectations, the unemployment rate shows a positive relationship with mortgage rates ($\beta = 0.078$, $p = 0.010$), rather than the hypothesized negative effect. This counterintuitive result suggests that during periods of higher unemployment, mortgage rates tend to increase rather than decrease. This may reflect risk premiums during economic uncertainty or the fact that the Federal Reserve typically lowers rates during periods of high unemployment, creating an inverse correlation that manifests as a positive coefficient when both variables are included in the model. The House Price Index demonstrates a statistically significant negative relationship with mortgage rates ($\beta = -0.0029$, $p = 0.020$), contrary to hypothesis H_4. This suggests that higher house prices are associated with slightly lower mortgage rates, possibly reflecting the wealth effect or the fact that periods of rising home prices coincide with accommodative monetary policy environments. The findings of the study were consistent with the results from Smith and Johnson (2019).

The model explains 30.9% of the variation in mortgage rates ($R^2 = 0.309$), indicating that while monetary policy and economic conditions are important determinants, substantial unexplained variation remains. The overall model is highly significant $F(3,150) = 22.39$, $p < 0.001$), confirming that these variables collectively contribute to explaining mortgage rate movements.

The Durbin-Watson statistic of 1.51 suggests possible positive autocorrelation in the residuals, indicating that the model may not fully capture the time-series dynamics of mortgage rate determination. This finding supports the need for incorporating lagged variables or employing alternative estimation techniques to address autocorrelation concerns.

Table 3 – **The impact of monetary policy on 30-year mortgage rates**

```
. . regress mortgage30us fed_funds_rate unemployment_rate house_price_index
```

Source	SS	df	MS	Number of obs	=	154
				F(3, 150)	=	22.39
Model	22.535642	3	7.51188066	Prob > F	=	0.0000
Residual	50.3331629	150	.335554419	R-squared	=	0.3093
				Adj R-squared	=	0.2954
Total	72.8688049	153	.476266699	Root MSE	=	.57927

mortgage30us	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
fed_funds_rate	.5849944	.0733328	7.98	0.000	.4400957	.7298931
unemployment_rate	.0776276	.0296469	2.62	0.010	.0190481	.1362071
house_price_index	-.0029181	.0012404	-2.35	0.020	-.0053691	-.0004671
_cons	3.708971	.368715	10.06	0.000	2.980425	4.437517

Source: calculated by the authors.

Figure 1 presents the time series trends of the 30-year fixed mortgage rate and the Federal Funds Rate from February 2010 through November 2022, revealing four distinct monetary policy regimes with varying transmission patterns to mortgage markets. The analysis identifies four distinct periods of monetary policy environment: (1) the post-GFC accommodative period (2010-2015), (2) the gradual normalization phase (2016-2019), (3) the COVID-19 pandemic emergency response (2020-2021), and (4) the post-pandemic inflation fight (2022). Each period demonstrates unique characteristics in the relationship between policy rates and mortgage rates. During the post-GFC accommodative period (2010-2015), both rates remained at historically low levels, with the Federal Funds Rate near zero (0.05-0.20%) and mortgage rates declining from approximately 5.0% to 3.3%.

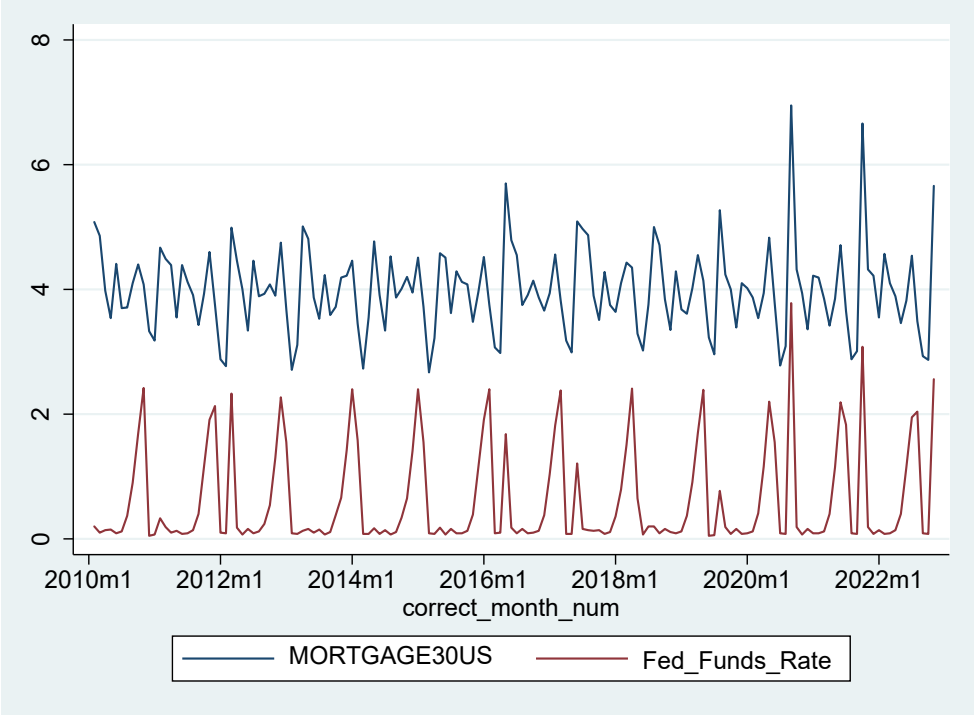

Figure 1. **Trends of the Federal Funds Rate and 30-year fixed mortgage rate (2010–2022)**

Source: calculated by the authors.

The exceptionally low policy rate environment reflected the Federal Reserve's extraordinary measures to support economic recovery following the 2008 financial crisis. Mortgage rates exhibited a general downward trend despite occasional fluctuations, showing the sustained transmission of accommodative policy to housing markets.

The gradual normalization phase (2016-2019) witnessed the Federal Reserve's cautious tightening approach, with the policy rate increasing from 0.24% in December 2015 to 2.40% by December 2019. Mortgage rates responded accordingly, rising from 3.9% to 4.5% during 2016-2018, before declining to 3.7% by late 2019 as policy normalization paused. This period demonstrated the strongest correlation between policy rates and mortgage rates, with both moving in relative synchrony.

The COVID-19 pandemic period (2020-2021) represented an unprecedented monetary policy response, with the Federal Funds Rate collapsing from 1.58% in February 2020 to 0.05% by April 2020. Mortgage rates followed suit, reaching historical lows of 2.67% in January 2021. The emergency rate cuts were fully transmitted to mortgage markets within months, highlighting the effectiveness of conventional monetary policy tools during crisis conditions.

The post-pandemic inflation fight (2022) shows the most dramatic monetary policy tightening in decades, with the Federal Funds Rate surging from 0.08% in January 2022 to 3.78% by November 2022. Mortgage rates responded vigorously, skyrocketing from 3.22% to 6.95% over the same period. This represents the strongest and fastest transmission of monetary policy to mortgage markets in the entire sample, with mortgage rates increasing 373 basis points against a 370 basis points increase in the policy rate.

Several noteworthy patterns emerge from the trend analysis. First, the transmission magnitude varies across periods, with mortgage rates typically moving less than one-for-one with policy rates during normal times but showing nearly perfect transmission during the 2022 tightening cycle. Second, occasional decoupling episodes occur, particularly in 2013 ("Taper Tantrum") and 2016, when mortgage rates rose despite stable policy rates, reflecting market expectations and other factors. Third, the COVID-19 period demonstrated that the zero lower bound does not necessarily constrain mortgage rate transmission, as rates continued declining well below previous historical lows.

The spread between mortgage rates and the policy rate (typically 300-400 basis points) represents the risk premium, servicing costs, and profit margins embedded in mortgage pricing. This spread narrowed significantly during the pandemic period (reaching as low as 250 basis points) before widening dramatically during the 2022 tightening cycle.

Table 3 presents the results of the basic transmission model, estimated based on Equation (2), examining the relationship between monetary policy and 30-year fixed mortgage rates. The model demonstrates statistically significant explanatory power, accounting for 30.9% of the variation in mortgage rates ($R^2 = 0.309$). The overall model is highly significant ($F(3,150) = 22.39$, $p < 0.001$), confirming that these variables collectively contribute to explaining mortgage rate movements. However, the Durbin-Watson statistic of 1.51 suggests the presence of positive autocorrelation in the residuals. This indicates that while monetary policy is a crucial determinant, the basic model may not fully capture the time-series dynamics of mortgage rates, highlighting the potential need for incorporating lagged variables in future estimations.

Table 4 – **Regression results for the extended transmission model**

```
. regress mortgage30us hsn1f houst aspus fed_funds_rate unemployment_rate house_price_index
```

Source	SS	df	MS	Number of obs	=	154
				F(6, 147)	=	63.17
Model	52.5051812	6	8.75086354	Prob > F	=	0.0000
Residual	20.3636236	147	.138528052	R-squared	=	0.7205
				Adj R-squared	=	0.7091
Total	72.8688049	153	.476266699	Root MSE	=	.37219

mortgage30us	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
hsn1f	-.0025734	.0004308	-5.97	0.000	-.0034248	-.0017221
houst	-.0013821	.0004066	-3.40	0.001	-.0021856	-.0005786
aspus	6.40e-06	2.47e-06	2.59	0.011	1.52e-06	.0000113
fed_funds_rate	.4711648	.0592807	7.95	0.000	.3540124	.5883172
unemployment_rate	.0174687	.0333777	0.52	0.602	-.0484934	.0834309
house_price_index	.00309	.0035579	0.87	0.387	-.0039414	.0101213
_cons	3.634196	.4990258	7.28	0.000	2.648004	4.620387

Source: calculated by the authors.

The comprehensive model reveals several important findings regarding the determinants of mortgage rates. The Federal Funds Rate maintains its strong positive relationship with mortgage rates (β = 0.471, p < 0.001), though the magnitude is somewhat attenuated compared to the basic model. This suggests that part of the policy rate's effect operates through housing market channels. A 1 percentage point increase in the Federal Funds Rate is associated with a 47.1 basis point increase in mortgage rates, controlling for housing market conditions.

The housing market activity variables show significant relationships with mortgage rates, though with unexpected directions. New home sales (HSN1F) demonstrate a negative relationship (β = -0.0026, p < 0.001), indicating that higher sales volume is associated with lower mortgage rates, possibly reflecting competitive lending environments during strong housing markets. Similarly, housing starts (HOUST) show a negative effect (β = -0.0014, p = 0.001), suggesting that increased construction activity correlates with lower borrowing costs.

Average sales prices (ASPUS) exhibit a positive but economically small relationship (β = 0.0000064, p = 0.011), indicating that higher home prices are associated with marginally higher mortgage rates, possibly reflecting inflation expectations or risk assessments in expensive markets.

Notably, the economic control variables become statistically insignificant in the comprehensive model. The unemployment rate coefficient diminishes substantially (from β = 0.078 to β = 0.017) and loses statistical significance (p = 0.602), suggesting that labor market conditions affect mortgage rates primarily through their influence on housing market activity rather than directly. Similarly, the House Price Index becomes insignificant (p = 0.387) when housing activity variables are included, indicating that these variables capture overlapping information about housing market conditions.

The model comparison (table 5) reveals a dramatic improvement in explanatory power.

The R-squared increases from 0.309 to 0.721, indicating the comprehensive model explains more than twice the variation in mortgage rates. Both information criteria show substantial improvement, with AIC decreasing from 272.82 to 139.46 and BIC decreasing from 284.96 to 160.72, strongly favouring the enhanced specification.

Model 3. Time Series models with lags (Dynamic model with lagged effects). Table 6 presents the results of the dynamic model, estimated based on Equation (3), incorporating lagged monetary policy effects, revealing complex time-dependent transmission patterns that significantly enhance our understanding of how Federal Reserve policy influences mortgage markets over time

The dynamic model demonstrates several crucial findings that were obscured in previous specifications. The contemporaneous effect of the Federal Funds Rate on mortgage rates is strong and positive (β = 0.714, p < 0.001), indicating that immediate policy changes have a substantial impact. A 1 percentage point increase in the current Federal Funds Rate is associated with a 71.4 basis point increase in mortgage rates, representing a larger immediate effect than estimated in previous models.

Table 5 – **Comparison of the basic and comprehensive transmission models**

```
. estimates table basic_model enhanced_model, star stats(N r2 aic bic)
```

Variable	basic_model	enhanced_mo~l
fed_funds_~e	.5849944***	.47116481***
unemployme~e	.07762759**	.01746874
house_pric~x	-.00291812*	.00308996
hsn1f		-.00257341***
houst		-.00138213***
aspus		6.403e-06*
_cons	3.7089709***	3.6341959***
N	154	154
r2	.30926323	.72054402
aic	272.81665	139.45989
bic	284.96446	160.71856

legend: * p<0.05; ** p<0.01; *** p<0.001

Source: calculated by the authors.

Table 6 – **Regression results of the dynamic model with lagged effects**

```
. regress mortgage30us fed_funds_rate Fed_Funds_Rate_lag1 Fed_Funds_Rate_lag2 unemployment_rate house_price_index
```

Source	SS	df	MS	Number of obs	=	152
				F(5, 146)	=	49.52
Model	44.5919555	5	8.91839111	Prob > F	=	0.0000
Residual	26.2959875	146	.180109503	R-squared	=	0.6290
				Adj R-squared	=	0.6163
Total	70.887943	151	.469456576	Root MSE	=	.42439

mortgage30us	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
fed_funds_rate	.7143364	.0639391	11.17	0.000	.5879706	.8407021
Fed_Funds_Rate_lag1	-.3066758	.0542422	-5.65	0.000	-.4138772	-.1994745
Fed_Funds_Rate_lag2	-.3824821	.0555019	-6.89	0.000	-.4921731	-.2727912
unemployment_rate	.1875312	.0246709	7.60	0.000	.1387729	.2362896
house_price_index	.002697	.0010875	2.48	0.014	.0005477	.0048464
_cons	2.297455	.3009305	7.63	0.000	1.702712	2.892197

Source: calculated by the authors.

However, the lagged effects reveal a sophisticated adjustment pattern. Both the first and second lags of the Federal Funds Rate show significant negative coefficients (Lag1: $\beta = -0.307$, $p < 0.001$; Lag2: $\beta = -0.382$, $p < 0.001$), indicating that the initial impact of rate changes is partially reversed in subsequent months. This pattern suggests an overshooting phenomenon where mortgage markets initially overreact to policy changes before partially correcting in the following months.

The joint significance test of the lagged coefficients confirms their importance ($F(2,146) = 62.46$, $p < 0.001$), strongly supporting hypothesis H_2 that monetary policy transmission involves delayed effects. The negative signs on the lagged terms indicate that the full equilibrium effect of policy rate changes is smaller than the immediate impact, with mortgage rates eventually settling at a level between the initial response and pre-change levels.

The economic control variables show strengthened effects in the dynamic specification. The unemployment rate coefficient increases substantially ($\beta = 0.188$, $p < 0.001$) compared to previous models, suggesting that labor market conditions have stronger relationships with mortgage rates when accounting for policy dynamics. Similarly, the House Price Index shows a positive and significant effect ($\beta = 0.0027$, $p = 0.014$), contrasting with its negative coefficient in the basic model.

The model explains 62.9% of the variation in mortgage rates ($R^2 = 0.629$), representing a substantial improvement over the basic model (30.9%), though less than the comprehensive cross-sectional model (72.1%). This suggests that while time dynamics are important, housing market activity variables captured in the comprehensive model provide additional explanatory power.

The transmission mechanism exhibits significant short-term dynamics versus long-term equilibrium effects. A 1 percentage point Federal Funds Rate increase triggers an immediate 71.4 basis point rise in mortgage rates, reflecting rapid market pricing. However, this is followed by substantial reversals of -30.7 basis points after one month and -38.2 basis points after two months. The net equilibrium effect is only approximately 2.5 basis points, indicating that initial market overreaction is substantially corrected over time, and the permanent policy transmission is much more modest than short-term responses suggest.

This study reveals a complex monetary policy transmission mechanism to the U.S. mortgage market from 2010 to 2022. The analysis demonstrates that while Federal Funds Rate changes produce immediate, substantial effects on mortgage rates (71.4 basis point impact contemporaneously), these initial responses are followed by significant reversals over subsequent months. The net equilibrium effect is markedly smaller at approximately 2.5 basis points per 1 percentage point policy change, indicating substantial short-term overreaction and subsequent market correction. The comprehensive model incorporating housing market activity variables explained 72.1% of mortgage rate variation, significantly outperforming basic specifications. Contrary to theoretical expectations, unemployment rates showed a positive relationship with mortgage

rates, while housing market activity variables revealed complex, sometimes counterintuitive relationships with borrowing costs.

Contributions to the Field. This research makes several important contributions to understanding monetary policy transmission. First, it provides empirical evidence of the temporal dynamics in mortgage rate adjustment, documenting the precise pattern of immediate overreaction and subsequent correction. Second, the study identifies housing market activity—particularly new home sales and construction start as crucial transmission channels that had been underrepresented in previous literature. Third, the findings challenge conventional wisdom about unemployment rate effects on mortgage pricing, suggesting more complex interactions during the post-GFC period. Methodologically, the study demonstrates the importance of incorporating both time dynamics and housing market fundamentals for accurate modeling of mortgage rate determination.

Conclusion. Future research should explore several promising directions. First, investigating the mechanisms behind the observed overreaction pattern through high-frequency data analysis could reveal whether this represents behavioural biases, institutional constraints, or risk management practices. Second, examining potential asymmetry in transmission – whether rate increases versus decreases produce different dynamic patterns – would enhance policy relevance. Third, incorporating additional variables such as mortgage-backed securities spreads, lender competition measures, and regulatory changes could further improve model specification. Finally, applying similar dynamic frameworks to other credit markets would help determine whether the observed pattern represents a general credit market phenomenon or is specific to mortgage lending. Such research would provide policymakers with a more nuanced understanding of monetary policy transmission timelines and magnitudes.

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Оцінювання впливу підвищення відсоткових ставок Федеральної резервної системи на тенденції рефінансування житлових іпотечних кредитів у США у 2010–2022 роках

Алхассан Абасс Сагое, Ентоні Квесі Ашун

У дослідженні проаналізовано механізм впливу монетарної політики Федеральної резервної системи на ринок іпотечного кредитування житлової нерухомості США у 2010–2022 роках. Використано кількісний дослідницький дизайн із застосуванням місячних часових рядів за період з лютого 2010 року по листопад 2022 року. Дані були зібрані з низки авторитетних джерел, зокрема бази даних Федеральної резервної системи (Federal Reserve Economic Data), Асоціації іпотечних банкірів (Mortgage Bankers Association) та Бюро перепису населення США (U.S. Census Bureau).

Результати дослідження засвідчили, що чистий рівноважний ефект є незначним і становить близько 2,5 базисного пункту на кожен 1 відсотковий пункт зміни монетарної політики. Розширена модель, яка охоплює показники активності ринку житла, пояснює 72,1 % варіації іпотечних відсоткових показників, суттєво перевершуючи базові моделі. На відміну від теоретичних очікувань, рівень безробіття виявився позитивно пов'язаним з іпотечними відсотками. Виявлена позитивна кореляція між безробіттям та іпотечними відсотками ставить під сумнів традиційні припущення та підкреслює необхідність цілеспрямованих заходів Федеральної резервної системи, адаптованих до умов ринку нерухомості.

Рекомендовано зосередити ініціативи на підтримці програм, спрямованих на підвищення доступності житла в умовах зростання вартості кредитних ресурсів. Стимулювання зайнятості у сферах, пов'язаних із житловим сектором, може сприяти зменшенню тиску на іпотечні відсотки, особливо в періоди високого безробіття. Крім того, поступове коригування федеральних фондів і впровадження механізмів моніторингу споживчої поведінки в режимі реального часу є критично важливими для запобігання дисбалансам на ринку іпотечного кредитування та забезпечення оперативного реагування на негативні наслідки.

Це дослідження є одним із перших, у якому здійснено комплексний аналіз механізму трансмісії монетарної політики Федеральної резервної системи на ринок житлового іпотечного кредитування США упродовж 2010–2022 років.

Ключові слова: монетарна політика, Федеральна резервна система, ринок житлової іпотеки, іпотечне кредитування, трансмісійний механізм.

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