Monetary Policy Transmission through Housing Duration: Evidence from Reaching-for-Income Investors

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ABSTRACT

In fixed-income theory, long-duration bonds—those with cash flows concentrated further in the future—are more sensitive to interest rate changes, because small shifts in discount rates have a larger effect on the present value of distant payments. This principle is often assumed to extend to other asset classes. However, I show that U.S. housing markets depart from this prediction: short-duration markets respond more strongly to monetary policy. Following the concept of Macaulay duration, I construct a novel zip-code–level housing duration measure defined as the weighted average timing of expected rental cash flows, with shorter durations corresponding to higher local rental yields. I show that a 100 basis-point cut in the federal funds rate raises average house prices by 1.86% over two years, but markets with durations one standard deviation shorter rise an additional 0.71%—about 38% of the average effect. These results are robust to alternative duration measures, monetary policy surprises, and property-level evidence controlling for mortgage and tax cash flows. Detailed property transaction and rental listing data reveal that "reaching-for-income" behavior by buy-to-rent investors drives the reverse sensitivity. After rate cuts, income-seeking investors disproportionately purchase high-yield properties for rental purposes and prioritize near-term income even at the cost of lower long-run total returns. This investor demand raises local prices and lowers required returns most strongly in short-duration markets, generating a non-parallel shift in the housing term structure. Overall, the paper documents a novel heterogeneity in monetary policy transmission to asset prices and highlights how rental-income-driven investment behavior shapes local house price dynamics.

JEL classification: Monetary Policy Transmission, Real Estate, Reaching-for-Income.

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Duration links interest rates to asset prices. It measures the value-weighted average timing of an asset's expected cash flows and summarizes how sensitive its price is to discount rate changes. Because small shifts in interest rates affect the present value of distant cash flows much more than near-term ones, long-duration assets whose value is concentrated far in the future exhibit larger price responses. In fixed-income markets, this logic explains why long-duration bonds have a higher interest rate sensitivity and rise more when rates fall. Duration has therefore become the standard tool for measuring interest-rate sensitivity and managing portfolio risk, and it also plays a central role in how monetary policy redistributes wealth (Auclert, 2019).[1]

Because the duration-sensitivity relationship is so well established in bonds, many studies extend the principle to other asset classes, including real estate. For example, Greenwald, Leombroni, Lustig, and Van Nieuwerburgh (2021) treat housing as a long-duration asset and attribute part of the rise in wealth inequality to capital gains on such assets when rates decline. Likewise, Catherine, Miller, Paron, and Sarin (2023) assign long duration to real estate in household balance sheets and show that wealthy and middle-aged households face greater exposure to interest-rate risk as a result.

However, the duration–sensitivity relationship for bonds relies on strong assumptions: cash flows remain fixed and the term structure shifts in parallel. If the assumptions fail—for example, after a rate cut, if risk premia fall more on short-duration assets than on long-duration assets, or if short-duration assets deliver stronger expected cash flows—then long-duration prices need not rise by more.

Given these strong assumptions, this paper asks whether conventional duration measures capture the true interest-rate sensitivity of house prices in housing markets. I show that the answer is no: properties with shorter cash-flow durations respond more strongly to monetary policy than those with longer durations. This reversal challenges the standard duration view and motivates a new framework for understanding how monetary policy transmits through housing markets.

Figure 1 previews the main finding. Panel A shows that, following a 100 basis-point cut in the federal funds rate (FFR), short-duration housing markets rise significantly more than long-duration markets. By contrast, Panels B and C confirm the conventional duration prediction in bonds and equities: longer-duration assets exhibit greater sensitivity. The side-by-side comparison underscores how sharply housing markets deviate from the standard duration principle.

[1] See also van Binsbergen (2020); Drechsler, Savov, and Schnabl (2021); DeMarzo, Krishnamurthy, and Nagel (2024).

Figure 1. Difference Interest Rate Sensitivities of Asset Prices by Duration

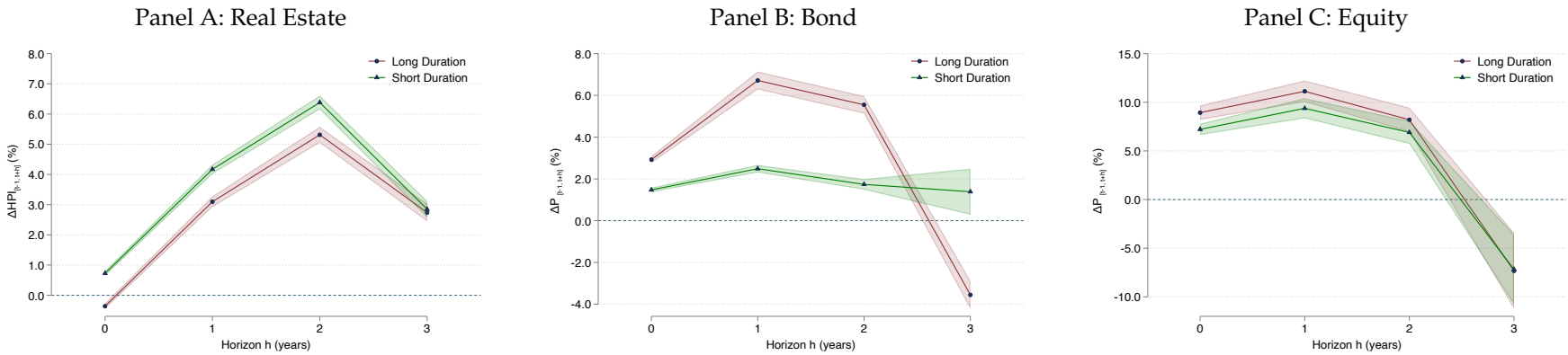


Figure 1 illustrates the different responses of asset prices to a 100 basis-point decrease in the federal funds rate (FFR), categorized by asset cash flow duration. Panels A, B, and C depict the responses for real estate, bond, and equity, respectively. The interest rate shock occurs at horizon 0, corresponding to the period from the end of year $t-1$ to t. The x-axis indicates the response horizon h in years following the shock, while the y-axis shows the cumulative percentage change in asset prices. Red and green lines represent price changes for long-duration and short-duration assets, respectively. The analysis is performed at the zip code-year level for real estate (Panel A) and at the individual asset-year level for bond and equity (Panels B and C) using the following regression specification:

$$\Delta HPI_{i,[t-1,t+h]} = \alpha_h + \beta_{1,h}\,\Delta r_{[t-1,t]} \times \mathbb{1}\{\text{Long Duration}\}_{i,t-1} + \beta_{2,h}\,\Delta r_{[t-1,t]} + \beta_{3,h}\,\mathbb{1}\{\text{Long Duration}\}_{i,t-1} + \epsilon_{i,t,h},$$

where $\Delta HPI_{i,[t-1,t+h]}$ denotes the cumulative price change of asset i from year $t-1$ to $t+h$. $\Delta r_{[t-1,t]}$ represents the annual change in the FFR from year $t-1$ to t. The indicator $\mathbb{1}\{\text{Long Duration}\}_{i,t-1}$ equals one if the asset's duration in year $t-1$ exceeds the median across all assets in year $t-1$, and zero otherwise. Linear combination tests of estimated regression coefficients determine the plotted values: the green line (short duration) equals $-0.0100 \times \hat{\beta}_{2,h}$, and the red line (long duration) equals $-0.0100 \times (\hat{\beta}_{1,h} + \hat{\beta}_{2,h})$. Shaded areas represent 95% confidence intervals. The standard errors are clustered at the zip code level (Panel A) or at the individual asset level (Panels B and C).

To investigate this surprising pattern more formally, I first adapt the concept of Macaulay duration to construct housing duration measure at the zip code level. This step allows me to examine how local house prices respond to monetary policy across markets with different durations. I then turn to property-level data, where I estimate rental yields as proxies for property-level duration and examine the pattern while controlling for mortgage and tax payments, ensuring the results are not driven by housing cash-flow mismeasurement. Finally, I test the mechanism by identifying buy-to-rent (BTR) investor activity and show that reaching-for-income behavior explains why short-duration markets are more sensitive to interest rate changes. The next sections lay out this progression in detail.

I start with a zip-code–level analysis. Using American Community Survey (ACS) data from 2011 to 2023, I construct a novel measure of residential housing cash-flow duration. Following the concept of Macaulay duration, I define housing duration as the weighted average timing of expected rental cash flows. It captures how quickly a homebuyer receive cash flows back from the purchase price either through rental income for landlords or through housing consumption for owner-occupants. Empirically, shorter housing durations are strongly associated with higher rental yields, consistent with Greenwald et al. (2021). Under conventional duration logic, one would therefore expect longer-duration properties to rise more in price after interest rate cuts, since more of their value is concentrated in distant cash flows.

With this measure in hand, I examine how local house prices respond to monetary policy at the zip-code–year level. The results reveal a striking reversal of the conventional duration prediction: shorter-duration housing markets, which also tend to have higher rental yields, respond more strongly to interest rate cuts. On average, a 100-basis-point decline in the federal funds rate increases house prices by about 1.86 percent over two years, but zip codes with durations one standard deviation shorter experience an additional 0.71 percent increase—representing roughly 38 percent of the average effect."

I next turn to property-level data to confirm that the zip-code results are not driven by cash-flow mismeasurement. Using detailed transaction records from ATTOM linked with rental listings from Altos, I estimate property-level rental yields, which serve as direct proxies for housing duration. This approach allows me to test the interest rate sensitivity of individual properties while explicitly controlling for mortgage and property tax payments. The results mirror the zip-code findings: high-rental-yield (short-duration) properties show greater sensitivity of transaction prices to monetary policy shocks

than low-yield (long-duration) properties. Importantly, this relationship holds even after accounting for these cash outflows, reinforcing that the abnormal sensitivity of short-duration housing markets is a robust fact rather than an artifact of measurement.

Having established that short-duration housing markets are more sensitive to monetary policy at both the zip-code and property levels, I next turn to the mechanism behind this reversal. The key question is why shorter-duration properties, rather than longer-duration ones, display greater price responses to rate cuts. As shown in a conceptual framework in Section I, house price sensitivity equals modified duration when rents are fixed and the term premium is either constant or shifts in parallel with policy rates. Two potential channels can overturn this benchmark: non-parallel, horizon-dependent shifts in the housing term structure (the discount-rate channel) and interest-rate-dependent rents (the cash-flow channel). This framework motivates the following mechanism tests.

To investigate the mechanism, I begin by focusing on buy-to-rent (BTR) investors, who invest with a preference for rental income. Using transaction records and historical tax assessments from ATTOM, I classify BTR purchases as properties held for at least two years that become or remain non-owner-occupied within two years of purchase, based on owner-occupancy status or mailing address. This conservative definition captures purchases intended for long-term rental income while excluding short-horizon flippers and migrant buyers. The resulting BTR classification provides a clean measure of investor activity in rental housing markets and allows me to examine how monetary policy shocks translate into investor demand for short-duration, high-yield properties.

I provide direct evidence that reaching-for-income behavior shapes investor demand in housing markets. On average, properties with a one-standard-deviation higher rental yield are 4.6 percentage points more likely to be purchased by BTR investors. More importantly, this effect intensifies when interest rates fall: a 100-basis-point cut in the federal funds rate increases the probability that a high-yield property is bought by a BTR investor by nearly one percentage point, or about 21 percent relative to the baseline probability. These results are not explained by endogenous monetary policy shocks or by stronger rental demand in high-yield markets: I instrument federal funds rate changes with monetary policy surprises (MPS) and control for rental vacancy rates, demographics, and their interactions with interest rate changes. Overall, the findings demonstrate that income-seeking investors reallocate disproportionately into high-yield, short-duration properties after rate cuts, providing direct evidence that rental-income-driven investment behavior amplifies local house price responses to monetary pol-

icy.

I also test a key implication of the reaching-for-income hypothesis: investors sacrifice long-run returns in exchange for near-term rental income. To evaluate this, I construct realized annualized returns for BTR investors who purchase and later resell a property. Realized returns combine observed capital gains with imputed rental yields over the holding period. The evidence shows that high-rental-yield properties earn significantly lower realized returns following FFR cuts, with the effects even larger when instrumenting interest rate changes with the MPS. While high-yield properties appreciate more immediately after a rate cut, they underperform low-yield properties at horizons beyond two years, and the return gap widens with holding length. These patterns are inconsistent with forward-looking rational investment motives and instead highlight that BTR investors chase near-term rental income at the expense of long-run returns.

A potential concern is that BTR activity in high-rental-yield properties may not translate into broader price effects if investors primarily purchase homes that are already in the rental sector. To address this, I examine property transitions between owner- and renter-occupied status. The results show that following rate cuts, high-yield properties are significantly more likely to shift from owner- to renter-occupied and less likely to transition from renter- to owner-occupied. These asymmetric dynamics indicate that monetary easing reallocates housing stock toward rental use, particularly in high-yield markets, consistent with reaching-for-income behavior. The evidence also rules out the alternative explanation that price pressures in high-yield markets simply reflect stronger demand from first-time homebuyers.

Finally, I show that reaching-for-income investment activity explains the high sensitivity of short-duration markets. Exploiting cross-sectional variation in local BTR intensity, I find that the gap in interest rate sensitivity between short- and long-duration markets is negligible in low-BTR areas but becomes large and monotonically increasing in high-BTR areas. Regression evidence confirms that once BTR activity is accounted for, short-duration markets no longer exhibit greater contemporaneous sensitivity to interest rate changes, and over a two-year horizon, their abnormal sensitivity to interest rates is cut nearly in half. These results highlight reaching-for-income behavior as an important mechanism influencing monetary policy transmission to local housing markets.

Together, these results establish reaching-for-income behavior by BTR investors as the central mechanism behind the abnormal sensitivity of short-duration housing markets. When rates fall, in-

vestors with strong preferences for near-term rental income disproportionately enter high-yield, short-duration markets. Their inflows raise local prices and lower required returns, especially for short-duration properties, after rates fall. This non-parallel shift in the housing term structure explains why shorter-duration markets exhibit a higher price increase after rate cuts.

Contribution and Literature Review. This paper contributes to the literature on monetary policy transmission to housing market dynamics by documenting an intriguing pattern of house price responses to monetary policy changes and proposing a novel mechanism that amplifies the interest rate sensitivity in certain market segments. Prior work shows that expansions in credit supply amplify housing booms (Mian and Sufi, 2009; Favara and Imbs, 2015; Favilukis, Ludvigson, and Van Nieuwerburgh, 2017), and that mortgage credit constraints, such as payment-to-income (PTI) and debt-to-income (DTI) limits, amplify monetary policy effects (Greenwald, 2018; Bosshardt, Di Maggio, Kakhbod, and Kermani, 2024; Adelino, Schoar, and Severino, 2025). Through the deposits channel, Drechsler, Savov, and Schnabl (2017, 2022); Drechsler, Savov, Schnabl, and Supera (2024) have detailed how monetary tightening reshapes mortgage lending. Closest to my work, Hacamo (2024) documents heterogeneity in house price responses to mortgage rate changes by local price level. I introduce a novel perspective by showing that short-duration (high-rental-yield) housing markets exhibit significantly greater sensitivity to interest rate changes. The heightened sensitivity arises from the buy-to-rent housing investors who seek higher rental yields and adjust their investment strategies in response to monetary policy changes. My mechanism complements segmentation frameworks such as Landvoigt, Piazzesi, and Schneider (2015), which emphasize constrained buyers causing lower-tier market volatility, by highlighting instead the important role of investor behavior and reaching-for-income behavior in shaping monetary transmission.

Second, this paper advances the literature on the duration and term structure of equity returns by providing novel insights from the housing market, an important yet under-explored asset class. Building on the foundational work of Dechow, Sloan, and Soliman (2004) and Lettau and Wachter (2011), who established equity duration as a key determinant of asset risk, and the empirical findings of Binsbergen, Brandt, and Koijen (2012) and Van Binsbergen and Koijen (2017), who document higher returns for short-term equity claims, I uncover a similar pattern in real estate markets. Specifically, my study finds that short-duration housing markets, on average, experience higher future house price growth. This evidence aligns with the short-duration premium identified in equity markets by Weber

(2018), Gonçalves (2021), and Gormsen and Lazarus (2023). Unlike equities with measurement controversies (Schulz, 2016; Boguth, Carlson, Fisher, and Simutin, 2023), my findings from housing markets provide robust and complementary evidence, similar to Giglio, Maggiori, and Stroebel (2015); Giglio, Maggiori, Rao, Stroebel, and Weber (2021). However, I advance this literature by exploring how duration influences monetary policy transmission to asset prices and highlight the amplified sensitivity of short-duration housing markets to monetary policy changes.

Third, the paper contributes to the "reaching-for-income" literature by identifying a granular, investor-driven transmission channel through which monetary policy shapes housing market dynamics. Prior studies document how investors reallocate toward higher-yielding assets in low-interest-rate environments, significantly influencing equity markets (Daniel, Garlappi, and Xiao (2021); Jiang and Sun (2020)), bond markets (Hanson and Stein (2015); Becker and Ivashina (2015); Lian, Ma, and Wang (2019); Choi and Kronlund (2018)), historical housing markets (Korevaar (2023)), and across various asset classes due to behavioral biases and demographic differences (Lian et al. (2019); Gomes, Peng, Smirnova, and Zhu (2022)). Closest to my work, Gargano and Giacoletti (2022) show that lower rates lead older individuals to substitute interest income with rental income and influence their participation in rental markets. Yet prior studies do not directly connect reaching-for-income behavior to heterogeneous monetary transmission across asset markets. I fill this gap by providing micro-level evidence that high-rental-yield properties disproportionately attract buy-to-rent investors following monetary easing. Their reaching-for-income behavior amplifies the price sensitivity of short-duration markets, influences the monetary policy transmission to local house prices, and generates spatial disparities in housing market responses.

The remainder of this paper is organized as follows: Section I is a conceptual framework that lays out the relationship between interest rate sensitivity and housing duration when different assumptions of Macaulay duration are relaxed. Section II describes data and the construction of measurements. Section III shows the empirical results. Section IV concludes the paper.

I. Conceptual Framework

This section develops the theoretical link between the interest rate sensitivity of house prices and housing duration. I begin with the classical Macaulay duration benchmark with the assumption of fixed rents and a constant premium. Then, I sequentially relax assumptions to incorporate features

specific to housing markets, including parallel and non-parallel shift term structure and interest-rate-dependent expected rents. At each step, I show how price sensitivity maps to or diverges from the traditional duration measure. Full derivations and proofs are provided in the Internet Appendix A.

A. Interest Rate Sensitivity with Fixed Rents and Constant Term Premium

Consider a representative property that delivers an infinite, deterministic stream of gross rental cash flows $\{C_{t+h}\}_{h\geq 1}$ without operating costs, depreciation, and taxes. As a start, I assume that the discount rate applied at t is $r_t = i_t + \phi$, which equals the sum of the policy rate i_t and a premium $\phi > 0$ that is held fixed with respect to i_t (i.e., $\partial\phi/\partial i_t = 0$). I assume a flat term structure of discount rates at t, so the same r_t applies to all horizons of cash flows $\{C_{t+h}\}_{h\geq 1}$. Hence, the house price and duration are

$$P_t = \sum_{h=1}^{\infty} \frac{C_{t+h}}{(1+r_t)^h}, \qquad D_t = \sum_{h=1}^{\infty} h \, \frac{C_{t+h}(1+r_t)^{-h}}{P_t} \equiv \sum_{h=1}^{\infty} h \, w_t(h), \tag{1}$$

with PV weights $w_t(h)$ summing to one.

Proposition 1: *Holding $\{C_{t+h}\}$ and ϕ fixed, the interest rate sensitivity of house price is*

$$-\frac{\partial \ln P_t}{\partial i_t} = \frac{D_t}{1+r_t} \equiv \widetilde{D}_t. \tag{2}$$

$\widetilde{D}_t$ is called modified duration. So longer-duration properties have a greater interest rate sensitivity.

B. Interest-Rate Sensitivity with Fixed Rents and a Parallel Shift of the Term Premium

Let the discount rate for horizon h be $r_t(h) = i_t + \phi_t(h)$, where $\phi_t(h)$ is a horizon-dependent term premium. At time t the term structure is taken to be *flat*, so $\phi_t(h) = \phi_t$ for all $h \geq 1$, and hence $r_t(h) = r_t = i_t + \phi_t$. Assume a *parallel shift* of the term structure: there exists a scalar level factor y_t such that $r_t(h) = y_t$ for all $h \geq 1$, so that a small change Δy_t shifts all maturities one-for-one. Define $\kappa_t \equiv \partial\phi_t/\partial i_t$ (parallel across h).

Proposition 2 (Parallel shift of a flat term structure): *Under a parallel shift of the (flat) discount curve y_t,*

$$-\frac{\partial \ln P_t}{\partial y_t} = \frac{D_t}{1+y_t} \equiv \widetilde{D}_t. \tag{3}$$

Corollary (mapping to the policy rate). By the chain rule,

$$-\frac{\partial \ln P_t}{\partial i_t} = (1+\kappa_t)\widetilde{D}_t. \tag{4}$$

Cross-sectionally, duration ordering still holds so long as κ_t is common across properties. In the next subsection, I specifically discuss the case where κ_t covaries with $\widetilde{D}_t$ across properties.

C. Interest-Rate Sensitivity with Fixed Rents and Non-Parallel Shift of Term Premium

Maintain fixed rents and evaluate under a flat level y_t, but allow a non-parallel shift in the housing term premium when the policy rate changes. Define $\kappa_t(h) \equiv \partial\phi_t(h)/\partial i_t$, so $\partial r_t(h)/\partial i_t = 1+\kappa_t(h)$. Let

$$\alpha_t(h) \equiv \frac{h\, w_t(h)}{D_t}, \qquad \bar{\kappa}_t \equiv \sum_{h\geq 1} \alpha_t(h)\kappa_t(h) \quad \text{(duration-weighted pass-through)}.$$

Proposition 3 (Discount-rate channel — non-parallel term-structure shift): *With a flat curve at t and horizon-dependent pass-through,*

$$-\frac{\partial \ln P_t}{\partial i_t} = \left(1+\bar{\kappa}_t\right)\widetilde{D}_t. \tag{5}$$

Interpretation and cross-section. If $\kappa_t(h) \equiv \kappa_t$ (i.e., parallel pass-through), Equation 5 collapses to 4. If the pass-through profile is *front-loaded* — i.e., $\kappa_t(h)$ is decreasing in h so that short-maturity premium decreases more than long-maturity premium when i_t falls — then the duration-weighted average $\bar{\kappa}_{x,t}$ is *larger* for assets placing more weight on early cash flows (shorter duration).

Consider two otherwise similar properties A and B with $D_{A,t} < D_{B,t}$. Property A will have a greater interest rate sensitivity than Property B if

$$\frac{1+\bar{\kappa}_{A,t}}{1+\bar{\kappa}_{B,t}} > \frac{D_{B,t}}{D_{A,t}}.$$

Thus, a sufficiently front-loaded pass-through (i.e., the decline in short premium is greater than that in long premium on a rate cut) can raise $\bar{\kappa}_{A,t}$ enough that the shorter-duration asset A exhibits a larger interest rate sensitivity of house price than B despite $D_{A,t} < D_{B,t}$.

D. Interest Rate Sensitivity with Interest-rate-dependent Rents and Constant Term Premium

Now allow expected rents to move with i_t while holding ϕ constant. The price and duration are

$$P_t = \sum_{h=1}^{\infty} \frac{\mathbb{E}_t[C_{t+h}]}{(1+r_t)^h}, \qquad D_t = \sum_{h=1}^{\infty} h \frac{\mathbb{E}_t[C_{t+h}](1+r_t)^{-h}}{P_t} \equiv \sum_{h=1}^{\infty} h\, w_t(h). \tag{6}$$

Let $\Gamma_t(h) \equiv \partial \ln \mathbb{E}_t[C_{t+h}]/\partial i_t$ and $\overline{\Gamma}_t \equiv \sum_{h=1}^{\infty} w_t(h)\Gamma_t(h)$.

Proposition 4 (Cash-flow channel): *Under the interest-rate-dependent expected rents,*

$$-\frac{\partial \ln P_t}{\partial i_t} = \frac{D_t}{1+r_t} - \overline{\Gamma}_t \equiv \widetilde{D}_t - \overline{\Gamma}_t. \tag{7}$$

Interpretation and cross-section. If $\overline{\Gamma}_t > 0$ (i.e., a cut lowers expected rents), duration will overestimate the actual interest rate sensitivity; if $\overline{\Gamma}_t < 0$, the actual sensitivity will be larger than duration predicts. For two properties A and B with $D_{A,t} < D_{B,t}$, Property A will have a greater interest rate sensitivity than Property B if

$$\overline{\Gamma}_{A,t} - \overline{\Gamma}_{B,t} > \widetilde{D}_{A,t} - \widetilde{D}_{B,t}.$$

II. Data and Measurement

A. Data Source

A.1. Zip Code-level Housing Data

American Community Survey (ACS)

My baseline analysis relies on detailed zip code-level housing market information from the American Community Survey (ACS) provided by the U.S. Census Bureau.[2] The ACS is an ongoing survey conducted annually by the U.S. Census Bureau, providing detailed demographic, social, economic, and housing characteristics of the U.S. population at various geographic levels, including the zip code tabulation area (ZCTA). To ensure reliable estimates at the zip code level, I use the ACS 5-year estimates, which aggregate data collected over 60 months. The 5-year estimates provide the largest sample sizes and most precise measurements, which will enhance reliability for my zip code-level analyses. [3]

[2]The ACS data can be accessed via the U.S. Census Bureau website at https://data.census.gov/. Stata users can efficiently download ACS data using the getcensus package.

[3]For more details on the differences among ACS 1-year, 3-year, and 5-year estimates, see https://www.census.gov/

ACS zip code tabulation area (ZCTA, hereafter referred to as zip code) data has been available since 2011. As a result, my baseline analysis covers a sample period from 2011 to 2023, spanning 13 years. Specifically, for each zip code and year from 2011 to 2023, I collect comprehensive local demographic and economic characteristics, including population size, median household income, age distribution, labor force participation rate, and unemployment rate. Importantly, the dataset provides extensive housing market information at the zip code level, such as median rents, median property values, homeownership rates, vacancy rates, property type distributions (e.g., single-family versus multi-family units), building ages, and room counts.

In particular, the two variables, median rent and house value, provide information for typical rental and house prices within each zip code and year. The data enables us to construct precise zip-code measures of rent growth and rental yield. Notably, with the rent growth and house price level of a zip code and year, I can predict future rent growth and construct the housing cash flow duration for local housing markets. The detailed duration construction procedure is described in Section II.B.

Zillow Home Value Index (ZHVI) and Zillow Observed Rent Index (ZORI)

I use the Zillow Home Value Index (ZHVI) to measure zip-code house price levels and changes over time. ZHVI provides a measure of the house price levels of the typical home in the 35th to 65th percentile range within zip codes. My analysis uses the smoothed and seasonally adjusted ZHVI as the primary proxy for local house price levels and to compute annual house price changes. The earliest available ZHVI data for some zip codes dates back to January 2000, which enables the calculation of annual price changes beginning as early as 2001. The cumulative annual house price change from the end of year $t-1$ to year $t+h$ for zip code z is defined as:

$$\Delta HPI_{z,[t-1,\,t+h]} = \frac{\text{HPI}_{z,\,t+h}}{\text{HPI}_{z,\,t-1}} - 1, \tag{8}$$

where $\text{HPI}_{z,\,t-1}$ is the ZHVI for zip code z in year $t-1$.

While my primary analyses rely on data from the American Community Survey (ACS), I additionally construct zip code-level housing duration measures using Zillow data to perform robustness checks, detailed in Appendix Section F. To accomplish that, I combine ZHVI with the Zillow Observed Rent Index (ZORI). Similarly, ZORI reflects the observed market rent within zip codes for typical

programs-surveys/acs/guidance/estimates.html.

homes in the 35th to 65th percentile range. It employs a repeat-rent methodology, weighted according to the rental housing stock, to maintain the representativeness of the entire local rental market.

I use the same smoothed and seasonally adjusted versions of ZHVI and ZORI to minimize discrepancies arising from differences in index construction or property-type measurement error. However, because zip code-level ZORI data is only available starting in 2015, later than ACS data, I only present results based on Zillow-constructed durations as robustness analyses in Internet Appendix Section F.

A.2. Property-level Housing Data

ATTOM Property Data

In my property-level analysis, I leverage ATTOM Record data to obtain property-level transaction information. ATTOM is a premier U.S. real estate data provider, and its data has been extensively used in literature. ATTOM has collected a nationwide panel of transaction records from all over the country, including more than 500 million real estate and loan transactions in over 2,690 counties. From ATTOM, I am able to collect detailed deed transaction information, such as transaction date, property address, buyer and seller information, and sales prices. ATTOM deed transaction data dates back as far as the early 1970s and has relatively better geographic coverage since 1990.

I obtain the property characteristics from ATTOM Tax Assessment data, which covers more than 155 million properties in more than 3,000 counties nationwide. The data set includes publicly available information collected by county tax assessor offices, such as assessed land and property values, tax amount, and, most importantly, property characteristics. With the unique property ID across ATTOM data products, I can easily merge the transaction and property characteristics.

Before analysis, I first clean the deed transaction data to identify valid transaction records and the transactions that, although invalid, still result in the end of property ownership for the previous homeowner. My cleaning algorithm, which refers to methodologies from several studies (**?**Goldsmith-Pinkham and Shue, 2023; Reher and Valkanov, 2024), is innovative and provides advantages in generating more reliable transaction samples. This approach allows us to generate more meaningful and unbiased estimation without losing much valid information. A detailed discussion of my cleaning algorithm can be found in Internet Appendix Section B.

Altos Rental Intel Data

Altos Rental Intel dataset provides comprehensive, weekly updated rental listing data covering the

active rental market for single-family homes and apartments. The dataset achieves a national coverage rate of approximately 98% and encompasses extensive rental listing information, including rental rates, property types, square footage, number of bedrooms and bathrooms, and available amenities.

The Altos rental data covers the period from 2011 to 2024. It is sourced independently from MLS and excludes platforms such as Craigslist. Altos sources data primarily from proprietary providers under private contracts, ensuring coverage of most major metropolitan areas and states, effectively encompassing nearly all zip codes in the U.S. with available rental properties. The weekly refresh rate ensures that the dataset delivers timely and accurate snapshots of rental market conditions.

Combining both ATTOM housing transaction data and Altos rental listing data, I compute average housing transaction prices and rental rates at the zip code-year level to proxy typical house and rental prices. Specifically, by following the methodology similar to that employed by ZORI and ZHVI[4], I calculate mean prices and rents by taking the average of the middle 30% (35th to 65th percentiles) of housing transaction prices and asking rents. These average rent and house price measures enable the estimation of annual rent growth and rental yields at the zip code level. I subsequently construct housing cash flow duration measures consistent with those derived from ACS and Zillow data, described comprehensively in Section II.B.

To validate my primary findings derived from ACS data, I perform robustness checks by replicating the baseline analysis using the duration measure constructed by the ATTOM and Altos datasets. The detailed results of these analyses are presented in the Internet Appendix Section E.

A.3. Bond and Equity Data

To document the abnormal heterogeneity in interest rate sensitivity of house prices by duration, I perform a parallel analysis for Treasury bonds and equities to compare the results directly with those observed in housing markets.

I obtain Treasury securities data from the Center for Research in Security Prices (CRSP) Monthly Treasuries dataset. The dataset calculates Macaulay duration for bonds expressed in days, which represents the weighted average number of days until cash flows occur. The present values of each cash flow, discounted by the yield to maturity, are used as weights in this calculation. In my final analysis, I convert the daily duration into years. While the data dates back to January 1919, I limit

[4]The detailed methodology is explained in https://www.zillow.com/research/methodology-zori-repeat-rent-27092/ for ZORI and in https://www.zillow.com/research/zhvi-methodology-2019-deep-26226/ for ZHVI.

the bond analysis to the period from 2011 to 2024 to ensure direct comparability with housing market results. Nonetheless, incorporating data from earlier periods does not change the robust relationship between longer duration and higher interest rate sensitivity of bond prices. Before analysis, I follow Hu, Pan, and Wang (2013) to clean the bond data. The details for bond data cleaning are illustrated in Section B.

I obtain equity data from the CRSP Monthly Stock dataset. This dataset offers comprehensive historical coverage dating back to December 1925. Similarly, to maintain comparability with the housing market analysis, my primary focus is on the period from 2011 to 2024. Including earlier data does not change my main finding that stocks with longer durations exhibit greater price sensitivity to interest rate changes. The details for equity data cleaning are illustrated in Section B as well.

I use the equity duration measure constructed by Gonçalves (2021). The paper defines equity duration as the present value-weighted average time until a firm's expected future payouts are realized. The equity duration measure is constructed at the *fiscal-year* level for each individual stock. For example, the duration for fiscal year 2023 corresponds to the period from July 2023 to June 2024. To avoid potential look-ahead bias and isolate the duration measure from ex-post monetary policy effects, I assign the duration from fiscal year $t-1$, which becomes available at the end of June in calendar year $t-1$, to the stock returns observed in calendar year t. In other words, the duration measure for a stock will be applied to its returns starting 6 months after it becomes available.

A.4. Interest Rate Changes and Monetary Policy Shock Measurement

In our primary analysis, we measure interest rate changes using the annual change in the federal funds rate. Additionally, we evaluate house price sensitivity to the 30-year mortgage rate change. Data for both rates are obtained from the Federal Reserve Economic Data (FRED). Specifically, for each year t, we compute the annual change as the difference in interest rates between the end of year $t-1$ and the end of year t.

To capture the unexpected component of interest rate movements, we construct a 1-year Treasury yield surprise measure. This measure is derived by first obtaining the 1-year and 2-year Treasury yields from FRED. Using these yields, we calculate the implied forward 1-year Treasury yield. The yield surprise is then defined as the difference between the actual realized 1-year Treasury yield and the implied 1-year forward yield from last year. Detailed definitions and calculations of this measure

are provided in the appendix table of variable definitions.

For robustness checks, we employ alternative monetary policy shocks developed by Bauer and Swanson (2023a) and Jarociński and Karadi (2020). The detailed descriptions and methodologies for these variables are included in the appendix table.

B. Construction of Housing Duration at the Zip Code Level

Macaulay duration is defined as the value-weighted average time of receiving cash flows from the bond. Extending this concept from bond markets to equity markets, previous studies such as Weber (2018) and Gonçalves (2021) define equity duration accordingly. Similarly, I build on the definition of Macaulay duration and construct a new measure called *housing cash flow duration* (hereafter referred to as housing duration). This measure is defined as the value-weighted average time until future cash flows (i.e., rental income) are received from housing markets. Formally, the duration for properties located in zip code z at time t is defined as:

$$\text{Duration}_{z,t} = \sum_{h=1}^{T} h \; w_{z,t+h}\,, \tag{9}$$

where the weight $w_{z,t+h}$ is calculated as:

$$w_{z,t+h} = \frac{\text{CF}_{z,t+h}\,/\,(1+r_{z,t})^h}{P_{z,t}}\,, \tag{10}$$

and expected cash flows $\text{CF}_{z,t+h}$ is defined as:

$$\text{CF}_{z,t+h} = \begin{cases} \mathbb{E}_t\Big[\text{Rent}_{z,t+h}\Big]\,, & \text{if } h < H \\ \mathbb{E}_t\Big[\text{Rent}_{z,t+H}\Big]\,(1+\bar{g}_{z,t})/(r_{z,t}-\bar{g}_{z,t})\,, & \text{if } h = H \end{cases} \tag{11}$$

In Equation 9, $w_{z,t+h}$ denotes the relative weight of the present value of expected cash flows $\text{CF}_{z,t+h}$ received in year $t+h$ relative to the total current house price $P_{z,t}$ in zip code z at time t. Here, h represents the time horizon when the cash flow is expected to be received. Intuitively, housing duration captures the weighted average maturity of housing cash flows, with the weights determined by the importance of the present values of expected future cash flows relative to the current investment value.

Unlike bonds, real estate assets (similar to equities) do not have deterministic maturity dates and predefined cash flows. Following Weber (2018), I address this issue by breaking down the cash flow equation into two components: the finite-horizon predicted rental incomes occurring before the terminal year $t+H$, and the infinite-horizon terminal house value at year $t+H$, as shown in Equation 11. The combined duration calculated from the two components constitutes my final measure.

In Equation 11, for periods before the terminal horizon H (i.e., $h < H$), the expected cash flow is the expected rental income $\mathbb{E}_t[\text{Rent}_{z,\,t+h}]$, which represents the expected annual rents received from a typical rental property in zip code z at future horizon h.

At horizon H (i.e., $h = H$), the terminal cash flow is calculated via the Gordon Growth Model (GGM) with the estimated zip-code long-term rent growth rate $\bar{g}_{z,t}$. It assumes the homeowner will sell the property and obtain the house value in year $t+H$, which would be the claim for all expected future rental income from the property. $\bar{g}_{z,t}$ is the long-run rent growth expectation formed by a homeowner in zip code z and year t. The detailed estimation procedure for the long-term growth rate is provided in Section II.B.1.

Empirically, I use a 5-year horizon as the terminal horizon for constructing my duration measurement. However, changing the assumed terminal horizon is unlikely to alter my main conclusions. That is because it is the cross-sectional ranking of housing duration, rather than the duration value itself, that leads to the heterogeneity in interest rate sensitivity. Nonetheless, I have also constructed an alternative duration measurement using a 10-year horizon. The results are robust and are presented in Internet Appendix Section Tables IA.C3 and IA.C8.

Similar to Gonçalves (2021), I derive the discount rate for a zip code and year t by solving the value equation in the following:

$$P_{z,t} = \sum_{h=1}^{T} CF_{z,t+h} \,/\, (1+r_{z,t})^h \tag{12}$$

The implied discount rate is equivalent to yield to maturity (YTM) or internal rate of return (IRR), equating the current property value to the sum of discounted expected future cash flows.

Empirically, I measure current house prices, $P_{z,t}$, by using the median house values obtained from the American Community Survey (ACS). The zip-code rental incomes are measured by the median gross rents from the same ACS data. With the rental income values, I calculate the realized rent growth and conduct predictive regressions using local economic characteristics to estimate expected future

rent growth and levels.

For robustness checks, I also create housing duration measures using alternative data sources from ATTOM, Altos, and Zillow. While my primary analyses are based on ACS data, I provide additional robustness analyses using the ATTOM and Altos datasets in Internet Appendix Section E, and those based on Zillow data are presented in Internet Appendix Section F.

In the next section, I will discuss in detail the estimation of the expected rents $\mathbb{E}_t\left[\text{Rent}_{z,t+h}\right]$.

B.1. Estimation of Zip Code-level Expected Rent Growth and Level

Previous literature assumes that dividend growth is stationary (Shiller, 1981; Campbell and Shiller, 1988). Also, I assume that zip-code rent growth is stationary (An, Deng, Fisher, and Hu, 2016), similar to dividend growth. This assumption allows us to reframe the estimation of expected future rent levels as the prediction of a sequence of future rent growth rates. Formally, standing in year t, the expected log rent at horizon h for zip code z can be expressed as:

$$\mathbb{E}_t\Big[\ln(\text{rent})_{z,\,t+h}\Big] = \ln(\text{rent})_{z,\,t} + \sum_{s=1}^{h} \mathbb{E}_t\Big[\Delta\ln(\text{rent})_{z,\,[t+s-1,\,t+s]}\Big]\,, \tag{13}$$

where $\ln(\text{rent})_{z,t}$ is the log of the observed rental value for a typical property in zip code z at year t, and $\mathbb{E}_t[\Delta\ln(\text{rent})_{z,[t+s-1,t+s]}]$ denotes the expected annual log rent growth at horizon s.

My forecasting method is close to Weber (2018) and Gonçalves (2021), which predict expected firm payouts to investors under the clean surplus accounting assumption. Specifically, Weber (2018) forecasts future equity payouts by forecasting return on equity and growth in book equity, assuming that the two ratios follow the autoregressive process based on Dechow et al. (2004). Extending this methodology, Gonçalves (2021) incorporates twelve firm-level characteristics to predict the ratio of clean surplus to book equity and the growth in book equity.

To predict expected log rent growth for each forecasting horizon s, I perform the *by-horizon* predictive regression estimation with the following specification:

$$\Delta\ln(\text{rent})_{z,\,[t+s-1,\,t+s]} = \alpha_s + \beta_{1,s}\,\ln(\text{rental yield})_{z,t} + \beta_{2,s}\,\Delta\ln(\text{rent})_{z,\,[t-1,\,t]} + \Gamma X_{z,t} + \epsilon_{z,t,s}\,, \tag{14}$$

where the dependent variable is the annual log rent growth at horizon s for zip code z in year t. The predictors include the log rental yield, $\ln(\text{rental yield})_{z,t}$, log rent growth in the last year, $\Delta\ln(\text{rent})_{z,\,[t-1,\,t]}$,

and a comprehensive set of local economic characteristics denoted as $X_{z,t}$.

The set $X_{z,t}$ captures various zip-code-year-level characteristics, including income ratio (i.e., zip-code median household income relative to national median household income), income growth, population ratio and growth, age distribution measures (shares of young and older residents and the growth), labor market indicators (i.e., labor force participation and unemployment rate and growth), housing market conditions (homeownership rate, rental vacancy rate, proportions of housing units by type, median room number growth), and renter-occupancy ratios and growth rates. The detailed list of predicting variables is presented in Internet Appendix Table IA.C1, and their definitions are explained in the Appendix.

To predict the long-term growth rate $\bar{g}_{z,t}$, I first calculate the average realized annual log rent growth from horizons 6 to 10 as Avg Δlog(rent)$_{z,[t+6,t+7,t+8,t+9,t+10]}$. I then apply the same predictive regression framework as Equation 14 but replace the dependent variable with this average realized annual log rent growth, thereby obtaining the predicted long-term growth rate.

Internet Appendix Table IA.C1 presents predictive regression results for future rent growth over short- and long-term horizons. Columns 1 to 5 show the prediction for the log annual rent growth over horizons ranging from one to five years (i.e., $t+1$ to $t+5$). Column 6 focuses on longer-term predictions by using average annual rent growth from years $t+6$ to $t+10$ as the dependent variable.

Additionally, I perform robustness checks using LASSO regressions with 10-fold cross-validation, which may help address potential concerns about overfitting due to the large number of predictors. Appendix Table IA.C2 reports the LASSO-selected predictors and estimation results. Notice that LASSO selection largely retains the original predictor set, with minimal variation in results compared to my baseline results. Consequently, the alternative duration measure using LASSO confirms robustness.

With the estimated coefficients, the expected log rent growth at horizon s is calculated as:

$$\mathbb{E}_t\Big[\Delta \ln(\text{rent})_{z,[t+s-1,t+s]}\Big] = \hat{\alpha}_s + \hat{\beta}_{1,s} \ln(\text{rental yield})_{z,t} + \hat{\beta}_{2,s} \Delta \ln(\text{rent})_{z,[t-1,t]} + \hat{\Gamma} X_{z,t} \tag{15}$$

C. Measuring Property-level Rental Yield

In my mechanism analysis, I exploit granular, property-level housing transaction and rental listing data to estimate rental yields for individual properties over time. As shown in Internet Appendix

A.A.5, the housing duration measure simplifies to rental yield under the assumption of constant rent growth. Thus, in the property-level mechanism analysis, rental yield serves as a proxy for property-level housing duration, with higher rental yields indicating shorter durations.

Specifically, I merge housing transaction data with rental listings at the property level to construct a comprehensive dataset of historical transaction prices and listed rents for comparable properties. Leveraging this rich and detailed dataset, I implement hedonic models to estimate the expected transaction prices, rents, and rental yields for each individual property over time.

The underlying intuition of the hedonic estimation is that observed transaction prices and listed rents for properties with observable characteristics can be used to infer the market prices and rents for similar properties that lack recent market transactions or rental listings. By integrating transaction and rental listing data, this approach thus estimates the rental yields for the entire universe of properties, including owner-occupied houses for which direct rental yields are typically unobservable.

C.1. Estimating Property-level Prices, Rents, and Rental Yields Using Hedonic Models

I start by estimating the expected annual house price for each property using the hedonic model. First, I estimate the time-varying relationship between observed transaction prices and property characteristics through hedonic regressions. I then apply the estimated hedonic coefficients to the full sample of properties to derive property-level expected house prices.

The hedonic estimations use all valid transaction data that include realized transaction prices, property characteristics, and geographic identifiers. Internet Appendix Section B describes the detailed process for cleaning the ATTOM housing transaction data and identifying valid transactions.

To estimate expected house prices, I conduct hedonic regressions separately for each county-year combination. Specifically, *for each county and year*, I conduct a regression with the following specification.[5]

$$\ln(\text{price}_{i,k,z,c,t}) = \alpha_{c,t} + \Gamma'_{c,t} X_{i,k,z,c,t} + \lambda_{k,z,c,t} + \epsilon_{i,k,z,c,t}\,, \tag{16}$$

where the dependent variable is the log transaction price for property i of property type k in zip code z, county c, and year t.

$X_{i,k,z,c,t}$ encompasses a comprehensive set of property characteristics selected based on prior liter-

[5]For robustness checks, I have also performed by-CBSA-year and by-MSA-year hedonic regression estimations. The alternative estimation approach yields very similar and consistent results.

ature (Giglio et al., 2015; Giglio, Maggiori, and Stroebel, 2016; Gen Li, 2023; Goldsmith-Pinkham and Shue, 2023; Halket, Loewenstein, and Willen, 2023; Diamond and Diamond, 2024). These characteristics include the log of the house age, the log of the property area in square feet, and the number of bedrooms and bathrooms, along with their squared terms. Additionally, I include dummy variables indicating the presence of a garage, a pool, cooling and heating facilities, a fireplace, a basement, as well as views of waterfronts, mountains, recreational areas, and general quality views.

$\lambda_{k,z,c,t}$ represents zip-code-by-property-type fixed effects, accounting for unobserved heterogeneity across property types and zip codes over time.[6] Consequently, $\lambda_{k,z,c,t}$ captures the average transaction prices for each property type in each zip code in a year.

The estimated coefficients from Equation 16 are then applied to all properties with available characteristics to calculate the expected log price for each property in a year with the following equation.

$$\mathbb{E}[\ln(\text{price}_{i,k,z,c,t})] = \widehat{\alpha}^{p}_{c,t} + \widehat{\Gamma}^{p\prime}_{c,t} X_{i,k,z,c,t} + \widehat{\lambda}^{p}_{k,z,c,t}, \tag{17}$$

where superscript p denotes coefficients specifically from hedonic estimations for house prices, distinguishing them from those obtained from rent hedonic estimations in the following.

Finally, given Jensen's inequality, the expected house price for property i in year t is defined as

$$\widehat{P}_{i,t} \equiv \mathbb{E}[\text{price}_{i,t}] = \exp\left\{ \mathbb{E}[\ln(\text{price}_{i,t})] + \frac{1}{2} \widehat{u^2_{c,t}}^{p} \right\}, \tag{18}$$

where $\widehat{u^2_{c,t}}^{p}$ is the estimated residual variance from by-county-year price hedonic regressions.

In parallel, I estimate property-level rents using analogous rent hedonic regressions. Using the ATTOM property sample with matched actual rental listing information, I first conduct *by-county-year* rent hedonic regressions with the following specification.

$$\ln(\text{rent}_{i,k,z,c,t}) = \alpha_{c,t} + \Gamma'_{c,t} X_{i,k,z,c,t} + \lambda_{k,z,c,t} + \epsilon_{i,k,z,c,t}, \tag{19}$$

where the dependent variable $\ln(\text{rent}_{i,k,z,c,t})$ is the log of listed rent for property i of property type k in zip code z, county c, and year t. $X_{i,k,z,c,t}$ represents the same property characteristics used in the price hedonic regression in Equation 16.

[6] The zip-code-by-property-type fixed effects, $\lambda_{k,z,c,t}$, includes the subscripts c and t due to the *by-county-year* regression analysis, which results in estimated coefficients varying across counties and years. The reason also applies to $\alpha_{c,t}$ and $\Gamma_{c,t}$.

Applying the estimated rent coefficients yields the expected log rent for each property over time:

$$\mathbb{E}\big[\ln(\text{rent}_{i,k,z,c,t})\big] = \widehat{\alpha}^{r}_{c,t} + \widehat{\Gamma}^{r\prime}_{c,t} X_{i,k,z,c,t} + \widehat{\lambda}^{r}_{z,k,s,t}\,, \tag{20}$$

where the superscript r denotes the coefficients estimated from rent hedonic regressions.

Finally, the expected rent for individual property i in year t is defined as

$$\widehat{\text{Rent}}_{i,t} \equiv \mathbb{E}\big[\text{rent}_{i,t}\big] = \exp\left\{\mathbb{E}\big[\ln(\text{rent}_{i,t})\big] + \frac{1}{2}\,\widehat{u^2_{c,t}}^{\,r}\right\}, \tag{21}$$

where $\widehat{u^2_{c,t}}^{\,r}$ denotes the estimated residual variance from rent hedonic regressions.

Finally, the expected annual rental yield for each property is computed as

$$\begin{aligned}\text{RY}_{i,t} \equiv \mathbb{E}\Big[\text{rental yield}_{i,t}\Big] = \exp\Big\{ & \mathbb{E}\big[\ln(\text{rent}_{i,t})\big] - \mathbb{E}\big[\ln(\text{price}_{i,t})\big] \\ & + \frac{1}{2}\left(\widehat{u^2_{c,t}}^{\,r} + \widehat{u^2_{c,t}}^{\,p} - 2\,\text{cov}(\widehat{u}^{r}_{c,t}, \widehat{u}^{p}_{c,t})\right)\Big\},\end{aligned} \tag{22}$$

where $\text{cov}(\widehat{u}^{r}_{c,t}, \widehat{u}^{p}_{c,t})$ represents the covariance of residuals from rent and price estimations.

D. Descriptive Statistics

D.1. Geographic Distribution of Housing Duration and Rental Yield

To gain an intuitive understanding of regional differences in housing durations and rental yields, I calculate the average housing duration and rental yield across all zip codes and years within each county. Figure 2 illustrates county-level geographic heterogeneity in housing duration (Panel A) and rental yield (Panel B). Counties are classified into quintiles (Q1 to Q5), with darker shading corresponding to higher values of housing duration or rental yield.

The figure reveals substantial regional heterogeneity in housing durations and rental yields. For instance, coastal counties in California generally display longer housing durations than inland counties. Moreover, counties located in the central regions of the United States typically show shorter housing durations and higher rental yields. Regions with high house prices and high-income households, such as those surrounding New York City, Boston, and San Francisco, also have relatively longer housing durations. Although coastal areas in many parts of the U.S. generally correlate with longer durations, Florida seems to deviate from this pattern, with some coastal counties showing durations in the lower

quintiles. This deviation suggests that other local factors beyond the house price level and coastal proximity may also influence housing durations and rental yields. Finally, comparing Panels A and B indicates a negative relationship between housing durations and rental yields.

D.2. Dominance Analysis for Housing Duration Variation

Figure 3 illustrates the proportion of housing duration variation attributed *uniquely* to each explanatory variable, estimated from a dominance analysis. The dominance analysis is a methodology designed to assess the relative importance of explanatory variables by decomposing the total variation explained in a regression model into unique contributions from each factor. Specifically, this analysis employs the Shapley value decomposition technique, derived from cooperative game theory, to allocate the explained variance among explanatory variables based on their average marginal contributions across all possible model combinations.

Rental yield emerges as the most influential factor, accounting for 47.1% of the explained variation in housing duration. Log(price) also demonstrates significant explanatory power, contributing 31.5%. Following that, Log(rent) and log(income) explain 7.4% and 7.0% of the variation, respectively. Other characteristics demonstrate a relatively smaller influence. Factors such as unemployment rate, labor force participation rate, and homeownership rate have relatively minor impacts. Population size, age demographics (% below 40 and % above 60), and rental vacancy rate show minimal explanatory power, each accounting for less than 1% of the total variation.

Overall, the analysis suggests that rental yield and property prices primarily explain the geographic heterogeneity in housing duration, while socioeconomic variables play secondary roles.

D.3. Description of Data

Table 1 presents descriptive statistics and a correlation matrix for the primary variables in the final sample analyzed in my baseline regressions in Tables 2 and 3. As I employ one-year-lagged housing market characteristics, Panels A, C, and D display statistics for these lagged variables, consistent with the regression analyses. The sample is limited to urban areas defined by the U.S. Census Bureau as those with at least 425 housing units per square mile, but results remain robust without this restriction.[7] The final sample with complete housing and local characteristics include 6,033 zip codes from

[7]The criteria defined by the U.S. Census Bureau are detailed at https://www.census.gov/newsroom/blogs/random-samplings/2022/12/redefining-urban-areas-following-2020-census.html.

2011 to 2023.

Panel A provides statistics for housing duration measures and associated housing cash flow characteristics. The mean 5-year housing duration is approximately 4.467 years, with a standard deviation of 0.230. Rental yield averages 6.3%, with a standard deviation of 3.3%. Additionally, alternative duration measures, including Duration 5Y^{LASSO}, Duration 10Y, and Duration 10Y^{LASSO}, are presented. The suffixes "5Y" and "10Y" denote assumed holding horizons of 5 and 10 years, respectively. The primary duration measure assumes a 5-year horizon. The superscript "LASSO" indicates measures constructed using predicted rent growth from LASSO regressions.

Panel B summarizes the dependent variables, house price changes over three-year horizons. Annual average house price growth is approximately 7.8%, accumulates to 15.7% over two years, and reaches a cumulative 25.2% increase within three years.

Panel C describes local socioeconomic and housing market characteristics. The mean log household income is 11.01, approximately corresponding to $60,476, while the mean log population is 10.08, roughly equivalent to 23,861 individuals. On average, 53% of the population in zip codes is under 40, while about 20.5% is above 60 years old. The average homeownership rate is 57.5%, the average rental vacancy rate is 6.5%, and the mean income-to-price ratio stands at approximately 0.25.

Finally, Panel D presents pairwise correlations among the variables. Housing duration exhibits a strong negative correlation with rental yield, consistent with Greenwald et al. (2021). Given that the housing duration could be simplified to the price-to-rent ratio under the assumptions of constant rent growth and perpetual cash flows, the empirically observed negative relationship is intuitive. Additionally, housing duration significantly correlates with economic and demographic factors, such as the log(income), log(income-to-price), unemployment rate, labor force rate, and age demographics.

III. Empirical Results

A. Baseline Specification

To examine heterogeneity in house price sensitivity to interest rate changes across zip codes with varying housing duration, I employ a regression analysis at the zip code-year level using the following baseline specification:

$$\begin{aligned}\Delta HPI_{z,c,[t-1,\,t+h]} = \alpha_h \;+\; \beta_h\, \Delta r_{[t-1,\,t]} \times \text{Duration}_{z,t} \\ +\; \delta_h\, \text{Duration}_{z,t} + \zeta_c \times \theta_t \;+\; \lambda_z \;+\; \epsilon_{z,c,t,h}\,,\end{aligned} \tag{23}$$

where $\Delta HPI_{z,c,[t-1,\,t+h]}$ is the percentage change in house prices of zip code z in county c from year $t-1$ to $t+h$, with h indicating the horizon over which the price change is measured. $\Delta r_{[t-1,\,t]}$ indicates the annual change in the federal funds rate (FFR) from the end of year $t-1$ to t, and $Duration_{z,t}$ denotes the housing duration level in zip code z in year t. The term $\zeta_c \times \theta_t$ represents the county-by-year fixed effects. λ_z denotes the zip code fixed effects. The fixed effects will help control for the time-varying county-level economic characteristics and time-invariant zip-code characteristics.

The primary explanatory variable of interest, $\Delta r_{[t-1,t]} \times Duration_{z,t-1}$, captures the heterogeneous house price sensitivity to FFR changes based on the zip-code housing duration. The coefficient of interest, β_h, measures how the sensitivity varies across zip codes with varying housing duration. Given a negative relationship between house price growth and interest rate changes, a positive estimated coefficient ($\hat{\beta}_h > 0$) indicates that zip codes with longer housing durations exhibit *lower sensitivity* to interest rate changes compared to those with shorter durations. In other words, a negative interest rate shock ($\Delta r < 0$) is associated with higher house price growth in areas with shorter housing durations. Conversely, a negative estimated coefficient ($\hat{\beta}_h < 0$) would imply greater sensitivity among zip codes with longer housing durations.

B. Monetary Policy Transmission to Zip-code House Prices by Housing Duration

B.1. Baseline Analysis

Figure 1 briefly illustrates the heterogeneous responses of asset prices to a 100 basis-point decrease in the federal funds rate (FFR), categorized by asset cash flow duration. Panels A, B, and C present price responses for real estate, bond, and equity markets, respectively. The interest rate shock occurs at horizon 0, representing the period from the end of year $t-1$ to year t. The x-axis indicates the response horizon h in years following the shock, while the y-axis shows cumulative percentage changes in asset prices. The red and green lines represent price changes for long-duration and short-duration assets, respectively.

[INSERT FIGURE 1 HERE]

Panel A of Figure 1 clearly demonstrates that short-duration housing markets exhibit significantly greater sensitivity to interest rate changes compared to long-duration markets. Specifically, at the contemporaneous year t (horizon 0), short-duration markets experience an immediate and statistically significant house price increase of approximately 1%, whereas long-duration markets show negligible immediate responses. This divergence widens significantly by the subsequent year (horizon 1), with short-duration markets cumulatively appreciating by around 4%, exceeding long-duration markets by approximately 1 percentage point. The gap remains stable until year three (horizon 2). By year four (horizon 3), the effect begins to dissipate. The price changes of the two markets converge at this point.

The pattern of interest rate sensitivity observed in housing markets contrasts sharply with that in bond and equity markets. Panels B and C reveal that long-duration bonds and equities demonstrate greater price sensitivity relative to their short-duration counterparts, consistent with theoretical predictions.

Specifically, Panel B shows that bond prices in both duration categories increase immediately following the decrease in rate; however, long-duration bonds appreciate approximately 2 percentage points more than short-duration bonds at the shock year (horizon 0). This divergence persists through year two (horizon 1) with a cumulative price increase difference of around 2 percentage points and remains stable even at year three (horizon 2).

Panel C presents similar patterns in equity markets compared to bond markets. Immediately after the interest rate decreases at horizon 0, equity prices for both duration categories increase significantly, but the magnitude is significantly greater for long-duration equities. The difference in cumulative price responses persists over the next two years, though narrowing slightly over time, and converges by year four (horizon 3).

In summary, the findings reveal an intriguing anomaly: Unlike bond and equity markets, housing markets exhibit greater price sensitivity to interest rate changes in short-duration markets rather than in long-duration markets. This phenomenon contradicts both theoretical predictions and empirical evidence from other asset classes.

[INSERT TABLE 2 HERE]

Table 2 rigorously examines the heterogeneous sensitivity of asset prices to interest rate changes across asset duration for real estate (Panel A), bonds (Panel B), and equities (Panel C). Panel A provides compelling evidence that *shorter-duration housing markets* exhibit *significantly greater sensitivity* to

changes in the federal funds rate (FFR), a stark contrast to the theoretically predicted positive relationship validated by bond and equity markets in Panels B and C.

In Column 1 of Panel A, I begin by including only the FFR change and housing duration. A 100 basis-point decrease in the FFR corresponds to an average two-year house price increase of approximately 1.86%. The negative coefficient on housing duration suggests higher price growth in shorter-duration zip codes on average.

Column 2 introduces an interaction term between FFR changes and housing duration. The significantly positive coefficient on this interaction term indicates greater sensitivity in short-duration housing markets. Specifically, a 100 basis-point FFR cut is associated with an additional price increase of roughly 0.4%[8] in zip codes with durations shorter by one standard deviation (0.23 years), representing approximately 22% of the average price response to the FFR cut. This result reveals the nontrivial influence of local market duration characteristics on both the direction and magnitude of house price responses.

Columns 3 and 4 progressively incorporate year and county-by-year fixed effects, respectively, controlling for nationwide house price trends and time-varying county characteristics. Column 5, my preferred specification, includes both county-year and zip-code fixed effects. The result confirms the higher sensitivity of shorter-duration housing markets. The interaction coefficient of 3.089 implies that a 100 basis-point decrease in the FFR yields an additional house price increase of approximately 0.71%[9] in zip codes with durations shorter by one standard deviation. The additional price increase represents approximately 37.6% of the average price response to the FFR cut.

In contrast, Panels B and C confirm the positive relationship between duration and price sensitivity to interest rate changes in bond and equity markets. To ensure comparability across asset classes, I consistently analyze the annual price changes over a two-year horizon. Specifically, a 100 basis-point decrease in the FFR is associated with average price increases of around 4.7% for treasury bonds and approximately 11% for equities. The significantly negative interaction coefficients in Columns 2 through 4 of Panels B and C confirm the expected duration-sensitivity relationship, which indicates that longer-duration bonds and equities experience significantly greater price increases following interest rate decreases.

Overall, Table 2 reveals a remarkable anomaly within housing markets: short-duration assets show

[8] $0.4\% \approx 1.7 \times 0.23 \times 1\%$

[9] $0.71\% \approx 3.089 \times 0.23 \times 1\%$

substantially higher sensitivity to interest rate changes, opposite to theoretical predictions and also empirical evidence from bond and equity markets. Further investigation into the mechanisms underlying this anomaly could offer valuable insights into monetary policy transmission within real estate markets.

B.2. Diminishing Interest Rate Sensitivities by Duration Quintiles

To further substantiate the negative relationship between housing cash flow duration and sensitivity of house prices to interest rate changes, I classify zip codes into five quintiles based on their estimated housing durations. Figure 4 presents the heterogeneous responses of house prices across these duration quintiles following a 100 basis-point (bps) reduction in the federal funds rate (FFR). Specifically, the figure highlights the relative differences in house price changes over horizons of 1, 2, and 3 years for each duration quintile compared to quintile 5, which represents zip codes with the longest housing durations. Quintile 1, conversely, represents zip codes with the shortest housing durations.

[INSERT FIGURE 4 HERE]

The figure demonstrates a robustly stronger response of shorter-duration housing markets to interest rate shocks over the subsequent three years. In particular, following a 100 bps decrease in the FFR, the shortest-duration zip codes (quintile 1) experience price increases that are approximately 0.44, 1.5, and 1.6 percentage points larger than those in the longest-duration zip codes (quintile 5) at the one-, two-, and three-year horizons, respectively. Quintiles 2 and 3 similarly exhibit significantly larger price increases relative to quintile 5 following the interest rate decrease.

Importantly, the figure reveals a clear monotonic decline in house price sensitivity as the housing duration quintile increases. The results robustly confirm a negative relationship between housing duration and price sensitivity to interest rate changes. In other words, shorter-duration housing markets are significantly more responsive to interest rate changes than their longer-duration counterparts, a result that corroborates the findings presented in Table 2.

B.3. Heterogeneity by Local Characteristics

Table 3 presents robust evidence of heterogeneity in the two-year house price response to annual changes in the federal funds rate (FFR) by controlling for a comprehensive set of local characteris-

tics. Specifically, the table investigates the robustness of the higher interest rate sensitivity of shorter-duration housing markets after controlling for a range of zip code-level demographic and economic characteristics, including median household income, population size, age distribution (proportions below 40 and above 60), labor force participation rate, unemployment rate, homeownership rate, rental vacancy rate, and income-to-price ratio.

[INSERT TABLE 3 HERE]

Column 1 extends the baseline specification by adding the past one-year house price growth to control for the momentum effect. The estimated coefficient on the interaction term between the FFR change and housing cash flow duration remains significantly positive at around 3.021. Based on the specification, Column 2 further incorporates nine local economic and demographic characteristics to account for potential confounding factors from local market conditions. Column 3 introduces the interaction terms between FFR changes and each local characteristic to explicitly capture the heterogeneous impacts of interest rate changes across local characteristics. The results confirm that even after accounting for heterogeneous interest rate sensitivity across other local characteristics, the higher sensitivity of shorter-duration housing markets remains significant, and the estimated magnitude does not change much.

The results confirm my finding that shorter-duration housing markets respond more substantially to interest rate changes. The finding is robust to the inclusion of a wide array of local demographic and economic controls, as well as their interactions with monetary policy changes.

[INSERT FIGURE 5 HERE]

Figure 5 explores the heterogeneous house price response to interest rate changes across diverse zip-code demographic and economic characteristics. Specifically, it illustrates the additional two-year cumulative house price change associated with a one-standard-deviation (sd) increase in each characteristic following a 100-basis-point decrease in the federal funds rate (FFR). The heterogeneity is derived from the estimated coefficients on interaction terms in Table 3.

Several key patterns of heterogeneity emerge. First, zip codes with higher income levels exhibit a stronger sensitivity to monetary policy changes, probably caused by the higher leverage or reliance on credit among high-income homeowners. Conversely, zip codes with a higher share of residents below 40 or above 60 years old demonstrate lower sensitivity to interest rate changes. Younger residents

typically dominate rental markets without much influence on the housing transaction markets. Old people usually have substantial cash savings and, hence, rely less on mortgages, which makes them less susceptible to interest rate changes.

Additionally, zip codes with higher labor force participation rates demonstrate less sensitivity to monetary policy changes, possibly because stable incomes from labor participation help homeowners better withstand interest rate fluctuations and mitigate forced sales caused by mortgage defaults during monetary tightening. Likewise, zip codes with higher income-to-price ratios, usually representing higher housing affordability, also show lower sensitivity.

Conversely, areas with higher unemployment rates or higher rental vacancy rates are more susceptible to interest rate changes. It could be driven by the increased vulnerability and reduced housing demand under deteriorating labor market conditions. A higher rental vacancy rate may exacerbate financial distress among property owners facing decreased rental revenues, which may force them to sell their properties at a fire sale during monetary tightening.

Overall, Figure 5 highlights substantial heterogeneity in the interest rate sensitivity across local characteristics following monetary policy changes. However, none of the characteristics I examined alter my primary finding that shorter-duration housing markets demonstrate greater interest rate sensitivity.

B.4. House Price Responses Across 1-, 2, and 3-year Horizons

[INSERT TABLE 4 HERE]

Panel A of Table 4 analyzes house price responses to changes in the federal funds rate (FFR) over one-, two-, and three-year horizons. Columns 1, 3, and 5 implement the preferred baseline specification consistent with Column 5 in Panel A of Table 2. Columns 2, 4, and 6 further incorporate zip code-level economic characteristics and their interactions with FFR changes to control for potential confounding factors.

The results consistently demonstrate significantly positive coefficients on the interaction term between housing duration and FFR changes across all horizons. It suggests a greater sensitivity of house prices to interest rate changes in shorter-duration housing markets. Importantly, this relationship remains robust even after controlling for time-varying economic conditions at the zip-code level.

Additionally, the heterogeneity in interest rate sensitivity becomes particularly pronounced over

the two-year horizon and remains substantial at the three-year horizon, suggesting a gradual transmission of monetary policy impacts to house prices. Specifically, Columns 1, 3, and 5 in Panel A indicate that, for a 100-basis-point reduction in the FFR, a one-standard-deviation (0.23 years) reduction in housing duration generates additional house price increases of approximately 0.25%, 0.71%, and 0.67% at the one-, two-, and three-year horizons, respectively. This gradual response aligns with existing literature (Kuttner, 2013; Williams, 2015), which identifies a gradual house price response to interest rate changes typically unfolding over a two- to three-year period.

B.5. House Price Responses to 30-Year Mortgage Rate Changes

People may be concerned that increases in short-term interest rates may not fully transmit to long-term mortgage rates. This concern arises due to the fundamental assumption underlying duration measures: a parallel shift of the yield curve. If an increase in short-term interest rate does not proportionately shift or negatively affect the long-term rate (Van Binsbergen and Grotteria, 2024), the relationship between interest rate sensitivity and duration measure may become distorted.

To directly address this potential issue, Panel B of Table 4 explicitly examines the impact of the 30-year mortgage rate on house prices across zip codes with varying housing durations. Similar to Panel A, Columns 1, 3, and 5 of Panel B present my preferred baseline specification, while Columns 2, 4, and 6 further incorporate zip-code economic characteristics and their interactions with changes in the 30-year mortgage rate.

Consistent with findings using the federal funds rate, the results robustly demonstrate greater sensitivity in shorter-duration housing markets across all time horizons analyzed. Specifically, Columns 1, 3, and 5 reveal significantly positive coefficients on the interaction terms, suggesting that a one-standard-deviation decrease in housing duration corresponds to additional house price increases of approximately 0.42%, 1.26%, and 1.56% at the one-, two-, and three-year horizons, respectively, following a 100-basis-point decrease in the 30-year mortgage rate. The findings remain robust when controlling for zip-code characteristics and their interactions with mortgage rate changes, as indicated in Columns 2, 4, and 6.

In summary, analyzing the impact of 30-year mortgage rates reinforces my central conclusion: shorter-duration housing markets consistently exhibit higher price sensitivity across multiple horizons, regardless of whether short-term or long-term interest rate changes are considered.

B.6. Robustness to Alternative Monetary Policy Shock (MPS) Measures

[INSERT TABLE 5 HERE]

A potential concern is that changes in interest rates might correlate with unobserved confounding factors that also affect house price changes. Specifically, the observed higher sensitivity of house prices in shorter-duration housing markets could be driven by the unobserved confounding factors rather than interest rate shocks per se. Although including zip-code characteristics and their interactions with interest rate changes partially addresses this issue, I further strengthen my analysis by using alternative measures of monetary policy shocks (MPS) to measure the *exogenous* interest rate changes.

Table 5 illustrates the robustness of my findings across various MPS definitions. These alternative MPS measures, which are designed to capture the unexpected interest rate changes, include the one-year Treasury yield surprise, monetary policy surprises constructed by Jarociński and Karadi (2020) (JK PM MPS and Median MPS), and those developed by Bauer and Swanson (2023b) (BS MPS and BS MPS_ORTH).

Consistently, across all specifications presented in Table 5, I observe significantly positive coefficients on the interaction between housing duration and each alternative MPS measure. This persistent pattern reinforces the conclusion that shorter-duration housing markets exhibit higher sensitivity to interest rate changes, irrespective of the specific MPS measurement employed. This robustness strongly indicates that my primary finding is less likely to result from omitted confounding variables correlated simultaneously with interest rate changes and house price dynamics.

B.7. Alternative Housing Duration Measures

My primary results build on the duration measure constructed with the 5-year terminal horizon. However, the findings remain robust under alternative construction assumptions and methods. I construct two additional duration measures to validate the findings: one based on an extended 10-year holding period assumption and another derived from rent growth predictions obtained via LASSO regression with 10-fold cross-validation. By expanding the holding period to 10 years, I assume that homeowners expect to hold properties for 10 years, receive housing cash flow within the period, and finally obtain a terminal value from the house at the end of year 10. Section II.B provides a detailed description of constructing the alternative duration measures.

10-Year Holding Horizon for Duration Measure Construction

Using the 10-year duration measure, I replicate the heterogeneity analysis from my baseline specification (Table 4), presenting the results in Panel B of Internet Appendix Table IA.C3. Panel A reproduces the baseline 5-year measure results from Table 4 for direct comparison. I consistently find significantly positive coefficients on the interaction terms between housing duration and interest rate changes across all horizons. Further robustness checks using the 30-year mortgage rate changes, monetary policy surprise series from Bauer and Swanson (2023a), and other alternative monetary policy shocks (Internet Appendix Tables IA.C4, IA.C5, IA.C6, and IA.C7) reinforce my primary findings that shorter-duration housing markets exhibit greater price sensitivity to interest rate changes.

Duration from LASSO-predicted Rent Growth

Internet Appendix Table IA.C8 presents results employing a housing duration measure constructed using LASSO-selected predictors for rent growth. The detailed outcomes of the LASSO prediction regression are provided in Internet Appendix Table IA.C2. The significantly positive coefficients on the interaction terms are robust across horizons and even show a larger heterogeneity across housing duration compared to my primary baseline analysis using the duration constructed by all predictors. Additional regression details are documented in Internet Appendix Tables IA.C8 to IA.C13, further underscoring the robustness and consistency of my main findings regarding housing duration and interest rate sensitivity.

B.8. Monetary Policy Transmission to House Prices by Rental Yield

A potential concern arises from measurement errors associated with my housing duration measure, potentially driving the documented negative relationship between housing duration and interest rate sensitivity. To rigorously address the duration measurement concern, I employ an alternative proxy for duration: rental yield, defined as the ratio of rent to property price.

Under the assumption of constant rent growth and infinite future rental cash flows with the Gordon Growth Model, housing duration can be simplified to the price-to-rent ratio (the reciprocal of rental yield), as demonstrated in Greenwald et al. (2021). Empirically, I indeed find a large and negative correlation between rental yields and my primary duration measure. Theoretically, this negative relationship suggests that lower rental yield areas, equivalent to longer-duration markets, should exhibit greater price sensitivity to interest rate changes.

[INSERT TABLE 6 HERE]

To validate my main findings, I reproduce the baseline analyses using rental yield as the primary explanatory variable. Table 6 presents heterogeneous house price responses to interest rate changes across zip codes with varying rental yields. The table consistently confirms my primary conclusions. Zip codes with higher rental yields, equivalent to shorter-duration housing markets, consistently demonstrate higher house price sensitivity to interest rate changes.

Specifically, in Panel A, Columns 1, 3, and 5 show that, following a 100-basis-point decrease in the FFR, zip codes with a one-standard-deviation (0.033) higher rental yield experience additional house price increases of approximately 0.23%, 0.65%, and 0.61%, over one-, two-, and three-year horizons, respectively. The additional price increases are economically nontrivial. For example, relative to an average two-year house price increase of approximately 1.77% after a 100-basis-point FFR cut, the additional increase of 0.65% accounts for 36.7% of the average price response. The findings are robust when controlling for local economic characteristics and their interactions with FFR changes.

Panel B investigates house price responses to changes in the 30-year mortgage rate over the same horizons. The results reinforce the main conclusion that housing markets with higher rental yields (shorter housing duration) are more sensitive to rate changes. Specifically, within two years of a 100-basis-point mortgage rate decrease, house prices increase on average by about 0.96%. A one-standard-deviation increase in rental yield (0.033), however, corresponds to an additional 1.03% price increase, which highlights substantial heterogeneity across housing markets by rental yields.

[INSERT FIGURE 6 HERE]

Figure 6 illustrates heterogeneity in interest rate sensitivity across zip-code rental yield quintiles. Zip codes are categorized annually into five rental yield quintiles, with quintile 1 corresponding to the lowest rental yields and quintile 5 the highest. The figure presents the differences in cumulative house price changes relative to the baseline (quintile 1) across horizons of one, two, and three years following a 100-basis-point (bps) decrease in the FFR.

The results consistently show that zip codes in higher rental yield quintiles exhibit substantially greater sensitivity to interest rate changes. For example, in the year of a 100-bps FFR cut, zip codes in the highest rental yield quintile experience a house price increase of approximately 0.41 percentage points greater than those in the lowest rental yield quintile. The response differences across rental

yield quintiles magnify significantly over longer horizons, reaching about 1.31 percentage points at the two-year horizon and approximately 1.39 percentage points at the three-year horizon.

The observed monotonic increase in sensitivity across rental yield quintiles, consistent with findings in Figure 4 regarding housing duration, reinforces my primary results and mitigates concerns that outliers may be driving the identified relationship between housing duration and interest rate sensitivity.

Additional robustness analyses employing alternative monetary policy measures, such as monetary policy surprises from Bauer and Swanson (2023a), yield similar results. These analyses, detailed in Internet Appendix Tables IA.C14 through IA.C17, confirm the robustness of my primary findings.

Overall, all analyses using rental yield as the proxy for housing duration support my main conclusion: housing markets with higher rental yields, equivalent to shorter durations, exhibit significantly higher sensitivity to interest rate changes. Thus, the abnormal heterogeneity in monetary policy transmission documented by housing duration in my primary analysis remains robust, effectively mitigating potential measurement error concerns.

B.9. Robustness Checks Using Zillow, ATTOM, and Altos Data

The baseline analyses rely on the American Community Survey (ACS) data, as it provides extensive geographic and time-series coverage at the zip-code level. However, I also reproduce the analyses using alternative datasets to validate the robustness of my findings, including zip-code-level housing data from Zillow and property-level transaction data from ATTOM combined with rental listings from Altos.

In Internet Appendix F, I present robustness results based on the Zillow dataset.[10] The Zillow-based analyses produce results consistent with the baseline findings. Moreover, they indicate somewhat stronger heterogeneity in interest rate sensitivity compared with the ACS-based estimates, likely due to the more recent sample period. Consistently, I also observe stronger heterogeneity in the ACS data when restricting the analysis to more recent years.

In Internet Appendix E, analyses using combined property-level transaction data from ATTOM and rental listings from Altos further corroborate the main results. The sample spans from 2011 to

[10]Specifically, I construct the housing duration measure using the Zillow Home Value Index (ZHVI) and the Zillow Observed Rent Index (ZORI), following the methodology detailed in Section II.B. Because the ZORI data are only available from 2015 onward—later than the initial ACS coverage—the Zillow sample is primarily used for robustness tests.

2023, as the availability of Altos rental data began in 2011.[11] Results based on the ATTOM and Altos datasets closely align with the baseline results, yielding highly similar estimates and further confirming the robustness of the primary findings.

C. Property Transaction-level Heterogeneity in Monetary Policy Transmission

Exploiting the granularity of property-level transaction data, Table 7 corroborates the zip-code-level baseline results. It also addresses concerns that the observed heterogeneity in monetary policy transmission might be driven by mismeasurement of housing cash outflows from mortgage or tax-related cash flows.

[INSERT TABLE 7 HERE]

Table 7 reports regressions of property-level transaction price sensitivity to FFR changes across properties with varying rental yields. The dependent variable is the cumulative two-year net price change, measured as the ratio of the actual transaction price in year t to the expected transaction price in year $t-2$ minus one. Expected prices are derived from price hedonic regressions using actual transaction prices of comparable properties, as described in Section II.C. Ex-ante property-level rental yield—negatively related to duration as documented in Internet Appendix A.A.5 and Greenwald et al. (2021)—serves as the property-level measure of housing duration.

Columns 1 and 2 reproduce the zip-code baseline analysis with the similar specifications. The estimates imply that following a 100 bps decline in the FFR, a property with a one-standard-deviation higher rental yield (≈ 0.072) have a higher transaction price increase by around 1.5 percentage points. This effect is both statistically and economically significant.

Columns 3 and 4 add mortgage-related controls: log annual mortgage payment and the loan-to-value (LTV) ratio, respectively, along with their interactions with FFR changes. Both specifications show that properties with larger mortgage payments or higher LTVs are themselves more sensitive to interest rate changes. Importantly, the coefficients on the FFR–rental-yield interaction become more

[11] To construct the housing duration measure at the zip-code level, I aggregate property-level transaction prices and listing rents following Zillow's published methodology. The Zillow methodology for rent indices is described at https://www.zillow.com/research/methodology-zori-repeat-rent-27092/, and for house price indices at https://www.zillow.com/research/zhvi-methodology-2019-deep-26226/. Specifically, I calculate the average of the middle 30% (35th–65th percentile) of asking rents and valid transaction prices to obtain representative mean rents and prices for each zip code and year. Realized rent growth, combined with mean house prices, is then used to construct the housing duration measure as detailed in Section II.B.

negative, suggesting that mortgage obligations do not attenuate the heterogeneity. If anything, omitting mortgage outflows understates the degree to which short-duration properties are more sensitive to monetary policy.

Columns 5 and 6 incorporate tax-related controls: log annual tax payment and the tax-to-value ratio, together with their interactions with FFR changes. The results again leave the main effect intact. The interaction between FFR changes and rental yield remains significantly negative, reinforcing that the higher interest rate sensitivity of shorter-duration (higher-yield) properties is not an artifact of ignoring tax-related outflows.

Overall, the property-level results confirm the main finding: short-duration properties exhibit higher price sensitivity to monetary policy changes, and this result cannot be attributed to mismeasurement of mortgage or tax-related cash flows.

D. Evidence of Reaching-for-Income Behavior in Housing Markets

To investigate whether reaching-for-income behavior contributes to the heterogeneity in house price sensitivity across various market segments, in this section, I will first examine whether lower interest rates increase the likelihood of properties being purchased for rental purposes, which I call "buy-to-rent" (BTR). Then, I will study the impact of this particular housing investment activity on the heterogeneity of monetary policy transmission to house prices across markets with varying housing duration.

D.1. Identifying Reaching-for-Income Housing Investment Activity

Using housing transaction records and historical tax assessment data from ATTOM, I identify buy-to-rent (BTR) transactions. The BTR investments are intended for long-term rental income rather than short-term capital gains. For this reason, I require a minimum *ex-post* property holding length of two years to be identified as a BTR transaction. This rule will help filter out those short-term investors, such as house flippers. Then, for each transaction, I verify whether the property is non-owner-occupied within two years of purchase. Owner-occupancy status is reported directly in the historical tax assessment data or, when missing, inferred by comparing the property and mailing addresses.[12]

[12] If the property and mailing addresses differ in a given year, I classify the property in that year as non-owner-occupied. If both the occupancy status and mailing address are missing, I assume owner-occupancy. This rule biases against identifying BTR and thus will only underestimate the effect.

A transaction is classified as BTR if the purchased property is non-owner-occupied in year $t+1$, regardless of its status in purchase year t. Thus, if a property is non-owner-occupied at purchase, it must retain the non-owner-occupied status in the subsequent years.[13] Conversely, if the property is owner-occupied at purchase, it must switch to non-owner-occupied within two years after the purchase to be classified as BTR.[14]

While non-owner-occupied status may occasionally reflect vacation homes rather than rental properties, this concern is limited. First, only a small fraction of vacant homes are seasonal or vacation units.[15] Moreover, vacation homes do not typically require a separate mailing address for receiving tax documents, as the homeowners still have access to the property. To more rigorously validate the classification, I conduct robustness checks by linking transactions to Altos rental listing data and redefining BTR transactions as properties listed for rent within 24 months of purchase.[16] I obtain consistent results.

To formally test for reaching-for-income behavior, I estimate the following specification:

$$\begin{aligned}\mathbb{1}\{BTR\}_{i,z,c,t} = \alpha + \beta\, \Delta r_{[t-h-1,\,t-h]} \times \mathrm{RY}_{i,\,t-h-1} + \delta\, \mathrm{RY}_{i,\,t-h-1} \\ + \Gamma' X_{i,t} + \zeta_c \times \theta_t + \lambda_z + \epsilon_{i,z,c,t},\end{aligned} \tag{24}$$

where the dependent variable $\mathbb{1}\{BTR\}_{i,z,c,t}$ equals one if property i in zip code z, county c, and year t is classified as buy-to-rent, and zero otherwise. $\Delta r_{[t-h-1,\,t-h]}$ measures the change in interest rates h years prior to transaction t. The baseline analyses use the FFR as the interest rate measure, with robustness checks based on changes in the 30-year mortgage rate (see Internet Appendix). $\mathrm{RY}_{i,\,t-h-1}$ denotes the ex-ante rental yield for property i, estimated via hedonic regression approach detailed in Section II.C.

The vector $X_{i,t}$ includes property characteristics used in the rental yield estimation, which capture attributes correlated with BTR probability. The county-by-year fixed effects, $\zeta_c \times \theta_t$, control for time-

[13] If a buyer lists a different mailing address in year t but moves into the property in year $t+1$, I classify the case as a migrant rather than a BTR investor.

[14] Primary-residence mortgages typically require occupancy within 60 days of closing and prohibit conversion to rental use within the first 12 months. My definition, therefore, includes buyers who initially claim primary residence to obtain favorable mortgage terms but subsequently convert the property to rental use. Also, the definition captures the investors who temporarily occupy a property during renovations before renting it out.

[15] Only ≈3.5% of vacant homes are seasonal, vacation homes based on an study using U.S. Census data.

[16] Rental listing records provide direct evidence that the property was purchased for rental purposes. Results using this alternative measure are consistent: when interest rates decline, high-rental-yield properties are disproportionately more likely to be purchased for rental use, corroborating the reaching-for-income hypothesis.

varying county characteristics, and zip code fixed effects, λ_z, absorb time-invariant zip-code characteristics. Identification thus arises from variation in rental yields across properties and zip codes over time.

With this specification, the coefficient of interest, β, measures the heterogeneity in the sensitivity of BTR activity to interest rate changes across properties with different ex-ante rental yields. A negative estimate of β implies that interest rate cuts disproportionately increase the probability of BTR activity for high-rental-yield properties, providing direct evidence of reaching-for-income behavior in housing markets.

D.2. High Buy-to-Rent Probability for High Rental Yield Properties as Interest Rates Decrease

Table 8 indicates that as interest rates decrease, higher-rental-yield properties are more likely to be purchased for rent (BTR). Specifically, the table reports transaction-level regressions where the dependent variable equals one if a purchase is buy-to-rent (BTR). The key independent variable is the interaction between the property's *ex-ante* rental yield, $RY_{i,t-h-1}$, and the change in the FFR during the transaction year (Columns 1–2) or the prior year (Columns 3–4). All specifications include property characteristics, county-by-year fixed effects, and zip code fixed effects. Even-numbered columns additionally control for zip-level economic characteristics and their interactions with ΔFFR.

[INSERT TABLE 8 HERE]

Two main patterns emerge. First, higher-yield properties are more likely to be purchased for rental on average. The coefficient on $RY_{i,t-h-1}$ is positive and significant across columns (e.g., 0.615 in Column 1), indicating that a one–standard-deviation increase in rental yield (≈ 0.075) is associated with a 4.6 percentage-point (pp) higher BTR probability. Second—and central to the reaching-for-income hypothesis—the interaction term $\Delta r_{[t-h-1,t-h]} \times RY_{i,t-h-1}$ is significantly negative in all specifications. It implies that BTR probability rises disproportionately for high-yield properties when interest rates fall. Specifically, Columns 2 and 4 show that a 100 bps FFR cut raises the likelihood that a one–standard-deviation higher-yield property is purchased for rent by about 0.95 pp (contemporaneous) and 0.9 pp (lagged), respectively. Relative to the average BTR probability of 4.6% for properties with rental yields one standard deviation above the mean, these effects represent an increase of about 21%. These effects are unlikely to be driven by stronger rental demand in high-yield markets, since the specifi-

cations already interact ΔFFR with zip-code demand proxies such as rental vacancy rates and local demographics.

Columns 5–8 instrument ΔFFR with orthogonalized monetary policy surprises (MPS) from Bauer and Swanson (2023a). The IV estimates on the interaction term remain significantly negative, confirming that the effect of rate cuts on BTR probability is concentrated in high-yield properties and is robust to using unanticipated monetary policy shocks.

Overall, Table 8 provides direct evidence of reaching-for-income behavior in housing markets. Lower interest rates make higher-yield properties more likely to be purchased for rental income than lower-yield properties. This pattern is not explained by local rental demand or other fundamentals, and is consistent with the broader evidence that declines in interest rates increase demand for income-generating assets (Daniel et al., 2021; Gargano and Giacoletti, 2022). Moreover, these results provide initial evidence that rental-income-driven investment behavior can shape local house price dynamics as interest rates change, which will be particularly examined in the next section.

D.3. Realized Returns of BTR Investors

The "reaching-for-income" hypothesis posits that when interest rates fall, investors who live off income tilt toward income-generating assets, such as high-yield stocks or properties, because the income from savings accounts and short-term bonds falls with rates. If this behavior reflects a preference for short-term cash flows, these investors may accept lower realized total returns in exchange for higher near-term income when rates fall.

To test this implication, I examine realized total returns for BTR buyers who both purchase and subsequently sell a BTR property. Among all BTR transactions, I restrict the sample to two-way transactions with observed and valid resale records. The realized total return is defined as the sum of the realized capital gain and the rental income expected over the holding period. Capital gains are measured as the ratio of resale to purchase prices of the same property.[17] Specifically, for each property i

[17] By referring Goldsmith-Pinkham and Shue (2023); Kermani and Wong (2024); Baldauf, Favilukis, Garlappi, and Zheng (2025), I construct realized capital gains from the two-way transactions. First, for each purchase transaction, I identify its subsequent ownership-end transaction and retain the pair only if both purchase and resale are valid, as described in Internet Appendix Section B. Second, I require a minimum holding period of six months. Third, I verify buyer-seller identity consistency by fuzzy-matching names across purchase and resale records, requiring at least one match above a 60 similarity score using the `partial_token_sort_ratio` algorithm in the `thefuzz` Python package.

purchased at year-month b and sold at year-month s, the realized gross return is

$$\text{Ret}_{i,b,s} = \underbrace{\frac{P_{i,s}}{P_{i,b}}}_{\text{realized capital gain}} + \underbrace{\frac{\sum_{\tau=b+1}^{s-1} \widehat{\text{Rent}}_{i,\tau}}{P_{i,b}}}_{\text{imputed rental yield over holding period}},$$

where $P_{i,b}$ and $P_{i,s}$ are the observed actual purchase and sale prices, respectively, and $\widehat{\text{Rent}}_{i,\tau}$ denotes the expected monthly rental income the buyer would receive were the property rented, which is obtained from the rent hedonic estimations described in Section II.C. The rental-yield component aggregates these imputed rents over the realized holding period (excluding the purchase and sale transaction months) and scales by the observed purchase price. I then annualize the realized total returns using the holding length information.

[INSERT FIGURE 8 HERE]

Figure 8 illustrates how realized returns of BTR investors vary with rental yields following a 100-bp cut in the FFR one year prior to the purchase. It reveals that after the rate cut, BTR properties in higher rental yield deciles will have lower realized total returns. Specifically, properties are sorted into deciles by *ex-ante* rental yield measured prior to the rate change. For each decile, the y-axis reports the change in realized annual return (percentage points) associated with a 100-bps FFR cut. Panel A uses raw changes in FFR, while Panel B instruments FFR with the monetary policy surprises (MPS) constructed by Bauer and Swanson (2023a).

Panel A reveals a monotonic decline in realized returns as rental yields increase: following a 100 bps cut in the FFR, properties in the lowest rental-yield decile experience a reduction in realized returns of about 1.5%, while those in the highest decile experience a nearly 4.5% realized return decrease. Panel B shows a similar pattern when instrumenting FFR with MPS, but the magnitudes are substantially larger, ranging from a 6% decline for low-yield properties to nearly 12% for high-yield properties.[18] These results underscore that BTR investors in high-yield markets earn lower realized returns after rate cuts, consistent with a preference for near-term rental income even at the expense of total returns.

[INSERT TABLE 9 HERE]

[18] Raw FFR changes may reflect contemporaneous macro conditions—for example, rates may fall when aggregate rental yields are high—so the MPS instrument helps identify the causal effect of unexpected policy changes.

Table 9 presents the formal regression analysis of realized returns for BTR investors across properties with varying rental yields purchased under different monetary policy environments. The results consistently indicate that when interest rates decline, investors purchasing higher-yield properties subsequently earn lower realized returns than those purchasing lower-yield properties.

Panel A uses changes in the FFR as the measure of monetary policy shocks. On average, declines in the FFR are associated with lower realized returns for BTR investors. More importantly, the interaction between FFR changes and rental yield is significantly positive across Columns 2 to 6, indicating that rate cuts are associated with disproportionately lower realized returns for properties with higher *ex-ante* rental yields relative to those with lower yields. Specifically, Column 2 shows that, with county-by-year and zip-code fixed effects, a one-standard-deviation increase in rental yield (≈0.082) corresponds to about a 0.4 percentage point reduction in realized returns when the FFR decreases by 100 bps prior to purchase. The results remain robust to the inclusion of controls for holding length, market-timing effects, and local economic characteristics, as well as their interactions with FFR changes in Columns 3 to 6.

Panel B instruments FFR changes with the MPS constructed by Bauer and Swanson (2023a) to address concerns about potential endogeneity. The findings are consistent with those in Panel A, but the magnitudes of the interaction terms are substantially larger. The results suggest that the effect of interest rate cuts on realized returns of high-yield properties is even more pronounced when focusing on plausibly exogenous monetary policy shocks.

[INSERT FIGURE 9 HERE]

Figure 9 shows how the realized returns of BTR investors respond to a 100 bps decline in the FFR across property holding horizons and *ex-ante* rental yields (RY). Although the baseline definition of BTR investors requires a minimum holding period of two years, I relax this restriction here to illustrate the dynamics for very short-horizon investors, such as house flippers.[19]

Using raw FFR changes, Panel A indicates that at the one-year horizon, high-yield properties earn higher realized returns relative to low-yield properties following a rate cut. This finding echoes the baseline result that high-yield (short-duration) properties appreciate more strongly in the immediate aftermath of monetary easing. However, this advantage vanishes quickly: beyond two years of

[19]This relaxation is purely illustrative; all other analyses maintain the two-year definition. One-year holders are not classified as BTR because their investment strategies are more plausibly driven by capital gains than by rental income.

holding, high-yield properties underperform their low-yield counterparts, and the return gap widens monotonically with horizon length, leaving long-run realized returns substantially lower than for low-yield properties. Panel B instruments FFR changes with the MPS from Bauer and Swanson (2023a) and produces even more negative estimates, suggesting that OLS coefficients may be attenuated by the endogeneity of monetary policy changes.

Overall, the figure demonstrates that investor tilts toward high-yield properties after rate cuts are unlikely to reflect forward-looking rational motives. If such motives dominated, high-yield properties should outperform relative to low-yield properties over longer horizons. Instead, the evidence is more consistent with a reaching-for-income mechanism: when rates fall, investors disproportionately chase income-generating assets that provide relatively high near-term rental income, even though this behavior entails lower total returns in the long run.

E. Reaching-for-Income Affect House Price Dynamics

The last section shows that the reaching-for-income investment activity does exist in the housing markets. That is, as the interest rates decrease, housing investors have a stronger preference for income-generating real estate assets and would be more likely to invest in properties with higher rental yield and rent them out. In this section, I further show that this housing investment motivation will have a price impact and, in the end, will drive the abnormal relationship of short duration and high house price sensitivity to interest rate changes documented in Section III.B.

E.1. Property Transition between Owner- and Renter-Occupied Status

A potential concern is that although high-rental-yield properties are more likely to be purchased for rental purposes when interest rates decline, this pattern may not necessarily generate broad price effects. In particular, the mechanism does not necessarily imply that short-duration (high-yield) markets will become more sensitive to interest rate changes. For instance, if BTR investors primarily target properties that are already renter-occupied, increased investor demand for rental houses would not put direct upward pressure on overall house prices.

[INSERT TABLE 10 HERE]

Table 10 addresses this issue by examining property transitions between owner- and renter-occupied status. Panel A shows that high-rental-yield properties are, on average, significantly more likely to

transition from owner to renter occupancy. Importantly, interest rate cuts amplify this tendency: following a decline in the FFR, high-yield properties exhibit an even higher probability of being converted to rental occupancy, with effects persisting up to two years after the shock. Using the MPS constructed by Bauer and Swanson (2023a) to instrument for FFR changes produces similar results, underscoring that the results are not driven by endogenous policy rate movements.

Panel B reports the reverse transition from renter to owner occupancy. First, properties with higher rental yields are less likely to transition into owner occupancy on average. Second, rate cuts further lower the likelihood: contemporaneous and lagged FFR cuts significantly reduce the probability that high-yield properties shift into owner use. Again, instrumenting with MPS corroborates the baseline findings.

In summary, the evidence in Table 10 indicates that declines in interest rates reshape the composition of the housing stock. High-rental-yield properties are increasingly likely to become renter-occupied and are less likely to become owner-occupied. These patterns are consistent with the reaching-for-income mechanism: investors facing lower interest rates disproportionately target short-duration, high-yield properties, exerting price pressure in the high-yield markets. Meanwhile, the results may rule out the alternative explanation that rising demand from first-time homebuyers drives the price pressure in high-yield markets. If that were the case, one would expect to observe greater transitions of such properties from renter to owner occupancy following interest rate cuts. The asymmetric transition dynamics thus provide direct evidence that investor-driven reaching-for-income behavior, rather than heightened owner demand, underlies the observed market dynamics in response to monetary policy.

E.2. House Price Sensitivity across Local Buy-to-Rent Activity

To test whether reaching-for-income activity drives the abnormal sensitivity of short-duration housing markets to interest rate changes, I exploit variation in local BTR intensity. Specifically, I sort zip codes into quintiles of *ex-ante* BTR transaction ratios and compare the house price response of short- and long-duration markets within each BTR quintile. This approach isolates the extent to which BTR activity amplifies the heterogeneity in price responses across housing duration.

[INSERT FIGURE 10 HERE]

Figure 10 shows that although shorter-duration housing markets, on average, respond more strongly

to interest rate cuts than longer-duration markets, this difference is concentrated in areas with high BTR activity. In low-BTR areas, the short-versus-long gap largely disappears, and in some cases, longer-duration markets are slightly more responsive. By contrast, in the highest-BTR quintiles, short-duration markets exhibit substantially greater interest rate sensitivity, consistent with reaching-for-income activity amplifying local price reactions.

Panels A and B present results for a 100-basis-point cut in the FFR, while Panels C and D show responses to a 100-basis-point decline in the 30-year mortgage rate. At the contemporaneous horizon ($h = 0$, Panels A and C), short-duration markets unconditionally have higher price growth in response to rate cuts, but conditional on BTR intensity, this pattern only holds in high-BTR areas. At the two-year horizon ($h = 1$, Panels B and D), the findings are consistent: the high price response of short-duration markets is concentrated in high-BTR areas, and the short-versus-long-duration gap increases monotonically with BTR intensity.

Overall, these results indicate that reaching-for-income activity is an important mechanism behind the abnormal responsiveness of short-duration housing markets. Nonetheless, the persistence of higher sensitivity even after conditioning on BTR suggests that other forces could also contribute, providing a promising direction for future research.

[INSERT TABLE 11 HERE]

Table 11 reports regression estimates of house price sensitivity to monetary policy changes across zip codes with varying housing duration and BTR intensity. Columns 1–4 use changes in the FFR as the interest rate measure, while Columns 5–8 use changes in the 30-year mortgage rate. Columns 1, 2, 5, and 6 present contemporaneous responses ($h = 0$), while Columns 3, 4, 7, and 8 report cumulative responses over a two-year horizon ($h = 1$).

The results suggest that reaching-for-income behavior by housing investors largely explains the high interest rate sensitivity in short-duration markets. In the baseline specification without controls for BTR intensity (Columns 1, 3, 5, and 7), shorter-duration markets consistently show stronger price responses to rate cuts, with magnitudes comparable to the baseline estimates in Table 4.

Once local BTR intensity is taken into account (Columns 2, 4, 6, and 8), the pattern changes substantially. In low-BTR areas, the sensitivity gap between short- and long-duration markets largely disappears. By contrast, in high-BTR areas, short-duration markets become disproportionately more

sensitive to rate changes, as indicated by the significantly positive coefficients on the triple interaction term $\Delta r_{[t-1,t]} \times \text{Duration}_{z,t-1} \times \text{BTR\%}_{z,t-1}$.

Specifically, at the contemporaneous horizon ($h = 0$), the coefficients on $\Delta r_{[t-1,t]} \times \text{Duration}_{z,t-1}$ are insignificant in Columns 2 and 6, implying that once BTR activity is accounted for, short-duration markets no longer exhibit greater sensitivity to interest rate changes. In fact, Column 6 shows a negative (though insignificant) coefficient, suggesting that long-duration markets may even respond more strongly when BTR activity is minimal. At the two-year horizon ($h = 1$), the coefficients on $\Delta r_{[t-1,t]} \times \text{Duration}_{z,t-1}$ are 47% to 68% smaller than in the baseline. The results again point to BTR intensity as an important driver of the abnormal heterogeneity in market responses to interest rate changes.

In summary, the results highlight reaching-for-income behavior as a key mechanism behind the heterogeneous transmission of monetary policy to local house prices. When rates fall, investors with strong preferences for rental income disproportionately enter high-yield, short-duration markets. Their inflows raise local prices and lower discount rates, particularly for high-yield, short-duration markets, which in turn generate the high interest rate sensitivity of short-duration markets documented in the baseline results.

IV. Conclusion

My study uncovers a striking anomaly in the transmission of monetary policy to housing markets: properties characterized by shorter cash flow durations exhibit significantly greater sensitivity to monetary policy shocks compared to those with longer durations, a finding contrary to conventional financial theory. Leveraging a novel zip-code-level measure of housing duration, meticulously constructed from detailed property-level transaction and rental listing data, I provide compelling evidence supporting this divergence and elucidate its underlying mechanisms.

Specifically, I demonstrate that buy-to-rent (BTR) investors exhibit pronounced "reaching-for-income" behavior, preferentially targeting properties with high rental yields and shorter cash flow durations in response to monetary policy easing. This investor-driven demand significantly amplifies house price sensitivity in these markets, challenging traditional duration-based asset pricing models. In contrast, areas with low BTR investment activity display price sensitivities aligned with conventional theory, further emphasizing the role of investment behavior in shaping monetary policy transmission to real

estate prices.

My empirical findings hold robust across various monetary policy shock measures, alternative interest rate indicators, and extensive local economic controls, reinforcing the robustness of my conclusions. The analysis leverages granular, property-level transaction and rental data, providing compelling evidence that investor-driven dynamics, particularly "reaching-for-income" behavior, are critical determinants of monetary transmission to real estate markets.

Appendix: Variable Definitions

Variable	Definition	Source
Interest rate change and monetary policy shock variables		
$\Delta r_{[t-1,t]}$	The annual change in the federal funds rates (FEDFUNDS) from the end of year $t-1$ to t.	FRED St. Louis Fed
$\Delta r^{30Y}_{[t-1,t]}$	The annual change in the 30-year mortgage rates (MORTGAGE30US) from the end of year $t-1$ to t.	FRED St. Louis Fed
1-Year Yield Surprise	$$Surprise_t = y_{t,1} - f_{t-1,1}\,,$$ where $y_{t,1}$ is the 1-year Treasury yield at year t, and $f_{t-1,1}$ is the 1-year forward rate: $$f_{t-1,1} = \frac{(1+y_{t-1,2})^2}{(1+y_{t-1,1})} - 1\,,$$ where $y_{t-1,2}$ is the 2-year Treasury yield at $t-1$. The measure captures the deviation between actual and expected yield.	FRED St. Louis Fed
BS MPS, BS MPS_ORTH	The raw (MPS) and orthogonalized monetary policy surprise series (MPS_ORTH) developed by Bauer and Swanson (2023b). To construct the raw MPS measurement, Bauer and Swanson (2023b) uses the first four quarterly Eurodollar futures contracts, ED1-ED4, and gets the first principal component of the changes in these four futures rates around the windows of monetary policy announcement events. They expand the set of monetary policy announcement events to include press conferences, speeches, and testimony by the Federal Reserve chair, in addition to the FOMC announcements. The orthogonalized monetary policy surprise (MPS_ORTH) measure is computed as the residuals from regressing raw MPS on the six macro and financial variables.	Bauer and Swanson (2023b)

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Variable	Definition	Source
JK PM MPS	Monetary Policy and Central Bank Information shocks obtained with simple ("Poor Man's") sign restrictions	Jarociński and Karadi (2020)
JK Median MPS	Monetary Policy and Central Bank Information shocks obtained with the median rotation that implements the sign restrictions	Jarociński and Karadi (2020)
Zip-code level variables		
$\Delta HPI_{z,[t-1,t+h]}$	House price growth in zip code z: $$\Delta HPI_{z,[t-1,t+h]} = \frac{\text{HPI}_{z,t+h}}{\text{HPI}_{z,t-1}} - 1\,,$$ where $HPI_{z,t}$ is the Zillow Home Value Index (ZHVI) at zip z in year t.	Zillow
$\text{Duration}_{z,t}$	Housing cash flow duration measurement constructed with the assumed holding horizon of five years. We also constructed alternative duration measures using a 10-year horizon (Duration 10Y) and using the LASSO regression (Duration $5Y^{LASSO}$ and Duration $10Y^{LASSO}$). See Section II.B for construction details.	Estimation
$\text{RY}_{z,t}$	Gross rental yield in zip code z in year t defined as the median rent in that zip code divided by the median home price, calculated as follows: $$\text{RY}_{z,t} = \frac{\text{Median Gross Rent}_{z,t} \times 12}{\text{Median Home Value}_{z,t}}\,,$$ where $\text{Median Gross Rent}_{z,t}$ and $\text{Median Home Value}_{z,t}$ are the median gross rent and the median home value in zip code z for the year t, respectively. Both variables are obtained from the DP04 table in the American Community Survey data conducted by the U.S. Census Bureau.	U.S. Census Bureau

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Variable	Definition	Source
log(rental yield)	Natural logarithm of the rental yield at the zip-code-year level	U.S. Census Bureau
log(rent)	Natural logarithm of gross median rent	U.S. Census Bureau
log(income)	Natural logarithm of median household income (B19013_001)	U.S. Census Bureau
Income growth	The annual change of median household income (B19013_001)	U.S. Census Bureau
log(population)	Natural logarithm of the total population (B01003_001)	U.S. Census Bureau
Population growth	The annual change of total population (B01003_001)	U.S. Census Bureau
% below 40	The number of the population below 40 divided by the total population	U.S. Census Bureau
% below 40 growth	The annual change of % below 40	U.S. Census Bureau
% above 60	The number of the population above 60 divided by the total population	U.S. Census Bureau
% above 60 growth	The annual change of % above 60	U.S. Census Bureau
Labor force rate	The number of population in the civilian labor force (b23025_003) divided by the total number of the population 16 years and over (b23025_001)	U.S. Census Bureau
Labor force rate growth	The annual change of labor force rate	U.S. Census Bureau
Unemployment rate	The number of unemployed people (b23025_005) as a percentage of the civilian labor force (b23025_003)	U.S. Census Bureau
Unemployment rate growth	The annual change of unemployment rate	U.S. Census Bureau
Homeownership rate	The number of owner-occupied housing units (b25003_002) divided by the total housing units in the zip code (b25003_001)	U.S. Census Bureau
Homeownership rate growth	The annual change of homeownership rate	U.S. Census Bureau
Rental vacancy rate	The percentage of vacant housing units in rental houses (DP04_0005)	U.S. Census Bureau
Log(income-to-price ratio)	The natural log of the ratio of median household income (B19013_001) to median home value from DP04 table in the American Community Survey data	U.S. Census Bureau

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Variable	**Definition**	**Source**
% $\text{BTR}_{z,t}$	The percentage of buy-to-rent (BTR) transactions in a zip code and year. The detailed identification procedure for BTR is discussed in Appendix Section I.	Altos and ATTOM

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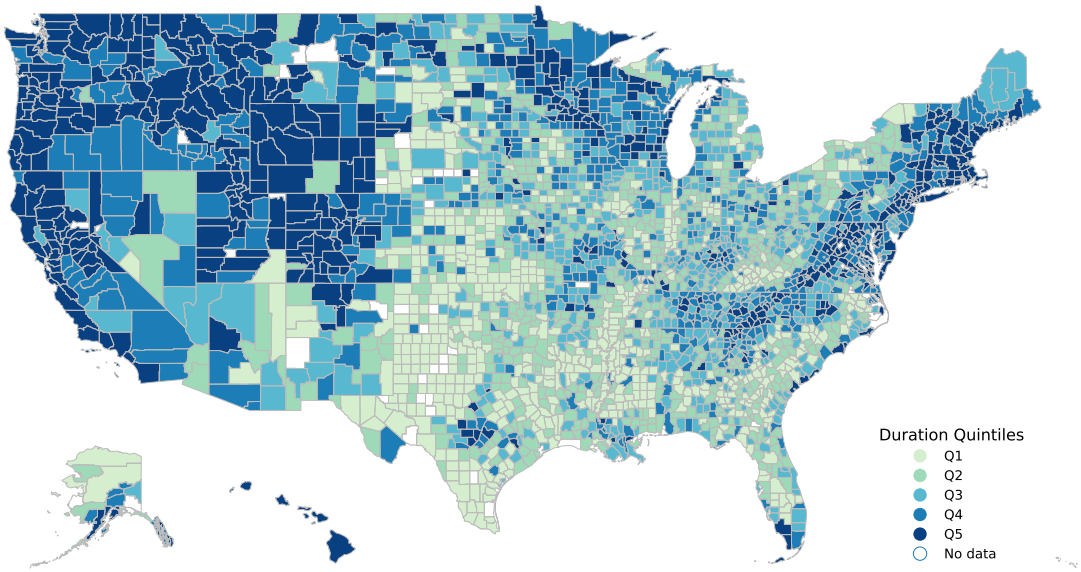
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Figure 2. County-level Geographic Heterogeneity in Housing Duration

Panel A: Duration



Panel B: Rental Yield

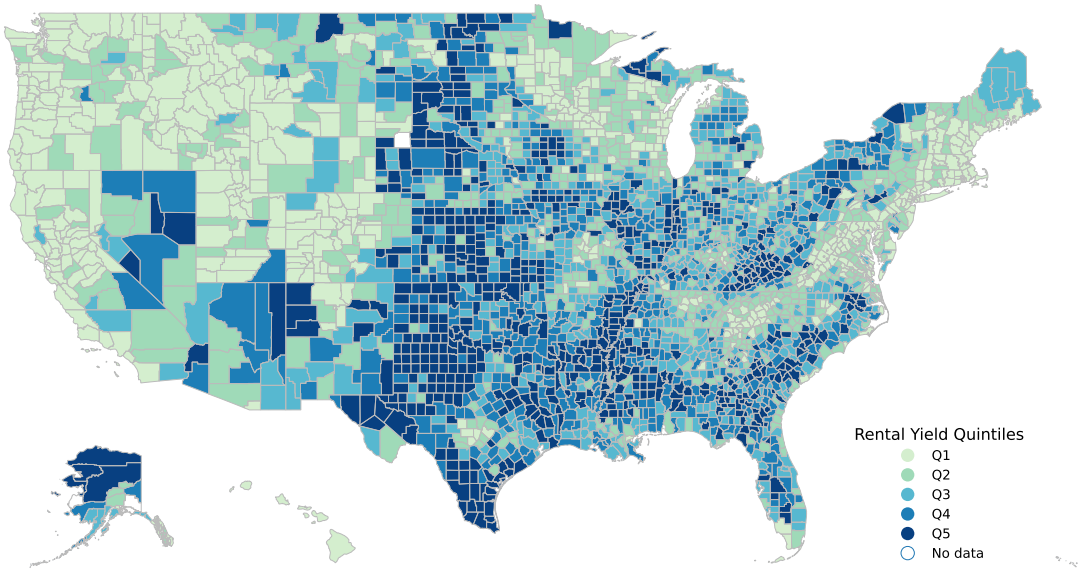


Figure 2 presents county-level geographic heterogeneity in housing duration (Panel A) and rental yield (Panel B). Both panels categorize counties into quintiles (Q1 to Q5), with darker shading indicating higher quintile values. Panel A illustrates the geographic distribution of housing durations. The detailed estimation procedures for housing duration at the zip-code level are provided in Section II.B. Panel B shows the distribution of rental yields, defined as the ratio of annualized median rent to property values, calculated from the American Community Survey (ACS) data. County-level measures for both housing duration and rental yield are computed by averaging across all available zip codes and years within each county. Counties without sufficient data are shown in white.

Figure 3. Percentage of Explained Housing Duration Variation

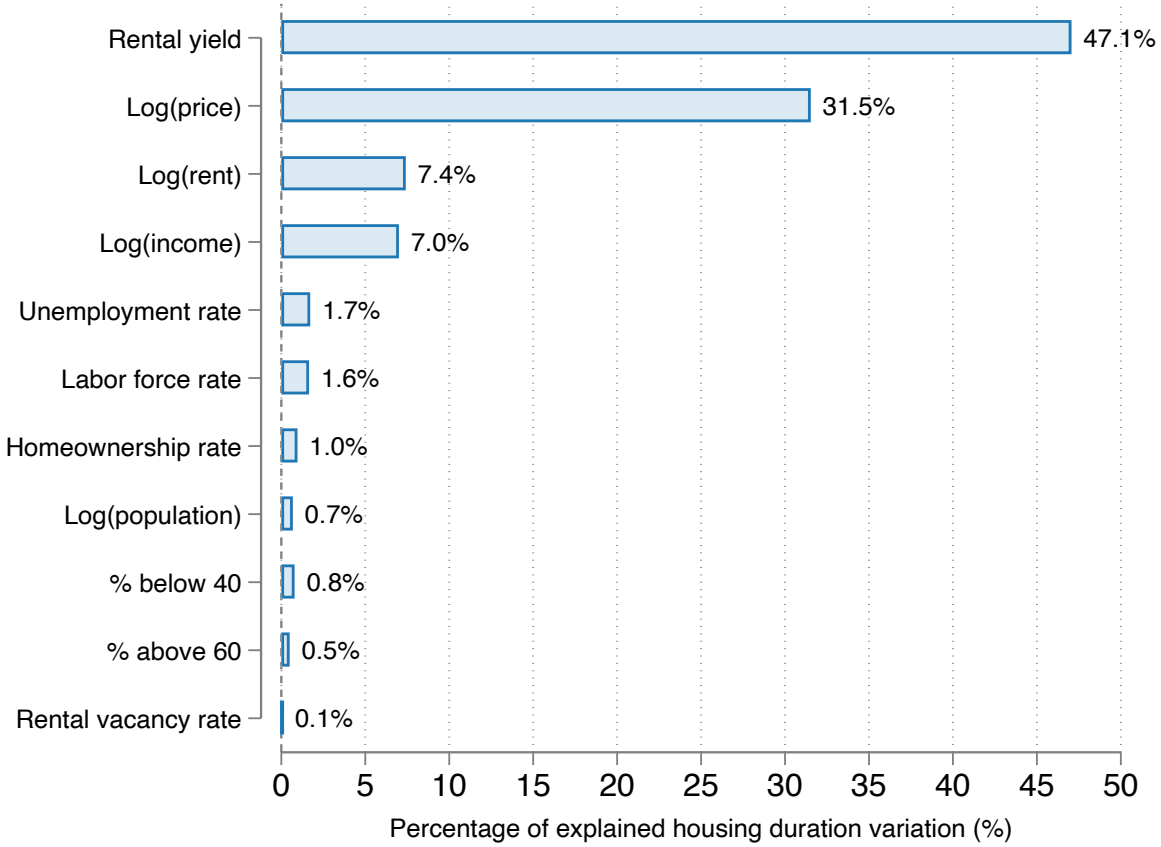


Figure 3 illustrates the proportion of housing duration variation attributed *uniquely* to each explanatory variable, estimated from a dominance analysis. The dominance analysis is a methodology designed to assess the relative importance of explanatory variables by decomposing the total variation explained in a regression model into unique contributions from each factor. Specifically, this analysis employs the Shapley value decomposition technique, derived from cooperative game theory, to allocate the explained variance among explanatory variables based on their average marginal contributions across all possible model combinations. The x-axis shows the percentage of explained housing duration variation, while the y-axis lists the examined local characteristics.

Figure 4. Heterogeneity in House Price Sensitivity across Housing Duration Quintiles

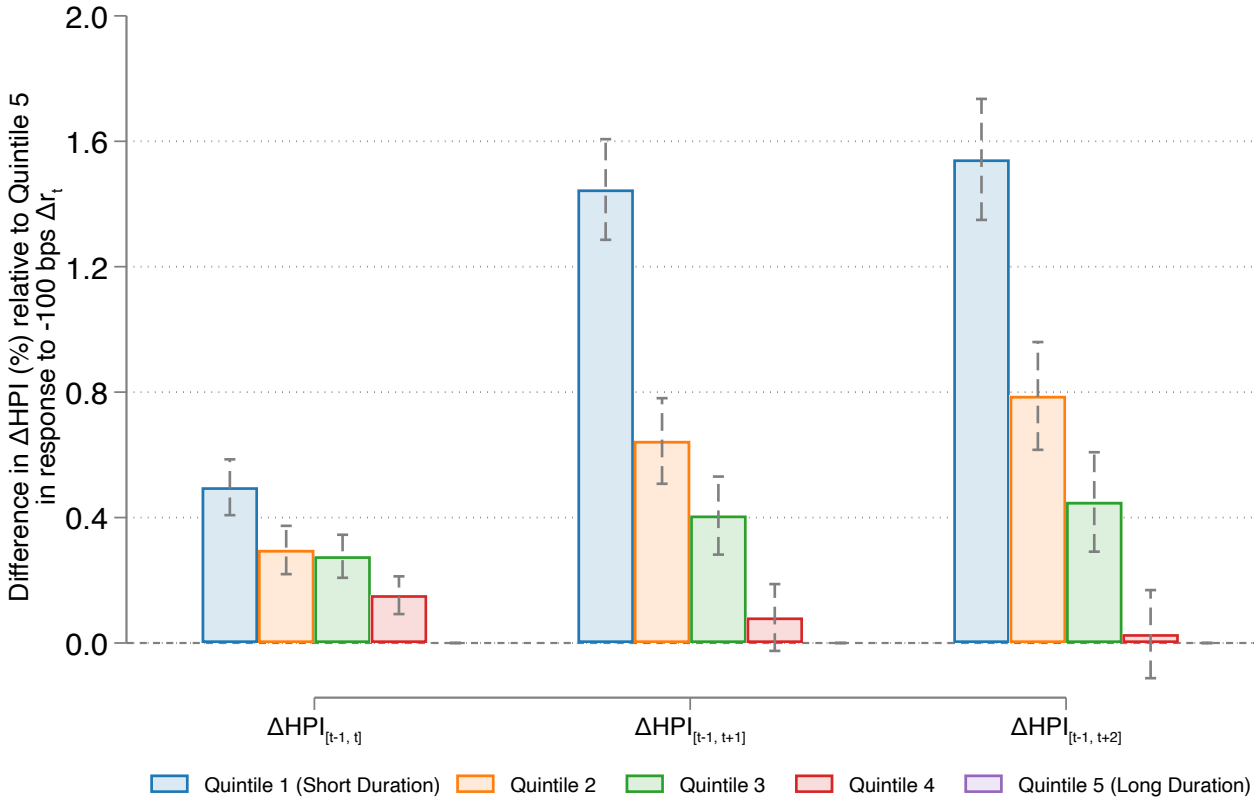


Figure 4 presents the heterogeneous responses of house prices across these duration quintiles following a 100 basis-point (bps) reduction in the federal funds rate (FFR). Specifically, the figure highlights the relative differences in house price changes over horizons of 1, 2, and 3 years for each duration quintile compared to quintile 5 (baseline group). Each year, zip codes are categorized into five housing duration quintiles, which are represented by five bars respectively. Quintile 1 represents zip codes with the shortest housing cash flow durations, while quintile 5 includes those with the longest housing durations. The interest rate shock is introduced at horizon 0, representing the period from year $t-1$ to t. The x-axis represents the response horizon h in years following the interest rate change, while the y-axis shows the difference in the cumulative percentage change in house prices over 1-, 2-, and 3-year horizons relative to the quintile 5 (long duration) group. The analysis employs the same regression specification as Column 5 of Table 2 Panel A for each horizon, as presented in the following:

$$\Delta HPI_{z,c,[t-1,t+h]} = \alpha_h + \beta_{1,h}\,\Delta r_{[t-1,t]} \times \text{Duration Quintile}_{z,t-1} + \beta_{2,h}\,\text{Duration Quintile}_{z,t-1} + \zeta_c \times \theta_t + \lambda_z + \epsilon_{z,c,t,h},$$

where $\Delta HPI_{z,c,[t-1,t+h]}$ is the cumulative house price change of zip code z in county c from year $t-1$ to $t+h$. $\Delta r_{[t-1,t]}$ indicates the annual change in the federal funds rate from year $t-1$ to t. $\text{Duration Quintile}_{z,t-1}$ is a categorical variable ranging from 1 to 5, indicating the quintile ranking of housing cash flow duration for zip code z in year $t-1$. The term $\zeta_c \times \theta_t$ represents the county-year fixed effects, and λ_z denotes the zip code fixed effects. The gray-capped error bars indicate 95% confidence intervals. Standard errors are clustered at the zip code level.

Figure 5. Heterogeneity in House Price Sensitivity across Local Economic Characteristics

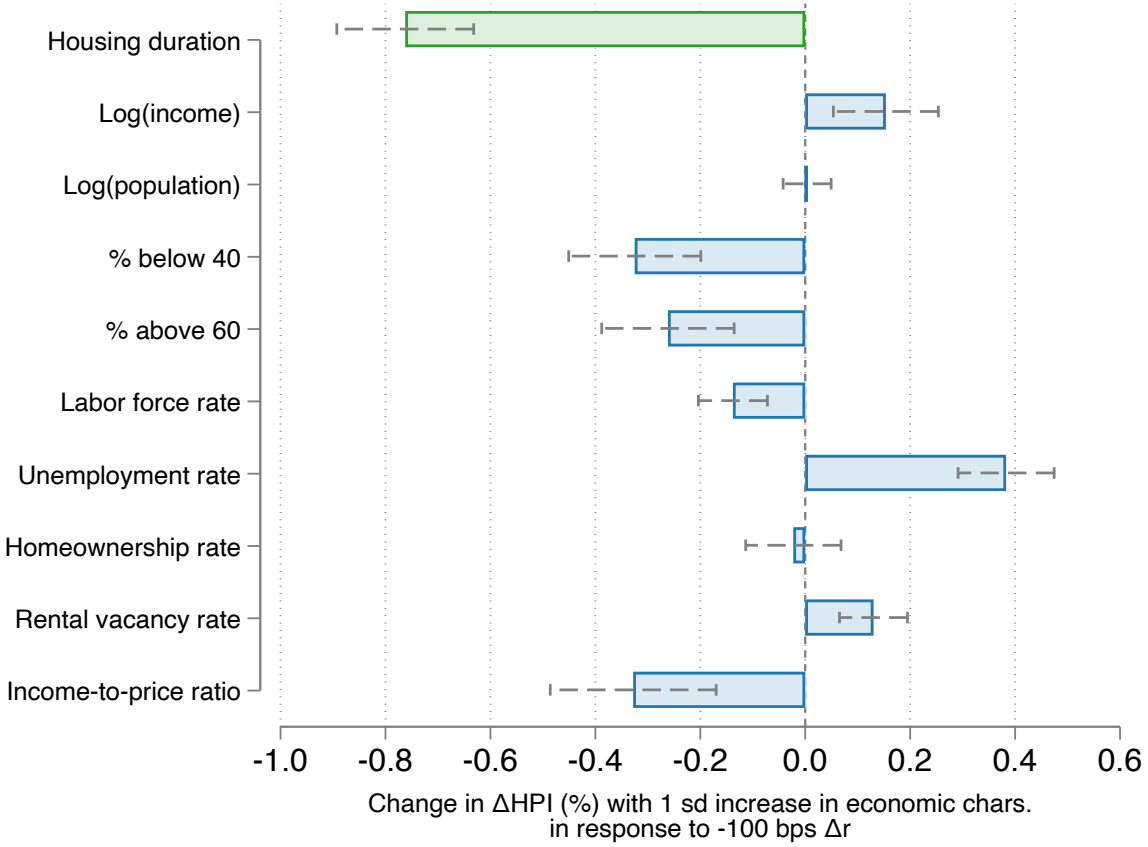


Figure 5 explores the heterogeneous house price response to interest rate changes across diverse zip-code demographic and economic characteristics. Specifically, it illustrates the additional two-year cumulative house price change associated with a one-standard-deviation (sd) increase in each characteristic following a 100-basis-point decrease in the federal funds rate (FFR). The interest rate shock is introduced at horizon 0, representing the period from year $t-1$ to t. The x-axis indicates the additional two-year cumulative house price change, $\Delta HPI_{z,c,[t-1,t+1]}$, associated with a one standard deviation (sd) increase in a specific characteristic following the negative interest rate shock. The y-axis lists the economic characteristics examined. The heterogeneity is estimated using the regression specification employed in Column 3 of Table 3, as indicated in the following:

$$\begin{aligned}\Delta HPI_{z,c,[t-1,t+1]} = \alpha + \beta_1 \Delta r_{[t-1,t]} \times \text{Duration}_{z,t} + B' \Delta r_{[t-1,t]} \times \text{Economic Chars}_{z,t} \\ + \delta \, \text{Duration}_{z,t} + \gamma \, \text{Economic Chars}_{z,t} + \zeta_c \times \theta_t + \lambda_z + \epsilon_{z,c,t},\end{aligned}$$

where $\Delta HPI_{z,c,[t-1,t+1]}$ denotes the two-year cumulative house price change in zip code z, county c, from year $t-1$ to $t+1$, and $\Delta r_{[t-1,t]}$ represents the annual change in the FFR from year $t-1$ to t. The variable $\text{Duration}_{z,t}$ captures housing duration at the zip-code-year level. The term $\zeta_c \times \theta_t$ represents the county-year fixed effects, and λ_z denotes the zip code fixed effects. With the estimated coefficients, the bar value equals $\hat{\beta} \times 1$ sd of Economic Chars. $\times -1\%$. The gray-capped error bars indicate 95% confidence intervals. Standard errors are clustered at the zip code level.

Figure 6. Heterogeneity in House Price Sensitivity across Rental Yield Quintiles

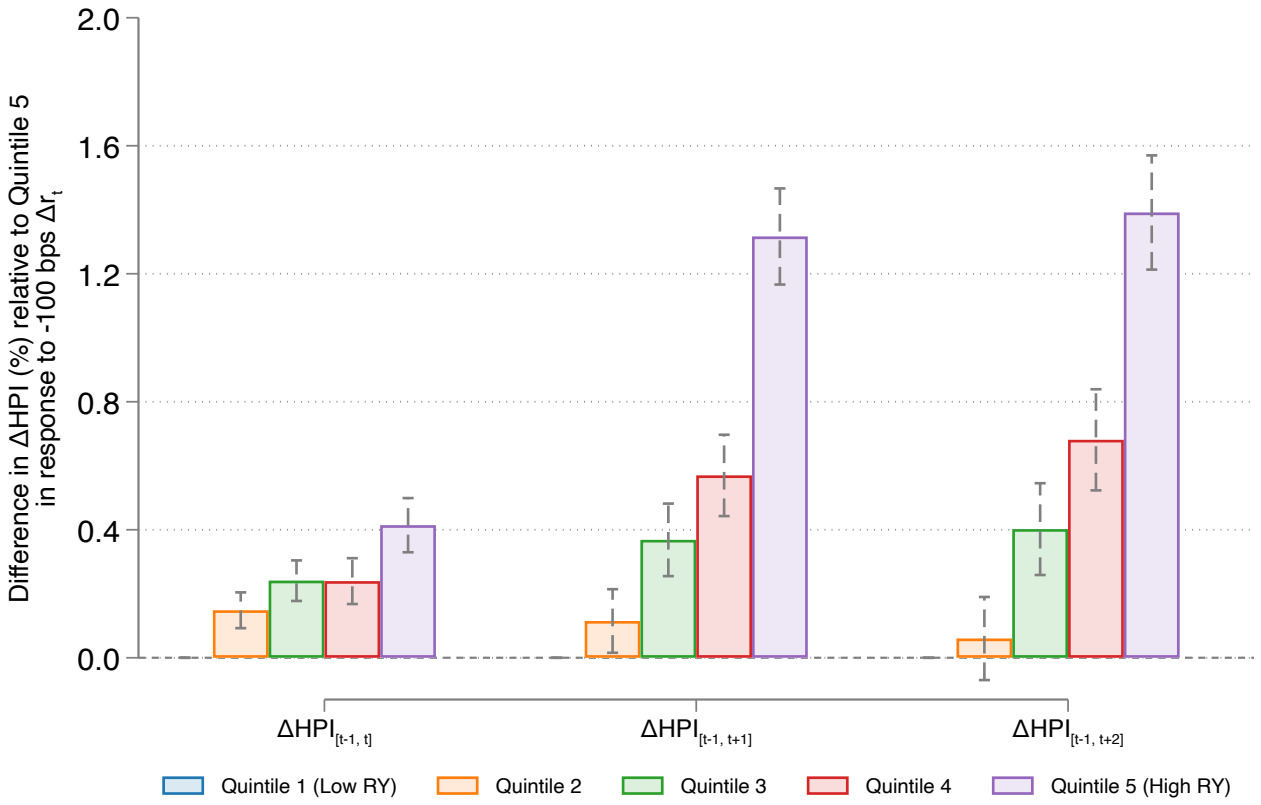


Figure 6 illustrates the differences in house price responses across zip-code rental yield quintiles following a 100 basis-point (bps) decrease in the federal funds rate (FFR), compared to quintile 1 (baseline group). Each year, zip codes are categorized into five rental yield quintiles, which are represented by five bars respectively. Quintile 1 represents zip codes with the lowest rental yield, while quintile 5 includes those with the highest rental yield. The interest rate shock is introduced at horizon 0, representing the period from year $t-1$ to t. The x-axis represents the response horizon h in years following the interest rate change, while the y-axis shows the difference in the cumulative percentage change in house prices over 1-, 2-, and 3-year horizons relative to the quintile 5 (long duration) group. The analysis employs the same regression specification as Column 5 of Table 2 Panel A for each horizon, as presented in the following:

$$\Delta HPI_{z,c,[t-1,t+h]} = \alpha_h + \beta_{1,h}\,\Delta r_{[t-1,t]} \times \mathrm{RY}_{z,t-1} + \beta_{2,h}\,\mathrm{RY}_{z,t-1} + \zeta_c \times \theta_t + \lambda_z + \epsilon_{z,c,t},$$

where $\Delta HPI_{z,c,[t-1,t+h]}$ is the cumulative house price change of zip code z in county c from year $t-1$ to $t+h$. $\Delta r_{[t-1,t]}$ indicates the annual change in the federal funds rate from year $t-1$ to t. $\mathrm{RY}_{z,t-1}$ is a categorical variable ranging from 1 to 5, indicating the quintile ranking of rental yield for zip code z in year $t-1$. The term $\zeta_c \times \theta_t$ represents the county-year fixed effects, and λ_z denotes the zip code fixed effects. The gray-capped error bars indicate 95% confidence intervals. Standard errors are clustered at the zip code level.

Figure 7. Average Estimated Rental Yield of Transacted Properties

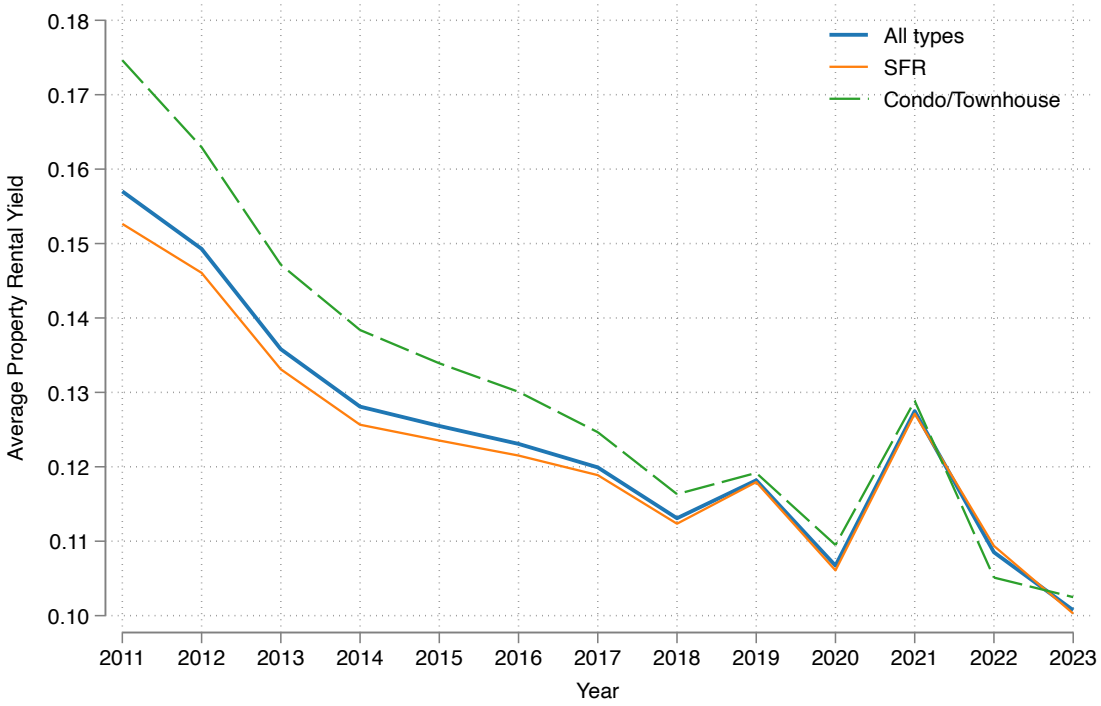
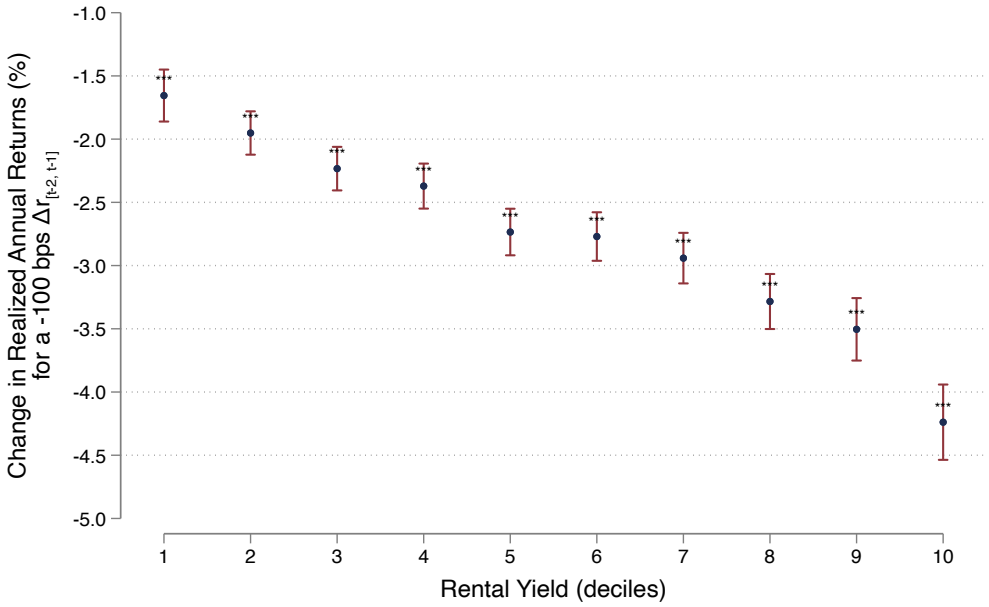


Figure 7 illustrates the annual average estimated rental yields of transacted properties from 2011 to 2023, categorized by property type. For each year and for all properties with characteristics available, I estimate property-level rental yields using hedonic models. The details of the estimation methodology are provided in Section II.C. Using the estimated rental yields, the figure presents the annual averages of transacted properties across different property types, as indicated in the legend.

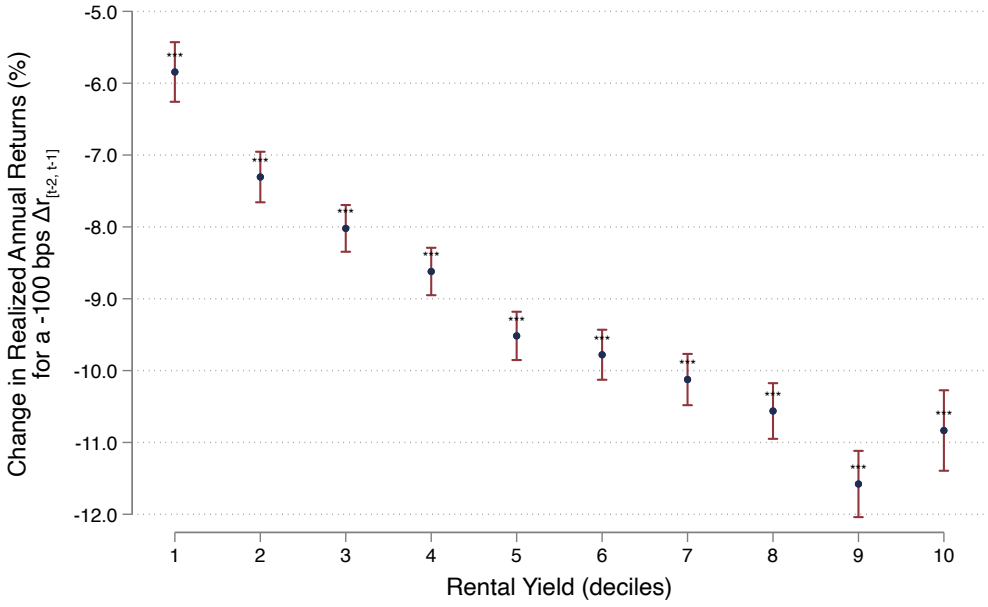
Figure 8. Change in Realized Returns of BTR Investors for a Federal Funds Rate (FFR) Cut

Panel A: Raw FFR Changes



* p < .1, ** p < .05, *** p < .01

Panel B: FFR Changes Instrumented by MPS

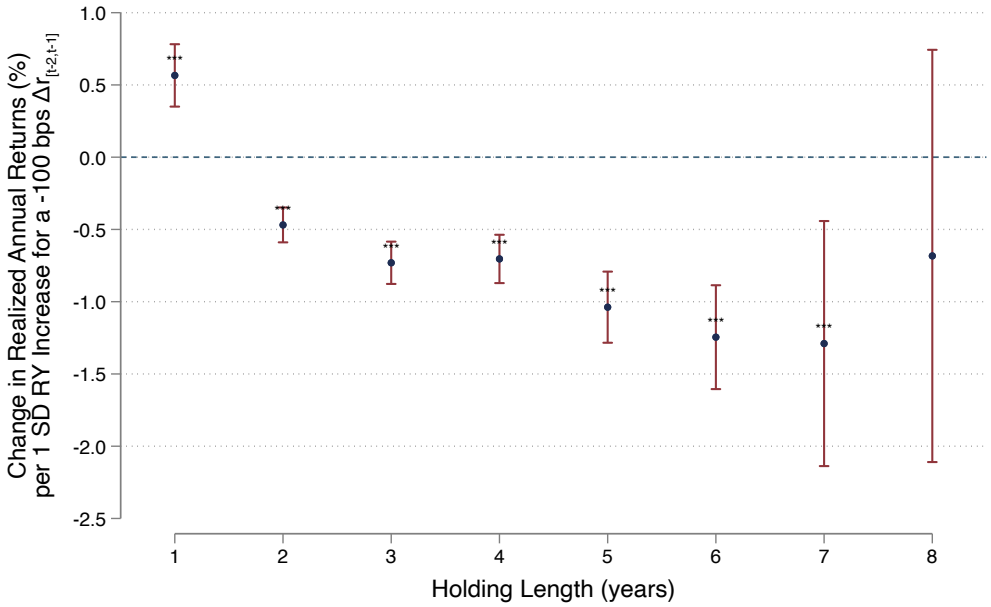


* p < .1, ** p < .05, *** p < .01

****** Figure 8 illustrates the heterogeneous effects of changes in the Federal Funds Rate (FFR) on the realized annual returns of Buy-to-Rent (BTR) investors across property rental yield and the length of the property holding period. Each point represents the estimated change in realized annual return (in percentage points) per one standard deviation (SD) increase in rental yield (RY) in response to a -100 basis points (bps) of FFR change. Panel A reports the results for 1-year-lagged changes in the FFR, measured from the end of year $t-2$ to the end of year $t-1$, one year prior to the purchase year t. Panel B presents results for contemporaneous changes in the FFR, measured from the end of year $t-1$ to the end of year t. Red-capped error bars represent the 95% confidence intervals. Standard errors are clustered at the property level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

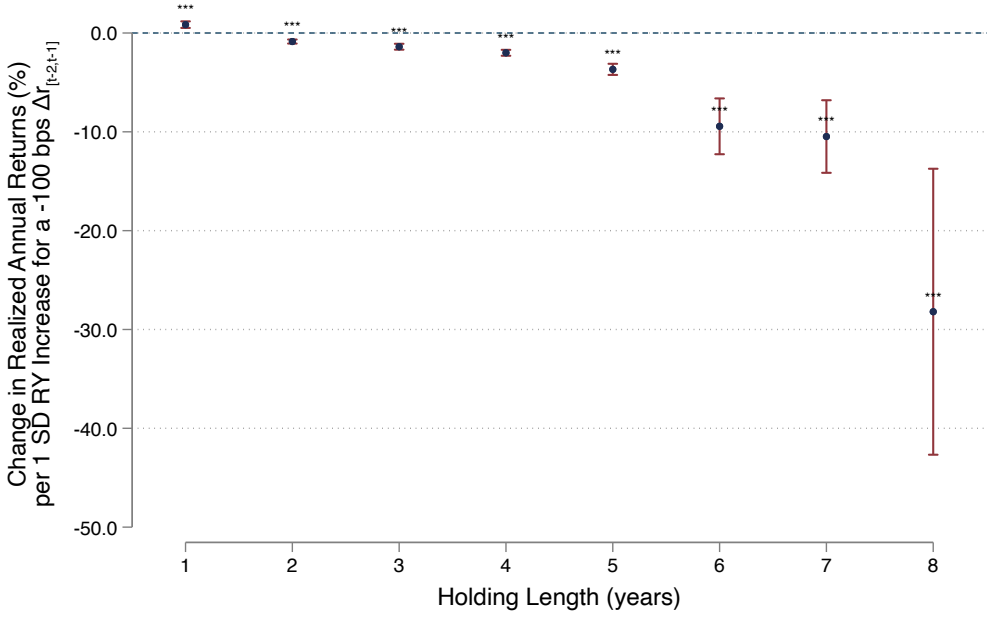
Figure 9. Change in Realized Returns of BTR Investors by Holding Length

Panel A: Raw FFR Changes



* p < .1, ** p < .05, *** p < .01

Panel B: FFR Changes Instrumented by MPS



* p < .1, ** p < .05, *** p < .01

******** Figure 9 illustrates the heterogeneous effects of changes in the Federal Funds Rate (FFR) on the realized annual returns of Buy-to-Rent (BTR) investors across property rental yield and the length of the property holding period. Each point represents the estimated change in realized annual return (in percentage points) per one standard deviation (SD) increase in rental yield (RY) in response to a -100 basis points (bps) of FFR change. Panel A reports the results for 1-year-lagged changes in the FFR, measured from the end of year $t-2$ to the end of year $t-1$, one year prior to the purchase year t. Panel B presents results for contemporaneous changes in the FFR, measured from the end of year $t-1$ to the end of year t. Red-capped error bars represent the 95% confidence intervals. Standard errors are clustered at the property level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Figure 10. Heterogeneity in House Price Sensitivity to Interest Rates across Buy-to-Rent Ratio Quintiles and Housing Duration

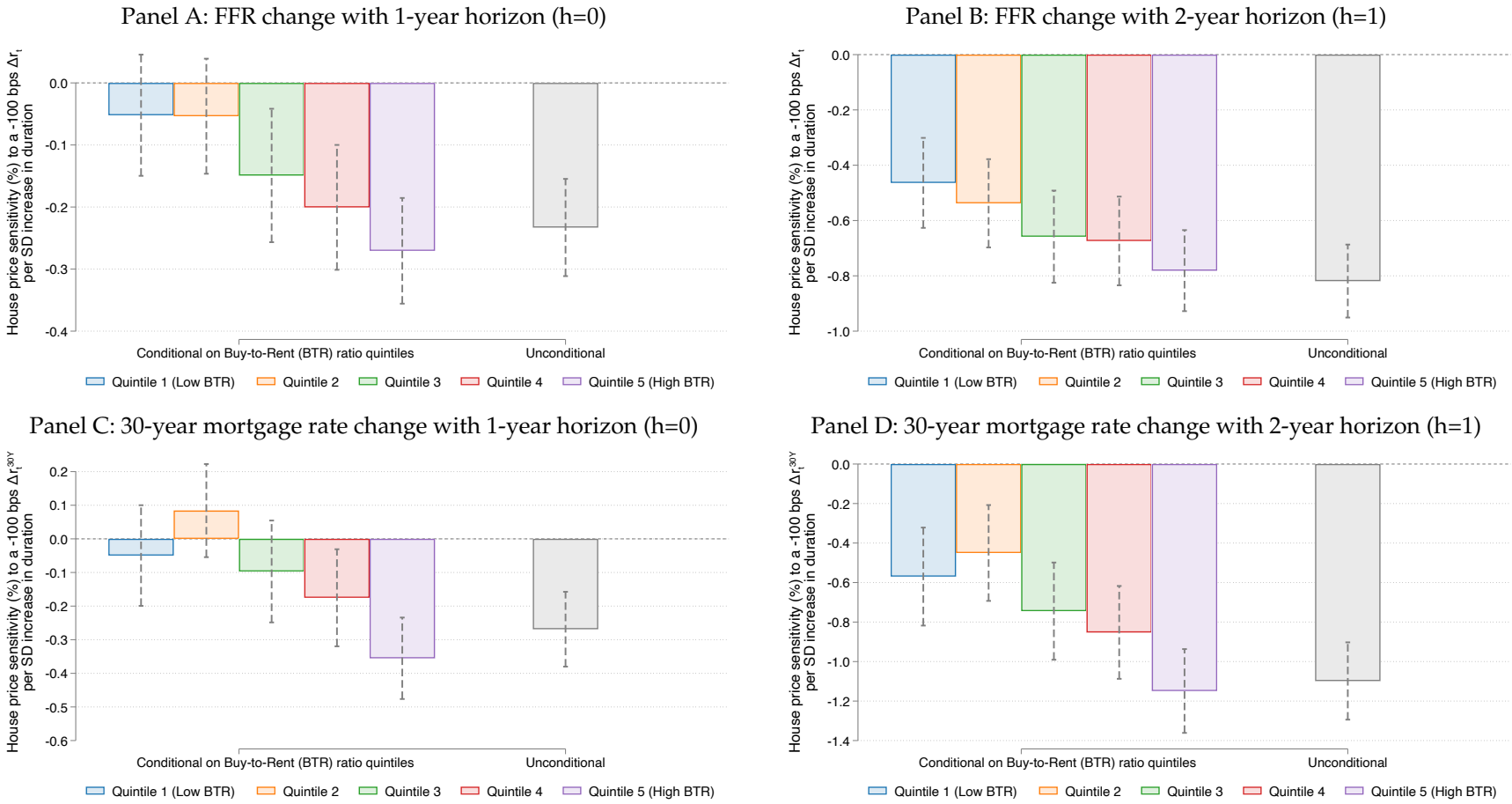


Figure 10 illustrates the heterogeneous sensitivity of house prices to interest rate reductions across zip-code Buy-to-Rent (BTR) ratio quintiles. Panels A and B present the additional increase in house prices associated with a one-standard-deviation (SD) increase in zip-code housing duration following a 100 basis point (bps) cut in the Federal Funds Rate (FFR), while Panel C illustrates this response to a 100 bps decrease in the 30-year mortgage rate. Each bar quantifies the additional change in house price sensitivity attributed to a one-SD increase in housing duration, segmented by BTR ratio quintiles. The estimations rely on the following regression specification:

$$\Delta HPI_{z,c,[t-1,t+h]} = \alpha_h + \sum_{q=2}^{5} \beta_{0,h,q}\ \Delta r_{[t-1,t]} \times \text{Duration}_{z,t-1} \times \mathbb{1}\{\text{BTR Quintile } q\}_{z,t-1} + \beta_{1,h}\ \Delta r_{[t-1,t]} \times \text{Duration}_{z,t-1} + \sum_{q=2}^{5} \beta_{2,h,q}\ \Delta r_{[t-1,t]} \times \mathbb{1}\{\text{BTR Quintile } q\}_{z,t-1}$$
$$+ \sum_{q=2}^{5} \beta_{3,h,q}\ \text{Duration}_{z,t-1} \times \mathbb{1}\{\text{BTR Quintile } q\}_{z,t-1} + \sum_{q=2}^{5} \mathbb{1}\{\text{BTR Quintile } q\}_{z,t-1} + \beta_{5,h}\ \text{Duration}_{z,t-1} + \zeta_c \times \theta_t + \lambda_z + X_{z,t} + \epsilon_{z,c,t,h}.$$

The rightmost gray bar represents the unconditional house price sensitivity across all zip codes, estimated via Equation 23. Panels A and C illustrate price responses within the same year of interest rate change ($h = 0$), while Panels B and D depict the responses within two years following the rate change ($h = 1$). Gray-capped error bars represent the 95% confidence intervals, with standard errors clustered at the zip-code level.

Table 1. Sumary Statistics

	Mean	SD	P5	P25	Median	P75	P95
Panel A: Housing Duration and Cash Flow Characteristics							
Duration	4.467	0.230	4.026	4.356	4.504	4.628	4.766
Duration 5Y^{LASSO}	4.468	0.229	4.029	4.358	4.505	4.628	4.766
Duration 10Y	7.861	0.807	6.342	7.426	7.961	8.434	8.990
Duration 10Y^{LASSO}	7.865	0.803	6.352	7.433	7.965	8.435	8.988
Rental yield	0.063	0.033	0.025	0.041	0.056	0.076	0.126
Log(rent growth)	0.038	0.046	-0.023	0.012	0.034	0.061	0.110
Log(price)	12.44	0.73	11.24	11.94	12.43	12.93	13.65
Panel B: House Price Changes over 3-year Horizons							
Δ HPI$_{z,[t-1,t]}$	0.078	0.066	-0.009	0.036	0.069	0.110	0.198
Δ HPI$_{z,[t-1,t+1]}$	0.157	0.116	0.000	0.079	0.141	0.219	0.371
Δ HPI$_{z,[t-1,t+2]}$	0.252	0.159	0.037	0.143	0.233	0.339	0.541
Panel C: Local Characteristics							
Log(income)$_{z,t-1}$	11.01	0.45	10.25	10.72	11.02	11.32	11.72
Log(population)$_{z,t-1}$	10.08	0.74	8.70	9.73	10.21	10.57	11.05
% below 40$_{z,t-1}$	0.530	0.092	0.391	0.478	0.531	0.585	0.665
% above 60$_{z,t-1}$	0.205	0.079	0.108	0.156	0.195	0.236	0.326
Labor force rate$_{z,t-1}$	0.650	0.076	0.515	0.614	0.659	0.698	0.757
Unemployment rate$_{z,t-1}$	0.076	0.042	0.029	0.047	0.065	0.093	0.158
Homeownership rate$_{z,t-1}$	0.575	0.184	0.234	0.459	0.593	0.714	0.844
Rental vacancy rate$_{z,t-1}$	0.065	0.056	0.014	0.034	0.055	0.082	0.141
Log(income-to-price)$_{z,t-1}$	-1.380	0.482	-2.256	-1.675	-1.318	-1.028	-0.709

Panel D: Correlation of Housing Duration and Local Characteristics

		1	2	3	4	5	6	7	8	9	10	11
1	Duration	1.000										
2	Rental yield	-0.991***	1.000									
3	Log(income)	0.573***	-0.564***	1.000								
4	Log(population)	0.076***	-0.086***	0.095***	1.000							
5	% below 40	-0.192***	0.180***	-0.332***	0.235***	1.000						
6	% above 60	0.130***	-0.127***	0.189***	-0.269***	-0.892***	1.000					
7	Labor force rate	0.243***	-0.254***	0.408***	0.180***	0.347***	-0.522***	1.000				
8	Unemployment rate	-0.423***	0.456***	-0.664***	-0.020***	0.219***	-0.190***	-0.340***	1.000			
9	Homeownership rate	0.022***	-0.036***	0.558***	0.004	-0.557***	0.414***	0.002	-0.319***	1.000		
10	Rental vacancy rate	-0.089***	0.094***	-0.132***	-0.251***	-0.185***	0.246***	-0.242***	0.112***	0.054***	1.000	
11	Log(income-to-price)	-0.789***	0.749***	-0.189***	-0.074***	0.021***	-0.054***	0.018***	0.090***	0.382***	0.067***	1.000

Table 1 presents summary statistics of key variables in the analysis. Panel A reports housing duration and associated cash flow characteristics. Panel B describes house price changes over one-, two-, and three-year horizons. Panel C provides descriptive statistics for zip-code socioeconomic and housing market characteristics. Panel D presents pairwise correlations between housing duration and local characteristics. Definitions of the variables are provided in the Appendix. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 2. Heterogeneous Interest Rate Sensitivity of Asset Prices by Duration

Panel A: Real estate

	Δ HPI$_{z,[t-1,t+1]}$				
	(1)	(2)	(3)	(4)	(5)
$\Delta r_{[t-1,t]} \times$ Duration$_{z,t-1}$		1.707***	1.752***	3.396***	3.089***
		(0.154)	(0.154)	(0.148)	(0.152)
$\Delta r_{[t-1,t]}$	-1.862***	-9.490***			
	(0.027)	(0.695)			
Duration$_{z,t-1}$	-0.120***	-0.128***	-0.128***	-0.176***	-0.308***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.018)
Adjusted R^2	0.108	0.111	0.251	0.746	0.805
Observations	60,920	60,920	60,920	60,920	60,920
Year FE			Yes		
County × Year FE				Yes	Yes
Zip FE					Yes

Panel B: Bond

	Δ P$_{i,[t-1,t+1]}$			
	(1)	(2)	(3)	(4)
$\Delta r_{[t-1,t]} \times$ Duration$_{i,t-1}$		-0.479***	-0.416***	-0.372***
		(0.013)	(0.020)	(0.014)
$\Delta r_{[t-1,t]}$	-4.679***	-1.168***	-1.081***	
	(0.191)	(0.084)	(0.118)	
Duration$_{i,t-1}$	0.001***	0.004***	0.024***	-0.015***
	(0.000)	(0.000)	(0.001)	(0.002)
Adjusted R^2	0.370	0.515	0.560	0.813
Observations	2,307	2,307	2,307	2,307
Bond FE			Yes	Yes
Year FE				Yes

Panel C: Equity

	Δ P$_{i,[t-1,t+1]}$			
	(1)	(2)	(3)	(4)
$\Delta r_{[t-1,t]} \times$ Duration$_{i,t-1}$		-0.071***	-0.057**	-0.055**
		(0.025)	(0.026)	(0.026)
$\Delta r_{[t-1,t]}$	-11.152***	-7.675***	-8.876***	
	(0.584)	(1.119)	(1.174)	
Duration$_{i,t-1}$	-0.001**	-0.000	-0.001	-0.001
	(0.000)	(0.000)	(0.001)	(0.001)
Adjusted R^2	0.019	0.020	0.119	0.170
Observations	22,011	22,011	22,011	22,011
Stock FE			Yes	Yes
Year FE				Yes

Table 2 illustrates the heterogeneous asset price responses to changes in the federal funds rate (FFR) across varying asset duration levels within the real estate (Panel A), bond (Panel B), and equity markets (Panel C). Panel A performs analysis at the zip code-year level for housing markets, while Panels B and C analyze individual asset-year observations for bonds and equities, respectively. The interest rate shock occurs at horizon 0 (i.e., year t), corresponding to the period from the end of year $t-1$ to t. To compare across asset classes, the table examines price responses within a two-year horizon following the shock. In Panel A, the dependent variable, $\Delta HPI_{z,[t-1,t+1]}$, denotes cumulative house price growth in zip code z from the end of year $t-1$ to $t+1$. Panels B and C examine the price changes for bonds and equities over the same horizon, respectively. The key explanatory variable, $\Delta r_{[t-1,t]} \times Duration_{i,t-1}$, captures the heterogeneous sensitivity of asset prices to the FFR changes based on the asset duration level. Section II.B provides details on the estimation of housing duration. Bond duration is defined by the Macaulay duration in years, calculated by the CRSP U.S. Treasury dataset, while equity duration is estimated by Gonçalves (2021). The combinations of fixed effects are indicated at the bottom of the table. Standard errors are clustered at the zip code (Panel A) or individual asset level (Panels B and C). ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 3. Heterogeneity in House Price Sensitivity to Interest Rate Changes by Housing Duration, Controlling for Local Economic Characteristics

	Δ HPI$_{z,[t-1,t+1]}$		
	(1)	(2)	(3)
$\Delta r_{[t-1,t]}\times$ Duration$_{z,t-1}$	3.021***	2.957***	3.314***
	(0.158)	(0.158)	(0.289)
Duration$_{z,t-1}$	-0.278***	-0.052**	-0.056***
	(0.017)	(0.022)	(0.022)
Δ HPI$_{z,[t-2,t-1]}$	0.180***	0.124***	0.129***
	(0.014)	(0.013)	(0.013)
$\Delta r_{[t-1,t]}\times$ log(income)$_{z,t-1}$			-0.342***
			(0.114)
$\Delta r_{[t-1,t]}\times$ log(population)$_{z,t-1}$			-0.005
			(0.031)
$\Delta r_{[t-1,t]}\times$ % below 40$_{z,t-1}$			3.547***
			(0.701)
$\Delta r_{[t-1,t]}\times$ % above 60$_{z,t-1}$			3.316***
			(0.816)
$\Delta r_{[t-1,t]}\times$ labor force rate$_{z,t-1}$			1.809***
			(0.440)
$\Delta r_{[t-1,t]}\times$ unemployment rate$_{z,t-1}$			-9.115***
			(1.112)
$\Delta r_{[t-1,t]}\times$ homeownership rate$_{z,t-1}$			0.123
			(0.252)
$\Delta r_{[t-1,t]}\times$ rental vacancy rate$_{z,t-1}$			-2.307***
			(0.586)
$\Delta r_{[t-1,t]}\times$ income-to-price ratio$_{z,t-1}$			0.680***
			(0.167)
Adjusted R^2	0.807	0.818	0.820
Observations	60,920	60,920	60,920
County × Year FE	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes
Zip Economic Chars		Yes	Yes

Table 3 presents heterogeneous impacts of annual changes in the federal funds rate (FFR) on two-year house price growth across zip codes with varying housing duration levels, controlling for local economic characteristics. The dependent variable, $\Delta HPI_{z,[t-1,t+1]}$, represents the house price growth from year $t-1$ to year $t+1$ in zip code z, where year t corresponds to the year of the FFR change. $\Delta r_{[t-1,t]}$ indicates the annual change in the federal funds rate from year $t-1$ to t, and $Duration_{z,t}$ denotes the housing duration level in zip code z in year t. The key explanatory variable, $\Delta r_{[t-1,t]} \times Duration_{z,t-1}$, captures the heterogeneous house price sensitivity to FFR changes based on the zip-code housing duration. Section II.B provides details on the estimation of housing duration. All specifications include county-year and zip-code fixed effects. Column 1 incorporates the lagged house price growth to control for momentum effects. Column 2 additionally controls for a comprehensive set of lagged local economic characteristics, such as log median income, population size, young and old ratios, labor force participation rate, unemployment rate, homeownership rate, rental vacancy rate, and the income-to-price ratio. Column 3 further introduces interaction terms between changes in FFR and the local economic characteristics. Definitions of the variables are provided in the Appendix. Standard errors are clustered at the zip code level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 4. Housing Duration and Heterogeneous House Price Responses to Interest Rate Changes over 1-, 2-, and 3-Year Horizons

Panel A: Federal Funds Rate Changes

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta r_{[t-1,t]}\times$ Duration$_{z,t-1}$	1.073***	0.939***	3.089***	3.314***	2.897***	3.084***
	(0.084)	(0.170)	(0.152)	(0.289)	(0.164)	(0.340)
Duration$_{z,t-1}$	-0.152***	-0.012	-0.308***	-0.056***	-0.426***	-0.101***
	(0.009)	(0.010)	(0.018)	(0.022)	(0.029)	(0.035)
Δ HPI$_{z,[t-2,t-1]}$		0.127***		0.129***		0.075***
		(0.008)		(0.013)		(0.017)
Adjusted R^2	0.773	0.787	0.805	0.820	0.805	0.821
Observations	60,947	60,947	60,920	60,920	55,292	55,292
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
$\Delta r_{[t-1,t]}\times$ Zip Economic Chars		Yes		Yes		Yes

Panel B: 30-Year Mortgage Rate Changes

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta r^{30Y}_{[t-1,t]}\times$ Duration$_{z,t-1}$	1.830***	1.127***	5.488***	4.584***	6.769***	5.679***
	(0.120)	(0.240)	(0.225)	(0.422)	(0.275)	(0.553)
Duration$_{z,t-1}$	-0.149***	-0.009	-0.302***	-0.048**	-0.423***	-0.094***
	(0.009)	(0.010)	(0.018)	(0.021)	(0.028)	(0.034)
Δ HPI$_{z,[t-2,t-1]}$		0.119***		0.110***		0.053***
		(0.008)		(0.013)		(0.017)
Adjusted R^2	0.773	0.788	0.806	0.822	0.808	0.824
Observations	60,947	60,947	60,920	60,920	55,292	55,292
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
$\Delta r^{30Y}_{[t-1,t]}\times$ Zip Economic Chars		Yes		Yes		Yes

Table 4 presents the heterogeneous effects of interest rate changes on house price growth over 1-, 2-, and 3-year horizons across zip codes with varying housing duration levels. Panel A uses the federal funds rate (FFR) as the interest rate measure, while Panel B employs the 30-year mortgage rate. The dependent variable in each column is the cumulative change in house prices, $\Delta HPI_{z,[t-1,t+h]}$, from the end of year $t-1$ to $t+h$, where $h \in \{0,1,2\}$ denotes the ex-post horizon in years. The key explanatory variable, $\Delta r_{[t-1,t]} \times Duration_{z,t-1}$, captures the heterogeneous house price sensitivity to FFR changes based on the zip-code housing duration. $\Delta r_{[t-1,t]}$ measures the annual change in the FFR (Panel A) or 30-year mortgage rate (Panel B) from the end of year $t-1$ to t. Section II.B provides details on the estimation of housing duration. All specifications include county-year and zip-code fixed effects. Columns 2, 4, and 6 additionally control for time-varying zip-code economic characteristics and their interactions with the interest rate change, consistent with Column 3 of Table 3. Standard errors are clustered at the zip code level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 5. Monetary Policy Shocks, Housing Duration, and House Price Growth

	Δ HPI$_{i,[t-1,t+1]}$									
	1-Year Yield Surprise$_t$		BS MPS$_t$		BS MPS_ORTH $_t$		JK PM MPS$_t$		JK Median MPS$_t$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MPS$_t$ × Duration$_{z,t-1}$	3.872***	3.425***	27.539***	25.053***	15.373***	33.825***	0.324***	0.260***	0.304***	0.260***
	(0.166)	(0.313)	(1.240)	(2.412)	(1.631)	(3.252)	(0.013)	(0.025)	(0.013)	(0.025)
Duration$_{z,t-1}$	-0.298***	-0.043**	-0.293***	-0.039*	-0.304***	-0.063***	-0.289***	-0.034	-0.285***	-0.031
	(0.018)	(0.021)	(0.017)	(0.021)	(0.018)	(0.022)	(0.017)	(0.021)	(0.018)	(0.021)
Δ HPI$_{z,[t-2,t-1]}$		0.125***		0.129***		0.142***		0.120***		0.126***
		(0.013)		(0.013)		(0.013)		(0.013)		(0.013)
Adjusted R^2	0.806	0.821	0.806	0.821	0.801	0.816	0.806	0.821	0.805	0.820
Observations	60,920	60,920	60,920	60,920	60,920	60,920	60,920	60,920	60,920	60,920
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes		Yes		Yes
MPS$_t$ × Zip Economic Chars		Yes		Yes		Yes		Yes		Yes

Table 5 examines how alternative measurements of monetary policy shocks (MPS) affect house price growth differently across zip codes with varying housing durations. The specific MPS measure used in each column is indicated at the top. The dependent variable, $\Delta HPI_{z,[t-1,t+1]}$, is the cumulative house price growth from the end of year $t-1$ to $t+1$. The primary explanatory variable, $MPS_t \times Duration_{z,t-1}$, captures the heterogeneous house price sensitivity to MPS based on the zip-code housing duration. Section II.B provides details on the estimation of housing duration. The MPS variable, MPS_t, aggregates monetary policy shocks occurring between the end of year $t-1$ and t. Columns 1 and 2 employ the 1-year treasury yield surprise as the MPS measure. Columns 3 and 4 utilize the standard MPS measure developed by Bauer and Swanson (2023a), while columns 5 and 6 apply the orthogonalized version from Bauer and Swanson (2023a). Columns 7 and 8 incorporate the PM MPS measure from Jarociński and Karadi (2020), and columns 9 and 10 use their median MPS measure. All specifications include county-year and zip-code fixed effects. Columns 2, 4, 6, 8, and 10 additionally control for time-varying zip-code economic characteristics and their interactions with MPS, consistent with Column 3 of Table 3. Standard errors are clustered at the zip code level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 6. Rental Yield and Heterogeneous House Price Responses to Interest Rate Changes over 1-, 2-, and 3-Year Horizons

Panel A: Federal Funds Rate Changes

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta r_{[t-1,t]}\times$ RY$_{z,t-1}$	-6.936***	-7.340***	-19.826***	-20.063***	-18.540***	-18.561***
	(0.558)	(0.988)	(0.936)	(1.625)	(1.059)	(1.944)
RY$_{z,t-1}$	0.856***	0.153***	1.724***	0.439***	2.453***	0.762***
	(0.053)	(0.055)	(0.107)	(0.115)	(0.166)	(0.177)
Δ HPI$_{z,[t-2,t-1]}$		0.151***		0.158***		0.117***
		(0.008)		(0.013)		(0.017)
Adjusted R^2	0.758	0.773	0.795	0.810	0.798	0.812
Observations	72,371	72,371	72,334	72,334	66,037	66,037
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
$\Delta r_{[t-1,t]}\times$ Zip Economic Chars		Yes		Yes		Yes

Panel B: 30-Year Mortgage Rate Changes

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta r^{30Y}_{[t-1,t]}\times$ RY$_{z,t-1}$	-9.142***	-9.750***	-31.156***	-28.188***	-37.882***	-33.313***
	(0.845)	(1.494)	(1.418)	(2.403)	(1.798)	(3.186)
RY$_{z,t-1}$	0.840***	0.139***	1.693***	0.394***	2.456***	0.739***
	(0.053)	(0.054)	(0.107)	(0.113)	(0.165)	(0.174)
Δ HPI$_{z,[t-2,t-1]}$		0.148***		0.151***		0.110***
		(0.008)		(0.013)		(0.017)
Adjusted R^2	0.757	0.774	0.796	0.810	0.799	0.814
Observations	72,371	72,371	72,334	72,334	66,037	66,037
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
$\Delta r^{30Y}_{[t-1,t]}\times$ Zip Economic Chars		Yes		Yes		Yes

Table 6 presents the heterogeneous effects of interest rate changes on house price growth over 1-, 2-, and 3-year horizons across zip codes with varying rental yield. Panel A uses the federal funds rate (FFR) as the interest rate measure, while Panel B employs the 30-year mortgage rate. The dependent variable in each column is the cumulative change in house prices, $\Delta HPI_{z,[t-1,t+h]}$, from the end of year $t-1$ to $t+h$, where $h \in \{0,1,2\}$ denotes the ex-post horizon in years. The key explanatory variable, $\Delta r_{[t-1,t]} \times$ RY$_{z,t-1}$, captures the heterogeneous house price sensitivity to FFR changes based on the zip-code rental yield. $\Delta r_{[t-1,t]}$ measures the annual change in the FFR (Panel A) or 30-year mortgage rate (Panel B) from the end of year $t-1$ to t. All specifications include county-year and zip-code fixed effects. Columns 2, 4, and 6 additionally control for time-varying zip-code economic characteristics and their interactions with the interest rate change, consistent with Column 3 of Table 3. Standard errors are clustered at the zip code level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 7. Property Price Sensitivity to Interest Rate Changes: Controlling for Mortgage and Tax Payments

	Δ P$_{i,[t-2,t]}$					
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta r_{[t-2,t-1]}\times$ RY$_{i,t-2}$	-19.875***	-22.043***	-25.404***	-25.072***	-35.933***	-32.583***
	(0.107)	(0.110)	(0.109)	(0.110)	(0.113)	(0.109)
RY$_{i,t-2}$	1.042***	1.123***	1.289***	1.277***	1.763***	1.674***
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)
Δ HPI$_{z,[t-3,t-2]}$		0.315***	0.306***	0.311***	0.350***	0.052***
		(0.004)	(0.004)	(0.004)	(0.003)	(0.003)
Log(Mortgage Payment)$_{i,t}$			0.017***			
			(0.000)			
$\Delta r_{[t-2,t-1]}\times$ Log(Mortgage Payment)$_{i,t}$			-0.064***			
			(0.001)			
LTV$_{i,t}$				0.152***		
				(0.000)		
$\Delta r_{[t-2,t-1]}\times$ LTV$_{i,t}$				-0.178***		
				(0.015)		
Log(Tax Payment)$_{i,t}$					0.297***	
					(0.000)	
$\Delta r_{[t-2,t-1]}\times$ Log(Tax Payment)$_{i,t}$					-1.688***	
					(0.012)	
Tax-to-Value Ratio$_{i,t}$						-25.086***
						(0.015)
$\Delta r_{[t-2,t-1]}\times$ Tax-to-Value Ratio$_{i,t}$						64.490***
						(1.180)
Adjusted R^2	0.136	0.138	0.172	0.164	0.225	0.325
Observations	28,399,832	28,399,832	28,399,832	28,399,832	28,399,832	28,399,832
Property Chars	Yes	Yes	Yes	Yes	Yes	Yes
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes	Yes	Yes	Yes	Yes
$\Delta r_{[t-2,t-1]}\times$ Zip Economic Chars		Yes	Yes	Yes	Yes	Yes

Table 7 reports transaction-level regressions of property price changes, $\Delta P_{i,[t-2,t]}$, on the interaction between the change in the FFR one year before the transaction, $\Delta r_{[t-2,t-1]}$, and the property's ex-ante rental yield measured at $t-2$, $RY_{i,t-2}$. The transaction occurs at year t. Columns 1 and 2 use the baseline controls and fixed effects from Table 3 and show how the sensitivity of transaction-level price changes to interest rate changes varies with ex-ante rental yields. Columns 3–6 sequentially control for log mortgage payment, loan-to-value ratio (LTV), log property tax payment, and tax-to-value ratio, along with their interactions with interest rate changes. All regressions include property characteristics, county-by-year fixed effects, ZIP code fixed effects, ZIP code economic characteristics, and their interactions with interest rate changes. Standard errors are clustered at the property level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 8. Impact of Interest Rate Changes on Buy-to-Rent (BTR) Probability

	$\mathbb{1}\{\text{BTR}\}_{i,t}$							
	ΔFFR				ΔFFR Instrumented by MPS			
	$h=0$		$h=1$		$h=0$		$h=1$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta r_{[t-h-1,t-h]} \times \text{RY}_{i,t-h-1}$	-11.772***	-12.645***	-11.263***	-11.752***	-10.984***	-11.118***	-9.306***	-9.402***
	(0.087)	(0.092)	(0.094)	(0.098)	(0.112)	(0.117)	(0.120)	(0.123)
$\text{RY}_{i,t-h-1}$	0.615***	0.635***	0.590***	0.594***	0.601***	0.602***	0.557***	0.553***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
$\Delta r_{[t-h-1,t-h]} \times \text{Log(Income)}_{z,t-h-1}$		-0.387***		-0.253***		-0.163***		-0.120*
		(0.034)		(0.043)		(0.051)		(0.064)
$\Delta r_{[t-h-1,t-h]} \times \text{Log(Population)}_{z,t-h-1}$		-0.036***		-0.154***		-0.070***		-0.178***
		(0.010)		(0.012)		(0.015)		(0.019)
$\Delta r_{[t-h-1,t-h]} \times$ % Below $40_{z,t-h-1}$		-0.609***		-2.401***		-4.238***		-6.249***
		(0.218)		(0.271)		(0.341)		(0.431)
$\Delta r_{[t-h-1,t-h]} \times$ % Above $60_{z,t-h-1}$		-1.052***		-0.955***		-2.597***		-2.975***
		(0.230)		(0.287)		(0.351)		(0.440)
$\Delta r_{[t-h-1,t-h]} \times \text{Labor Force Rate}_{z,t-h-1}$		0.346**		-0.805***		0.549**		-1.882***
		(0.144)		(0.181)		(0.221)		(0.278)
$\Delta r_{[t-h-1,t-h]} \times \text{Unemployment Rate}_{z,t-h-1}$		5.107***		2.085***		2.856***		1.516**
		(0.345)		(0.425)		(0.571)		(0.703)
$\Delta r_{[t-h-1,t-h]} \times \text{Homeownership Rate}_{z,t-h-1}$		0.163**		-1.025***		-0.616***		-2.008***
		(0.078)		(0.098)		(0.116)		(0.145)
$\Delta r_{[t-h-1,t-h]} \times \text{Rental Vacancy Rate}_{z,t-h-1}$		0.085		-0.353**		-0.393**		-1.108***
		(0.117)		(0.148)		(0.170)		(0.232)
$\Delta r_{[t-h-1,t-h]} \times \text{Income-to-Price Ratio}_{z,t-h-1}$		0.490***		0.214***		-0.416***		-0.538***
		(0.035)		(0.043)		(0.054)		(0.066)
$\Delta \text{ HPI}_{z,[t-h-2,t-h-1]}$		0.047***		-0.014***		0.041***		-0.018***
		(0.003)		(0.003)		(0.003)		(0.003)
Adjusted R^2	0.138	0.138	0.138	0.138	0.022	0.022	0.022	0.022
Observations	31,906,343	31,906,343	29,369,961	29,369,961	31,906,343	31,906,343	29,369,961	29,369,961
Property Chars	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes		Yes

Table 8 presents the impact of interest rate changes on the probability that a property is purchased for rental purposes (buy-to-rent, BTR) across properties with varying rental yields (RY). The dependent variable is an indicator equal to one if the property is purchased for rental purposes, and zero otherwise. The variable, $\Delta r_{[t-h-1,h-h]}$, measures the interest rate changes that occurred h years before the transaction. The variable, $\text{RY}_{i,\,t-h-1}$, is the ex-ante property rental yield value estimated through hedonic estimations described in Section II.C. The coefficient on the interaction term, $\Delta r_{[t-h-1,t-h]} \times \text{RY}_{i,t-h-1}$, captures the heterogeneous effects of interest rate changes on the BTR probability across varying property rental yields. Columns 1 to 4 present estimates using changes in the federal funds rate (FFR), while Columns 5–8 use the orthogonalized monetary policy surprise (MPS) measure of Bauer and Swanson (2023a) as an instrument for FFR changes. Columns 1, 2, 5, and 6 report contemporaneous effects ($h = 0$), and Columns 3, 4, 7, and 8 report effects of one-year-lagged interest rate changes ($h = 1$). All columns control for the same property characteristics used in the hedonic estimation of rental yields described in Section II.C and incorporate county-by-year and zip-code fixed effects. Additionally, Columns 2, 4, 6, and 8 further control for zip-code-level economic characteristics and their interactions with interest rate changes. Standard errors are clustered at the property level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 9. Realized Returns of BTR Investors, Rental Yield, and Federal Funds Rate (FFR) Changes

Panel A: ΔFFR

	Realized Ann Return$_{i,t}$					
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta r_{[t-2,t-1]} \times$ RY$_{i,t-2}$		4.852***	5.084***	4.529***	4.538***	3.715***
		(0.572)	(0.568)	(0.566)	(0.568)	(0.648)
$\Delta r_{[t-2,t-1]}$	0.321***					
	(0.028)					
RY$_{i,t-2}$	0.508***	0.460***	0.468***	0.467***	0.468***	0.474***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Holding Length			-0.012***	-0.019***		
			(0.000)	(0.000)		
Δ HPI$_{z,[t-3,t-2]}$						0.041***
						(0.004)
Adjusted R^2	0.101	0.225	0.252	0.269	0.267	0.267
Observations	1,214,961	1,214,961	1,214,961	1,214,961	1,214,961	1,214,961
County × Buy Year FE		Yes	Yes	Yes	Yes	Yes
Zip FE		Yes	Yes	Yes	Yes	Yes
County × Sell Year FE				Yes	Yes	Yes
Buy Year × Sell Year FE					Yes	Yes
Zip Economic Chars						Yes
$\Delta r_{[t-2,t-1]} \times$ Zip Economic Chars						Yes

Panel B: ΔFFR Instrumented by MPS

	Realized Ann Return$_{i,t}$					
	(1)	(2)	(3)	(4)	(5)	(6)
$\widehat{\Delta r}_{[t-2,t-1]} \times$ RY$_{i,t-2}$		21.373***	21.859***	21.021***	21.471***	18.487***
		(1.060)	(1.042)	(1.037)	(1.041)	(1.177)
$\widehat{\Delta r}_{[t-2,t-1]}$	7.310***					
	(0.051)					
RY$_{i,t-2}$	0.527***	0.441***	0.449***	0.448***	0.449***	0.456***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Holding Length			-0.012***	-0.019***		
			(0.000)	(0.000)		
Δ HPI$_{z,[t-3,t-2]}$						0.030***
						(0.004)
Adjusted R^2	0.032	0.022	0.056	0.027	0.021	0.021
Observations	1,214,961	1,214,961	1,214,961	1,214,961	1,214,961	1,214,961
Cragg-Donald F Statistics	378,334	362,547	362,539	361,344	361,190	21,121
County × Buy Year FE		Yes	Yes	Yes	Yes	Yes
Zip FE		Yes	Yes	Yes	Yes	Yes
County × Sell Year FE				Yes	Yes	Yes
Buy Year × Sell Year FE					Yes	Yes
Zip Economic Chars						Yes
$\widehat{\Delta r}_{[t-2,t-1]} \times$ Zip Economic Chars						Yes

Table 9 presents the regression results for individual property-level realized annual returns on changes in the Federal Funds Rate (FFR) and their interaction with the property's *ex-ante* rental yield (RY). The dependent variable is the realized annual returns for Buy-to-Rent (BTR) investors, which include the estimated rental yield during the holding periods as well as capital gains from buying and selling the same property. Panel A analyzes the impact of the FFR change that occurred from the end of year $t-2$ to the end of year $t-1$, which is one year prior to the purchase transaction year t. In contrast, Panel B use the orthogonalized monetary policy surprise (MPS) measure of Bauer and Swanson (2023a) as an instrument for FFR changes. The fixed effects included in the analysis are noted at the bottom of the table. Standard errors are clustered at the property level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 10. Interest Rate Changes and Property Transitions Between Owner- and Renter-Occupied Property Statuses

Panel A: Owner to Renter (OTR)

	$\mathbb{1}\{\text{OTR}\}_{i,t}$							
	ΔFFR				ΔFFR Instrumented by MPS			
	$h=0$		$h=1$		$h=0$		$h=1$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta r_{[t-h-1,t-h]} \times \text{RY}_{i,t-h-1}$	-2.957***	-2.875***	-2.691***	-2.256***	-4.774***	-3.660***	-4.612***	-3.323***
	(0.077)	(0.082)	(0.083)	(0.088)	(0.101)	(0.105)	(0.106)	(0.108)
$\text{RY}_{i,t-h-1}$	0.140***	0.130***	0.123***	0.107***	0.172***	0.139***	0.156***	0.123***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
$\Delta \text{ HPI}_{z,[t-h-2,t-h-1]}$		-0.035***		-0.039***		-0.035***		-0.037***
		(0.003)		(0.003)		(0.003)		(0.003)
Adjusted R^2	0.059	0.060	0.058	0.058	0.001	0.001	0.000	0.000
Observations	31,906,343	31,906,343	29,369,961	29,369,961	31,906,343	31,906,343	29,369,961	29,369,961
Cragg-Donald F Statistics					48,002,310	1,804,414	43,648,238	1,436,506
Property Chars	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes		Yes
$\Delta r_{[t-h-1,t-h]} \times$ Zip Economic Chars		Yes		Yes		Yes		Yes

Panel B: Renter to Owner (RTO)

	$\mathbb{1}\{\text{RTO}\}_{i,t}$							
	ΔFFR				ΔFFR Instrumented by MPS			
	$h=0$		$h=1$		$h=0$		$h=1$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta r_{[t-h-1,t-h]} \times \text{RY}_{i,t-h-1}$	2.810***	2.517***	1.742***	0.890***	5.520***	4.506***	4.703***	3.019***
	(0.079)	(0.084)	(0.079)	(0.083)	(0.101)	(0.105)	(0.105)	(0.108)
$\text{RY}_{i,t-h-1}$	-0.087***	-0.071***	-0.054***	-0.026***	-0.136***	-0.105***	-0.104***	-0.062***
	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
$\Delta \text{ HPI}_{z,[t-h-2,t-h-1]}$		0.056***		0.064***		0.057***		0.061***
		(0.003)		(0.003)		(0.003)		(0.003)
Adjusted R^2	0.039	0.039	0.040	0.040	0.004	0.005	0.005	0.005
Observations	31,906,343	31,906,343	29,369,961	29,369,961	31,906,343	31,906,343	29,369,961	29,369,961
Cragg-Donald F Statistics					48,002,310	1,804,414.2	43,648,238	1,436,506.2
Property Chars	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes		Yes
$\Delta r_{[t-h-1,t-h]} \times$ Zip Economic Chars		Yes		Yes		Yes		Yes

****** Table 10 presents the effects of interest rate changes on the probability of transitions between owner-occupied and renter-occupied property statuses. The dependent variable is an indicator denoting whether a property transitions from owner- to renter-occupied (OTR, Panel A) or from renter- to owner-occupied (RTO, Panel B). The key interaction term, $\Delta r_{[t-h-1,t-h]} \times \text{RY}_{i,t-h-1}$, captures heterogeneous effects across properties with varying rental yields. Columns 1 to 4 illustrate responses to changes in the Federal Funds Rate (FFR), while Columns 5 to 8 use the orthogonalized monetary policy surprise (MPS) measure of Bauer and Swanson (2023a) as an instrument for FFR changes. The table presents the effect within 2 years after a rate change. Specifically, Columns 1, 2, 5, and 6 capture transitions within the year of the interest rate change ($h=0$), whereas Columns 3, 4, 7, and 8 report the effect of the rate change from two years ago ($h=1$). All columns control for property-level characteristics and incorporate county-by-year and zip-code fixed effects. Additionally, Columns 2, 4, 6, and 8 further control for zip-code-level economic characteristics and their interactions with interest rate changes. Standard errors are clustered at the property level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 11. Heterogeneity in House Price Sensitivity to Interest Rates across Buy-to-Rent Intensity and Housing Duration

	Δ HPI$_{z,[t-1,t+h]}$							
	FFR				30-Year Mortgage Rate			
	$h=0$		$h=1$		$h=0$		$h=1$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta r_{[t-1,t]}\times$ Duration$_{z,t-1}$	1.020***	0.069	3.585***	1.908***	1.177***	-0.402	4.809***	1.519***
	(0.175)	(0.213)	(0.295)	(0.360)	(0.248)	(0.321)	(0.437)	(0.549)
$\Delta r_{[t-1,t]}\times$ Duration$_{z,t-1}\times$ BTR%$_{z,t-1}$		0.012***		0.017***		0.021***		0.039***
		(0.002)		(0.004)		(0.003)		(0.006)
$\Delta r_{[t-1,t]}\times$ BTR%$_{z,t-1}$		-0.055***		-0.085***		-0.094***		-0.180***
		(0.010)		(0.017)		(0.016)		(0.026)
Duration$_{z,t-1}\times$ BTR%$_{z,t-1}$		-0.000		-0.000**		-0.000		-0.000**
		(0.000)		(0.000)		(0.000)		(0.000)
BTR%$_{z,t-1}$		0.000		0.001***		0.000		0.001***
		(0.000)		(0.000)		(0.000)		(0.000)
Duration$_{z,t-1}$	-0.024**	-0.021*	-0.078***	-0.058***	-0.021**	-0.019*	-0.069***	-0.048**
	(0.011)	(0.011)	(0.022)	(0.022)	(0.010)	(0.011)	(0.022)	(0.022)
Δ HPI$_{z,[t-2,t-1]}$	0.113***	0.112***	0.114***	0.114***	0.105***	0.106***	0.097***	0.097***
	(0.009)	(0.009)	(0.014)	(0.014)	(0.009)	(0.009)	(0.014)	(0.014)
Adjusted R^2	0.793	0.794	0.826	0.826	0.794	0.795	0.828	0.828
Observations	56,684	56,684	56,658	56,658	56,684	56,684	56,658	56,658
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\Delta r_{[t-1,t]}\times$ Zip Economic Chars	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 11 presents regression results examining the heterogeneous sensitivity of house prices at the zip-code level to changes in the Federal Funds Rate (FFR) and the 30-year mortgage rate, conditional on zip-code housing duration and Buy-to-Rent (BTR) investment intensity. Columns 1 to 4 report results for house price sensitivity to the FFR changes, while Columns 5 to 8 document the response to the 30-year mortgage rate changes. The table presents the effect within 2 years after a rate change. Specifically, Columns 1, 2, 5, and 6 illustrate house price responses within the year of the interest rate change ($h = 0$), whereas Columns 3, 4, 7, and 8 show cumulative responses observed two years after the rate change ($h = 1$). The key interaction terms, $\Delta r_{[t-1,t]} \times \text{Duration}_{z,t-1}$ and $\Delta r_{[t-1,t]} \times \text{Duration}_{z,t-1} \times \text{BTR\%}_{z,t-1}$, capture variations in house price sensitivity associated with differences in housing duration and the intensity of buy-to-rent investment across zip codes. The variable BTR% denotes percentiles of BTR transaction ratios across all zip codes in a given year, measuring the intensity of buy-to-rent investment activity. All columns include county-by-year fixed effects, zip-code fixed effects, zip-code economic characteristics, and their interactions with interest rate changes. Standard errors are clustered at the zip code level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

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Internet Appendix for "Monetary Policy Transmission through Housing Duration: Evidence from Reaching-for-Income Investors"

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A Conceptual Framework

This section develops the theoretical link between the interest rate sensitivity of house prices and housing duration. I start from the same assumption as defined by Macaulay duration and then sequentially relax its assumptions to incorporate features specific to housing markets. For each departure, the mapping between price sensitivity and duration is derived explicitly. The purpose is to show what relationship of interest rate sensitivity and traditional duration we will expect when each of the different assumptions is relaxed.

A.1. Interest Rate Sensitivity with Fixed Rents and Constant Term Premium

Consider a representative property that delivers an infinite, deterministic stream of gross rental cash flows $\{C_{t+h}\}_{h\geq 1}$ without operating costs, depreciation, and taxes. As a start, I assume that the discount rate applied at t is $r_t = i_t + \phi$, which equals the sum of the policy rate i_t and a term premium $\phi > 0$ that is held fixed with respect to i_t (i.e., $\partial\phi/\partial i_t = 0$). I assume a flat term structure at t, so the same r_t applies to all horizons of cash flows $\{C_{t+h}\}_{h\geq 1}$.

House price. The property value equals the sum of the present values of future rents:

$$P_t = \sum_{h=1}^{\infty} \frac{C_{t+h}}{(1+r_t)^h}, \tag{A1}$$

which converges under the usual transversality condition.

Housing cash-flow duration. Following Macaulay duration, the housing cash flow duration (hereafter referred to as housing duration) is defined as

$$D_t = \sum_{h=1}^{\infty} h \, \frac{C_{t+h}\,(1+r_t)^{-h}}{P_t} \equiv \sum_{h=1}^{\infty} h\, w_t(h), \tag{A2}$$

where the present-value weights are $w_t(h) \equiv C_{t+h}(1+r_t)^{-h}/P_t$ and $\sum_{h\geq 1} w_t(h) = 1$. Intuitively, D_t is the value-weighted average arrival time of cash flows.

Proposition 1: *Holding the cash-flow path $\{C_{t+h}\}$ fixed and the term premium ϕ constant with respect to i_t,*

$$-\frac{\partial \ln P_t}{\partial i_t} = \frac{D_t}{1+r_t} \tag{A3}$$

For a small change Δi_t applied to the policy rate,

$$\Delta \ln P_t = -\frac{D_t}{1+r_t}\Delta i_t\,, \tag{A4}$$

Equation (A4) implies that a 100-basis-point cut in the policy rate increases prices by approximately $(D_t/(1+r_t))$ percent. Therefore, longer-duration properties are more sensitive to interest rate changes than shorter-duration properties.

A.2. Interest-Rate Sensitivity with Fixed Rents and a Parallel Shift of the Term Premium

I now relax the constant-premium assumption while maintaining fixed, deterministic rents. Let the discount rate for horizon h be $r_t(h) = i_t + \phi_t(h)$, where $\phi_t(h)$ is a horizon-dependent term premium. At time t the term structure is taken to be *flat*, so $\phi_t(h) = \phi_t$ for all $h \geq 1$, and hence $r_t(h) = r_t = i_t + \phi_t$.

I assume a *parallel shift* of the term structure: there exists a scalar level factor y_t such that $r_t(h) = y_t$ for all $h \geq 1$, so that a small change Δy_t shifts all maturities one-for-one. For later reference, define the policy rate pass-through to premium as $\kappa_t \equiv \frac{\partial \phi_t}{\partial i_t}$, which is constant for all $h \geq 1$.

Proposition 2 (Parallel shift of a flat term structure): *Under a parallel, one-for-one shift of the (flat) discount curve, the semi-elasticity of price with respect to the level factor equals modified duration:*

$$-\frac{\partial \ln P_t}{\partial y_t} = \frac{D_t}{1+y_t} = \widetilde{D}_t. \tag{A5}$$

Corollary (mapping to the policy rate). By the chain rule, the sensitivity of house prices with respect to the policy rate i_t is

$$-\frac{\partial \ln P_t}{\partial i_t} = (1+\kappa_t)\widetilde{D}_t. \tag{A6}$$

The pure parallel-shift result (A5) is recovered when the "interest rate" is interpreted as the curve level y_t (so $\partial y_t/\partial i_t = 1$ by definition) or when $\kappa_t = 0$.

Cross-sectional implication. For two otherwise similar properties A and B, if $D_{A,t} > D_{B,t}$, then

$$-\frac{\partial \ln P_{A,t}}{\partial i_t} > -\frac{\partial \ln P_{B,t}}{\partial i_t},$$

So longer-duration assets are more sensitive to the policy rate i_t, provided κ_t is the same across A and B.

A.3. Interest-Rate Sensitivity with Fixed Rents and Non-Parallel Shift of Term Premium

I now maintain fixed, deterministic rents $\{C_{t+h}\}_{h\geq 1}$, but allow the non-parallel shift in the term premium as the policy rate changes. Then, the discount rate will be $r_t(h) = i_t + \phi_t(h)$ for all $h \geq 1$, where $\phi_t(j)$ is the term premium at horizon j. To simplify things, I assume the *flat* term structure at time t, so $r_t(h) = y_t$ for all $h \geq 1$ (i.e., $\phi_t(h) = \phi_t$). However, I allow the premium to co-move with the policy rate in a horizon-dependent way:

$$\kappa_t(j) \equiv \frac{\partial \phi_t(j)}{\partial i_t}, \qquad \Rightarrow \qquad \frac{\partial r_t(j)}{\partial i_t} = 1 + \kappa_t(j).$$

The property value is

$$P_t = \sum_{h=1}^{\infty} \frac{C_{t+h}}{(1+y_t)^h}.$$

Define present-value weights, Macaulay duration, and modified duration:

$$w_t(h) \equiv \frac{C_{t+h}(1+y_t)^{-h}}{P_t}, \qquad \sum_{h\geq 1} w_t(h) = 1, \qquad D_t \equiv \sum_{h\geq 1} h\, w_t(h), \qquad \widetilde{D}_t \equiv \frac{D_t}{1+y_t}.$$

Now allow horizon-dependent pass-through of the term premium to the policy rate:

$$\kappa_t(h) \equiv \frac{\partial \phi_t(h)}{\partial i_t} \quad \Rightarrow \quad \frac{\partial r_t(h)}{\partial i_t} = 1 + \kappa_t(h).$$

For notational economy, define *duration weights*

$$\alpha_t(h) \equiv \frac{h\, w_t(h)}{D_t}, \qquad \sum_{h\geq 1} \alpha_t(h) = 1,$$

and the corresponding *duration-weighted average pass-through*

$$\bar{\kappa}_t \equiv \sum_{h\geq 1} \alpha_t(h)\kappa_t(h).$$

Proposition 3 (Policy-rate sensitivity under flat curve with horizon-dependent pass-through): *With fixed rents and a flat curve at t but horizon-dependent premium pass-through,*

$$-\frac{\partial \ln P_t}{\partial i_t} = \widetilde{D}_t\left(1+\bar{\kappa}_t\right) = \frac{D_t}{1+y_t}\left(1+\sum_{h\geq 1}\alpha_t(h)\kappa_t(h)\right). \tag{A7}$$

Proof. Differentiating $P_t = \sum_{h\geq 1} C_{t+h}(1+r_t(h))^{-h}$ with respect to $r_t(h)$ yields $-\partial \ln P_t/\partial r_t(h) = h\, w_t(h)/(1+y_t)$ at $r_t(h) \equiv y_t$. By the chain rule,

$$-\frac{\partial \ln P_t}{\partial i_t} = \sum_{h\geq 1} \frac{h\, w_t(h)}{1+y_t}\left(1+\kappa_t(h)\right) = \frac{D_t}{1+y_t}\left(1+\sum_{h\geq 1}\alpha_t(h)\kappa_t(h)\right).$$

Connections. If pass-through is horizon-invariant, $\kappa_t(h) \equiv \kappa_t$, then

$$-\frac{\partial \ln P_t}{\partial i_t} = (1+\kappa_t)\widetilde{D}_t,$$

which is the parallel-shift result.

Ranking and possible inversion. Consider two otherwise similar properties A and B with $D_{A,t} < D_{B,t}$. From (A7),

$$-\frac{\partial \ln P_{x,t}}{\partial i_t} = \widetilde{D}_{x,t}\left(1+\bar{\kappa}_{x,t}\right), \qquad x \in \{A,B\}.$$

If the pass-through profile is *front-loaded*—i.e., $\kappa_t(h)$ is decreasing in h so that short-maturity premia compress more than long-maturity premia when i_t falls—then the duration-weighted average $\bar{\kappa}_{x,t}$ is *larger* for assets placing more weight on early cash flows (shorter duration). In particular, a shorter-duration property can be more policy-sensitive in magnitude than a longer-duration one

whenever

$$\frac{1+\bar{\kappa}_{A,t}}{1+\bar{\kappa}_{B,t}} > \frac{D_{B,t}}{D_{A,t}}.$$

Thus, sufficiently strong short-end compression can overturn the standard "longer duration ⇒ greater sensitivity" ranking.

Corollary 1 (Effective-duration ordering and inversion): *Let D_t be Macaulay duration, $\bar{\kappa}_t = \sum_h \alpha_t(h)\kappa_t(h)$ the duration-weighted pass-through, and define the* effective duration

$$D^{\text{eff}}_{x,t} \equiv D_{x,t}\big(1+\bar{\kappa}_{x,t}\big), \qquad x \in \{A,B\}.$$

Under fixed rents and a flat curve at t,

$$-\frac{\partial \ln P_{x,t}}{\partial i_t} = \frac{D^{\text{eff}}_{x,t}}{1+y_t}.$$

Hence the policy-rate sensitivity ranking is determined by D^{eff}:

$$-\frac{\partial \ln P_{A,t}}{\partial i_t} > -\frac{\partial \ln P_{B,t}}{\partial i_t} \quad \Longleftrightarrow \quad D^{\text{eff}}_{A,t} > D^{\text{eff}}_{B,t}.$$

In particular, even if $D_{A,t} < D_{B,t}$ (asset A is shorter), a sufficiently large front-loaded pass-through (so that $\bar{\kappa}_{A,t}$ exceeds $\bar{\kappa}_{B,t}$ enough) can invert the ranking.

Proof. From Proposition 3, $-\partial \ln P_{x,t}/\partial i_t = \frac{D_{x,t}}{1+y_t}(1+\bar{\kappa}_{x,t}) = \frac{D^{\text{eff}}_{x,t}}{1+y_t}$. Because y_t is common across A and B, ordering in semi-elasticities is equivalent to ordering in $D^{\text{eff}}_{x,t}$. □

A.4. Interest Rate Sensitivity with Interest-rate-dependent Rents and Constant Term Premium

I now relax the fixed-rent assumption and allow expected rents to co-move with the policy rate (i.e., $\frac{\partial \mathbb{E}_t[C_{z,t+h}]}{\partial i_t} \neq 0$). The term premium remains constant with respect to i_t, so $r_{z,t} = i_t + \phi_z$ with a flat term structure at t.

House price. The property value equals the sum of the present values of expected future rents:

$$P_t = \sum_{h=1}^{\infty} \frac{\mathbb{E}_t[C_{t+h}]}{(1+r_t)^h}, \tag{A8}$$

Housing cash-flow duration. Following Macaulay duration, the housing duration is defined as

$$D_t = \sum_{h=1}^{\infty} h\, \frac{\mathbb{E}_t[C_{t+h}](1+r_t)^{-h}}{P_t} \equiv \sum_{h=1}^{\infty} h\, w_t(h), \tag{A9}$$

where $w_t(h) \equiv \mathbb{E}_t[C_{t+h}](1+r_t)^{-h}/P_t$ and $\sum_{h\geq 1} w_t(h) = 1$. Intuitively, D_t is the value-weighted average arrival time of expected cash flows.

Proposition 4 (Cash flow channel): *Holding ϕ constant with respect to i_t and allowing $\{\mathbb{E}_t[C_{t+h}]\}$ to be*

interest rate dependent,

$$
\begin{aligned}
-\frac{\partial \ln P_t}{\partial i_t} &= \frac{D_t}{1+r_t} - \frac{1}{P_t}\sum_{h=1}^{\infty}\frac{1}{(1+r_t)^h}\frac{\partial \mathbb{E}_t[C_{t+h}]}{\partial i_t} \\
&= \frac{D_t}{1+r_t} - \sum_{h=1}^{\infty} w_t(h)\underbrace{\frac{\partial \ln \mathbb{E}_t[C_{t+h}]}{\partial i_t}}_{\Gamma_t(h)} \equiv \frac{D_t}{1+r_t} - \overline{\Gamma}_t
\end{aligned}
\tag{A10}
$$

where $\Gamma_t(h) \equiv \partial \ln \mathbb{E}_t[C_{t+h}]/\partial i_t$ *is the rent semi-elasticity with respect to* i_t*. Then,* $\overline{\Gamma}_t \equiv \sum_{h\geq 1} w_t(h)\Gamma_t(h)$ *is its PV-weighted average.*

Interpretation. Equation (A10) decomposes the interest rate sensitivity into two components: (i), D_t, identical to the Macaulay-based baseline; and (ii) a *cash-flow channel*, the PV-weighted rent semi-elasticity $\overline{\Gamma}_t$. If $\overline{\Gamma}_t > 0$ (i.e., expected rents tend to be higher when i_t is higher), a rate cut lowers expected rents, making prices *less* sensitive than Macaulay would predict. If $\overline{\Gamma}_t < 0$, expected rents rise when i_t falls, amplifying the price response relative to Macaulay.

Cross-sectional implication. Consider two similar properties, A and B, with the Macaulay duration $D_{A,t} > D_{B,t}$. If and only if $\overline{\Gamma}_{A,t} > \overline{\Gamma}_{B,t}$ and $\overline{\Gamma}_{A,t} - \frac{D_{A,t}}{1+r_t} > \overline{\Gamma}_{B,t} - \frac{D_{B,t}}{1+r_t}$, then the relationship between the rate sensitivity and duration is inverted, leading to

$$
-\frac{\partial \ln P_{A,t}}{\partial i_t} < -\frac{\partial \ln P_{B,t}}{\partial i_t}.
$$

This suggests that a property with a longer Macaulay duration may exhibit less interest rate sensitivity than a property with a shorter duration if $\overline{\Gamma}_{A,t}$ is large enough relative to $\overline{\Gamma}_{B,t}$.

A.5. Duration and Rental Yield under Constant Rent Growth

Assume a constant growth rate g_z for the infinite stream of rents of the representative property in zip code z, where $g_z < r_t$. Then $C_{z,t+h} = C_{z,t}(1+g_z)^h$.

House price. Equation (A8) collapses to the Gordon Growth Model (GGM):

$$
P_{z,t} = C_{z,t}\frac{1+g_z}{r_t - g_z}. \tag{A11}
$$

Housing duration. Let $x \equiv (1+g_z)/(1+r_t) < 1$. Using $\sum_{h=1}^{\infty} h\,x^{h-1} = (1-x)^{-2}$, the numerator of Equation (A9) becomes

$$
\sum_{h=1}^{\infty} h\frac{C_{z,t+h}}{(1+r_t)^h} = C_{z,t}\frac{(1+r_t)(1+g_z)}{(r_t-g_z)^2}. \tag{A12}
$$

Dividing by the house price from Equation (A11) yields the housing duration:

$$
D_{z,t} = \frac{1+r_t}{r_t - g_z}. \tag{A13}
$$

Inverse duration–yield relationship. Define the rental yield as

$$y_{z,t} \equiv \frac{C_{z,t}}{P_{z,t}} = \frac{r_t - g_z}{1 + g_z}. \tag{A14}$$

From Equation (A13) and Equation (A14),

$$D_{z,t} = 1 + \frac{1}{y_{z,t}} \quad \Longrightarrow \quad D_{z,t} \propto \frac{1}{y_{z,t}}. \tag{A15}$$

Equation (A15) suggests that rental yields negatively correspond to housing duration. A low rental yield property will have a long housing duration. Combined with Proposition 1, it predicts that lower rental yield housing markets should exhibit higher interest rate sensitivity.

B Data Cleaning

B.1. CRSP Monthly Treasuries Data

I obtain Treasury securities data from the Center for Research in Security Prices (CRSP) Monthly Treasuries dataset. This dataset provides comprehensive monthly-level information on U.S. Treasury bills, notes, and bonds. Specifically, it includes detailed bond-month-level data such as quotation and issuance dates, maturity dates, coupon rates, bond prices, returns, yield-to-maturity, and accrued interest. The dataset also calculates bond duration expressed in days, which represents the weighted average number of days until cash flows occur. The present values of each cash flow, discounted by the yield to maturity, are used as weights in this calculation. In my final analysis, I convert the daily duration into years.

While the CRSP Treasuries dataset dates back to January 1919, my primary analysis for bonds focuses on the period from 2011 to 2024 to ensure direct comparability with housing market results. Nonetheless, incorporating data from earlier periods corroborates the robust relationship between longer duration and increased interest rate sensitivity of bond prices.

I follow Hu et al. (2013) to clean the bond data through the following steps. First, I restrict the sample to Treasury bills, notes, and bonds that are noncallable, nonflowering, and with no special tax treatment. Second, I keep the observations with the reason for the end of data that falls into the category of "still quoted" or "matured." Third, I exclude securities with remaining maturities of less than one month due to potential liquidity issues. After cleaning the monthly-level data, I aggregate it into annual observations at the bond-year level. Given that my baseline housing market analysis is conducted annually, this aggregation facilitates a consistent comparison of the heterogeneous interest rate sensitivity across housing and Treasury bond markets.

B.2. CRSP Monthly Stock and Equity Duration Data

I obtain equity data from the Center for Research in Security Prices (CRSP) Monthly Stock dataset. This dataset offers comprehensive historical coverage dating back to December 1925. However, to maintain consistency and comparability with my housing market analysis, my primary focus is on the period from 2011 to 2024. Including earlier data does not change my main finding that stocks with longer durations exhibit greater price sensitivity to interest rate changes.

I follow standard data cleaning procedures consistent with previous literature. Specifically, I restrict my sample to stocks with share codes 10 or 11 and exchange codes 1, 2, or 3. These selections correspond to ordinary common stocks traded on the three primary U.S. stock exchanges: the New York Stock Exchange (NYSE), the American Stock Exchange (AMEX), and Nasdaq. Stock prices are adjusted using the factor `cfacpr` provided by CRSP to account for the effects of stock dividends, stock splits, and other corporate distribution events.

Finally, I aggregate monthly stock-level data into annual observations, thereby constructing a consistent dataset at the asset-year level. It allows for comparability across housing, bond, and equity markets in analyzing asset price sensitivities to interest rate changes. To calculate annual stock returns and price changes (i.e., returns excluding dividends), I require at least 11 non-missing monthly

observations in a year for the variables `ret` or `retx`.

Equity Duration Measure from Gonçalves (2021)

To obtain equity duration, I adopt the stock-year-level duration measure constructed by Gonçalves (2021). The paper defines equity duration as the present value-weighted average time until a firm's expected future payouts are realized.

Specifically, Gonçalves (2021) constructs the equity duration by estimating future firm payouts, which include dividends, share repurchases, and net equity issuances. The paper employs a firm-level Vector Autoregression (VAR) model with 12 state variables derived from firm fundamentals in Compustat data. These forecasted payouts are then discounted using firm-specific discount rates to compute the weighted average maturity of the expected cash flows.

The equity duration is originally constructed at the *fiscal-year* level for each individual stock. For example, the duration for fiscal year 2023 corresponds to the period from July 2023 to June 2024. To avoid potential look-ahead bias and isolate the duration measure from ex-post monetary policy effects, I match the duration from fiscal year $t-1$, which becomes available at the end of June in calendar year $t-1$, with the stock returns observed in calendar year t. In other words, the duration measure for a stock will be applied to its returns starting 6 months after it becomes available.

B.3. ATTOM Housing Transaction Data

The ATTOM record dataset contains all housing transactions and mortgage records of properties in the United States. Before analysis, I clean the deed record data to identify valid transaction records and the transactions that are invalid but will end the property ownership of the prior homeowner. I follow some papers to form my cleaning algorithm, such as **?**Goldsmith-Pinkham and Shue (2023); Reher and Valkanov (2024). For example, some non-arm's-length transactions are conducted among family members with very low transaction prices relative to comparable houses. Some deed records could even be added to include family members (e.g., offspring) as additional homeowners with zero recorded transaction prices. Those are deemed invalid transactions and are excluded from the final analysis. There could be some other examples that are invalid but end the property's prior owners' ownership. For example, some foreclosure transactions are made because of payment defaults. Those foreclosure transactions will end the ownership of the prior owners, but the associated properties could be sold at a large discount. Some other deed record types, such as affidavits of death, also end ownership at very low prices for special situations. Overall, I do not want those abnormally low prices to bias my estimations and final analysis.

Starting from the raw ATTOM record data, I perform the following steps to finalize my sample for analysis.

1. Through variable `"TransferInfoPurchaseTypeCode"`, I keep only deed transfer and foreclosure records from the record data. I drop records of construction loans and mortgages.
2. Through variable `"PropertyUseGroup"`, I keep only residential property transaction records by removing non-residential records such as commercial and industrial purpose records.

Previous literature often employs various filters to eliminate transactions during the early stages of data cleaning. However, I retain those transaction records initially while identifying whether a transaction is valid or not, and when a homeowner ends her ownership of a property. my goal is to maintain a comprehensive sample that allows for the identification of key transitions, particularly the precise time points when homeowners enter and exit property ownership. In my main analysis and hedonic estimation, I will only use valid transactions, consistent with the approach taken in previous literature.

For each transaction, I assign a dummy variable to indicate whether it is a "valid" transaction based on specific criteria. However, it is important to clarify that a "non-valid" transaction is not necessarily invalid in a legal sense; rather, it only represents that these transactions will be excluded when creating certain measurements or statistics for analysis, as previous literature does. For instance, intra-family transactions often involve extremely low transaction prices, which do not reflect arm's-length transactions or the actual state of the housing market. The abnormal housing returns from such transactions can bias my estimations, even though the transactions are legally valid. A transaction record will be classified as invalid if it meets any of the following criteria.

1. Non-arm's length transactions identified by variable "ArmsLengthFlag"
2. Foreclosure or auction transactions identified by variables "TransferInfoPurchaseTypeCode" and "ForeclosureAuctionSale"
3. Quit claim deed transactions identified by variable "QuitclaimFlag"
4. Transactions in which only a portion of the parcel is conveyed, or multiple parcels are conveyed, which are identified from variable "TransferInfoMultiParcelFlag"
5. Transactions with only partial interest conveyed, as indicated by variable "PartialInterest"
6. Transacted deeds fall into the categories of affidavit of death, intrafamily transfer, and gift deed, as indicated by variable "DocumentTypeCode"
7. The rest of the transactions with a transfer amount of less than 5,000.

For each transaction, I assign a dummy variable to identify whether a transaction ends the ownership of the homeowner. Similarly, I have the following criteria.

1. If a transaction is not an arm's length transaction (identified by "ArmsLengthFlag") and the transaction price is greater than or equal to 5,000, it will end the ownership of the previous homeowner. If the non-arm's-length transaction has a transaction price of less than 10,000, I will *not* consider it a legitimate transfer of ownership and will continue the ownership of the homeowner. For example, some homeowners may transfer the deed from their own names to family trusts with a transaction price of zero. I will not consider such transactions as the end of ownership.
2. If a transaction is a foreclosure or auction (identified by "TransferInfoPurchaseTypeCode" and "ForeclosureAuctionSale"), I consider it as the end of the ownership of the prior homeowner.
3. If a transaction is a quit claim deed transfer, has only a portion of the parcel or multiple parcels conveyed, only partial interest conveyed, or is an intrafamily transfer or gift deed transfer and

the transaction price is greater than or equal to 5,000, I interpret this as a legitimate transfer of ownership and, hence, the end of ownership for the previous homeowner. If the transaction price is less than 5,000, I consider it a non-legitimate transfer and assume that the previous homeowner retains the property ownership.

4. If a transaction is the transfer type of affidavit of death, I consider it as the property ownership end for the previous homeowners.

C Baseline Analysis with ACS Sample

C.1. Rent Growth Predictive Regression

Table IA.C1. Future Rent Growth Prediction using Local Characteristics

	Δ log(rent)$_{i,[t+h-1,t+h]}$					Avg Δ log(rent)$_{i,[t+h-1,t+h]}$
	h=1	h=2	h=3	h=4	h=5	h=6, 7, 8, 9, 10
	(1)	(2)	(3)	(4)	(5)	(6)
log(rental yield)$_{i,t}$	-0.019***	-0.013***	-0.012***	-0.013***	-0.007***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
Δ log(rent)$_{i,t}$	-0.072***	-0.011**	-0.007	0.022***	-0.205***	-0.006**
	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)	(0.003)
Δ log(price)$_{i,t}$	0.074***	0.076***	0.056***	0.071***	0.073***	-0.030***
	(0.003)	(0.003)	(0.005)	(0.004)	(0.004)	(0.003)
Income ratio$_{i,t}$	-0.010***	-0.006***	-0.006***	-0.011***	-0.005***	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Income growth$_{i,t}$	0.053***	0.028***	0.039***	0.040***	0.023***	0.003
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.003)
Population ratio$_{i,t}$	47.616***	51.011***	61.658***	76.291***	75.311***	56.340***
	(2.394)	(2.477)	(2.673)	(2.849)	(3.060)	(2.187)
Population growth$_{i,t}$	0.068***	-0.002	-0.145***	-0.121***	0.199***	0.010
	(0.008)	(0.008)	(0.010)	(0.010)	(0.012)	(0.008)
% below 40$_{i,t}$	0.076***	0.096***	0.042***	-0.076***	-0.076***	-0.008*
	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.004)
% below 40 growth$_{i,t}$	-0.033***	-0.007	0.093***	0.099***	-0.117***	-0.001
	(0.004)	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)
% above 60$_{i,t}$	0.077***	0.116***	0.062***	-0.066***	-0.052***	0.009*
	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.005)
% above 60 growth$_{i,t}$	-0.035***	0.022***	0.060***	-0.018***	-0.043***	0.010***
	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.002)
Labor force rate$_{i,t}$	0.003	0.002	-0.007***	-0.005*	-0.001	0.011***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
Labor force rate growth$_{i,t}$	-0.002	0.030***	0.024***	-0.039***	-0.009	0.005
	(0.006)	(0.006)	(0.007)	(0.008)	(0.009)	(0.006)
Unemployment rate$_{i,t}$	-0.111***	-0.120***	-0.122***	-0.080***	-0.083***	0.021***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.004)
Unemployment rate growth$_{i,t}$	0.003***	0.001*	-0.003***	-0.003***	-0.004***	-0.004***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Homeownership rate$_{i,t}$	0.404	-0.103	-0.238	-0.358	0.970	0.055
	(0.463)	(0.490)	(0.508)	(0.554)	(0.607)	(0.384)
Homeownership rate growth$_{i,t}$	0.006	0.018***	0.020***	0.031***	0.020***	-0.002
	(0.005)	(0.004)	(0.005)	(0.008)	(0.005)	(0.004)
Rental vacancy rate$_{i,t}$	-0.028***	-0.029***	-0.026***	-0.016***	-0.014***	0.004
	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.003)
Rental vacancy rate growth$_{i,t}$	0.001***	-0.001**	0.000	-0.001*	-0.000	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
% single family house$_{i,t}$	0.001	0.002	0.005**	0.008***	0.007***	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)
% 2-4 unit house$_{i,t}$	-0.009***	-0.006**	-0.006**	-0.008***	-0.013***	-0.016***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)
% 5+ unit house$_{i,t}$	0.004*	0.005**	0.006**	0.008***	-0.001	-0.002
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
% single family house growth$_{i,t}$	-0.006***	0.004	-0.012***	-0.010***	-0.004	-0.001
	(0.002)	(0.003)	(0.004)	(0.004)	(0.003)	(0.002)
% 2-4 unit house growth$_{i,t}$	-0.000	0.001**	-0.001	0.000	0.003***	-0.000
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
% 5+ unit house growth$_{i,t}$	0.000	0.000	-0.001	-0.001	0.002***	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
Median room number growth$_{i,t}$	-0.027***	0.015	-0.040***	-0.036***	-0.087***	-0.023***
	(0.009)	(0.009)	(0.010)	(0.011)	(0.012)	(0.008)
% renter occupied$_{i,t}$	0.408	-0.092	-0.216	-0.331	1.017*	0.085
	(0.463)	(0.490)	(0.508)	(0.554)	(0.607)	(0.384)
% renter occupied growth$_{i,t}$	-0.007**	-0.006*	-0.011***	-0.012***	-0.017***	-0.001
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.002)
Adjusted R^2	0.048	0.040	0.039	0.035	0.066	0.055
Observations	246,689	224,825	202,991	180,733	158,169	66,846

Table IA.C1 presents predictive regression results for future rent growth over short- and long-term horizons using local economic characteristics as predictors. In Columns 1 to 5, the dependent variable is the logarithm of annual rent growth from year $t+h-1$ to $t+h$, where t represents the current year when predictions are made, and h denotes the forecast horizon specified at the top of each column. Therefore, Columns 1 through 5 predict annual rent growth over horizons ranging from one to five years (i.e., $t+1$ to $t+5$). Column 6 focuses on longer-term predictions by using average annual rent growth from years $t+6$ to $t+10$ as the dependent variable. Standard errors are clustered at the zip code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table IA.C2. Future Rent Growth Prediction using Local Characteristics Selected by LASSO

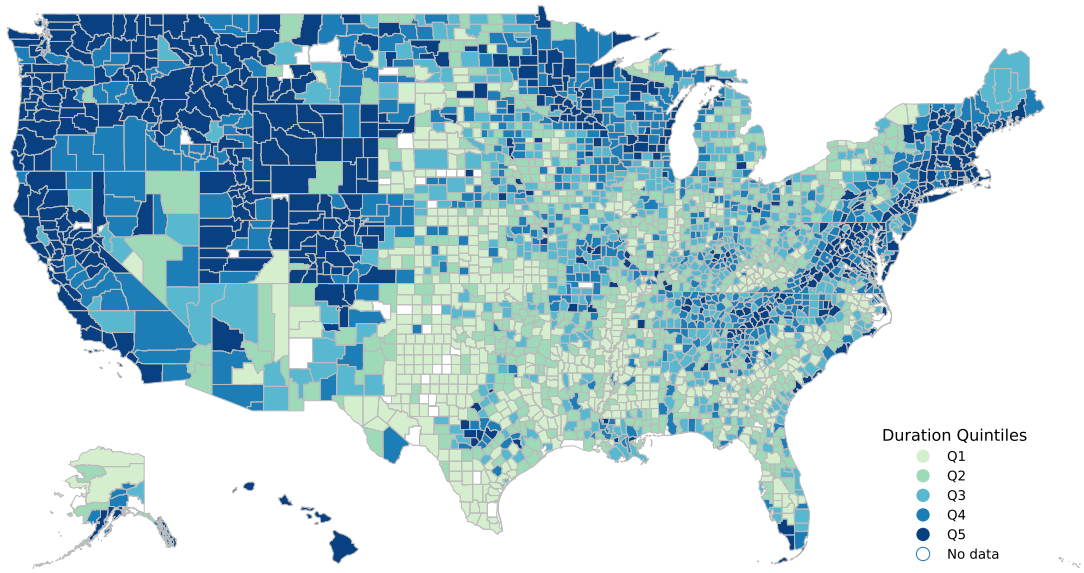
	Δ log(rent)$_{i,[t+h-1,t+h]}$					Avg Δ log(rent)$_{i,[t+h-1,t+h]}$
	h=1	h=2	h=3	h=4	h=5	h=6, 7, 8, 9, 10
	(1)	(2)	(3)	(4)	(5)	(6)
log(rental yield)$_{i,t}$	-0.019***	-0.017***	-0.012***	-0.013***	-0.007***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Δ log(rent)$_{i,t}$	-0.072***	-0.018***	-0.007	0.022***	-0.205***	
	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)	
Δ log(price)$_{i,t}$	0.074***	0.067***	0.056***	0.071***	0.073***	-0.028***
	(0.003)	(0.003)	(0.005)	(0.004)	(0.004)	(0.003)
Income ratio$_{i,t}$	-0.011***	-0.006***	-0.006***	-0.011***	-0.005***	
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	
Income growth$_{i,t}$	0.054***	0.023***	0.039***	0.040***	0.023***	-0.001
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.003)
Population ratio$_{i,t}$	47.625***	56.346***	61.657***	76.283***	75.308***	59.225***
	(2.397)	(2.386)	(2.673)	(2.849)	(3.060)	(3.165)
Population growth$_{i,t}$	0.068***		-0.145***	-0.121***	0.199***	0.007
	(0.008)		(0.010)	(0.010)	(0.012)	(0.005)
% below 40$_{i,t}$	0.077***	0.096***	0.042***	-0.076***	-0.076***	-0.019***
	(0.005)	(0.004)	(0.005)	(0.006)	(0.006)	(0.003)
% below 40 growth$_{i,t}$	-0.033***		0.093***	0.099***	-0.117***	
	(0.004)		(0.005)	(0.005)	(0.006)	
% above 60$_{i,t}$	0.076***	0.111***	0.062***	-0.066***	-0.051***	
	(0.006)	(0.005)	(0.006)	(0.007)	(0.006)	
% above 60 growth$_{i,t}$	-0.035***	0.015***	0.060***	-0.018***	-0.043***	0.010***
	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.002)
Labor force rate$_{i,t}$	0.003	-0.004*	-0.007***	-0.005*		0.010***
	(0.002)	(0.002)	(0.003)	(0.003)		(0.003)
Labor force rate growth$_{i,t}$	-0.002	0.030***	0.024***	-0.039***	-0.010	0.008
	(0.006)	(0.006)	(0.007)	(0.008)	(0.009)	(0.005)
Unemployment rate$_{i,t}$	-0.110***	-0.125***	-0.122***	-0.080***	-0.082***	0.020***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)
Unemployment rate growth$_{i,t}$	0.003***	0.001**	-0.003***	-0.003***	-0.004***	-0.004***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Homeownership rate$_{i,t}$		-0.012***	-0.021***	-0.026***		0.013
		(0.002)	(0.003)	(0.003)		(0.373)
Homeownership rate growth$_{i,t}$	0.006	0.012***	0.020***	0.031***	0.020***	
	(0.005)	(0.004)	(0.005)	(0.008)	(0.005)	
Rental vacancy rate$_{i,t}$	-0.028***	-0.028***	-0.026***	-0.016***	-0.013***	
	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	
Rental vacancy rate growth$_{i,t}$	0.001***		0.000	-0.001*	-0.000	-0.001***
	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)
% single family house$_{i,t}$	0.001		0.005**	0.008***	0.007***	
	(0.002)		(0.002)	(0.002)	(0.002)	
% 2-4 unit house$_{i,t}$	-0.007***	-0.008***	-0.006**	-0.008***	-0.014***	-0.017***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
% 5+ unit house$_{i,t}$	0.006***	0.002	0.006**	0.008***	-0.002	-0.004*
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)
% single family house growth$_{i,t}$	-0.006***	0.006*	-0.012***	-0.010***	-0.004	
	(0.002)	(0.003)	(0.004)	(0.004)	(0.003)	
% 2-4 unit house growth$_{i,t}$	-0.000	0.000	-0.001	0.000	0.003***	
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	
% 5+ unit house growth$_{i,t}$	0.000	-0.000	-0.001	-0.001	0.002***	-0.000
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)
Median room number growth$_{i,t}$	-0.027***	0.007	-0.040***	-0.036***	-0.087***	-0.031***
	(0.009)	(0.009)	(0.010)	(0.011)	(0.012)	(0.008)
% renter occupied$_{i,t}$					0.047***	0.043
					(0.003)	(0.373)
% renter occupied growth$_{i,t}$	-0.006**	-0.005*	-0.011***	-0.012***	-0.017***	
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	
Adjusted R^2	0.048	0.032	0.039	0.035	0.066	0.052
Observations	246,689	258,741	202,991	180,733	158,169	68,418

Table IA.C2 presents predictive regression results for future rent growth over short- and long-term horizons using LASSO-selected local characteristics as predictors. The table performs LASSO regressions with 10-fold cross validation (CV). In Columns 1 to 5, the dependent variable is the logarithm of annual rent growth from year $t+h-1$ to $t+h$, where t represents the current year when predictions are made, and h denotes the forecast horizon specified at the top of each column. Therefore, Columns 1 through 5 predict annual rent growth over horizons ranging from one to five years (i.e., $t+1$ to $t+5$). Column 6 focuses on longer-term predictions by using average annual rent growth from years $t+6$ to $t+10$ as the dependent variable. Standard errors are clustered at the zip code level. *, ** and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

C.2. Duration, Δr, Δ30-Year Mortgage Rate, and Monetary Policy Shocks

Figure IA.C1. County-level Geographic Heterogeneity in Housing Duration

Panel A: Duration using all predictors



Panel B: Duration using LASSO-selected predictors

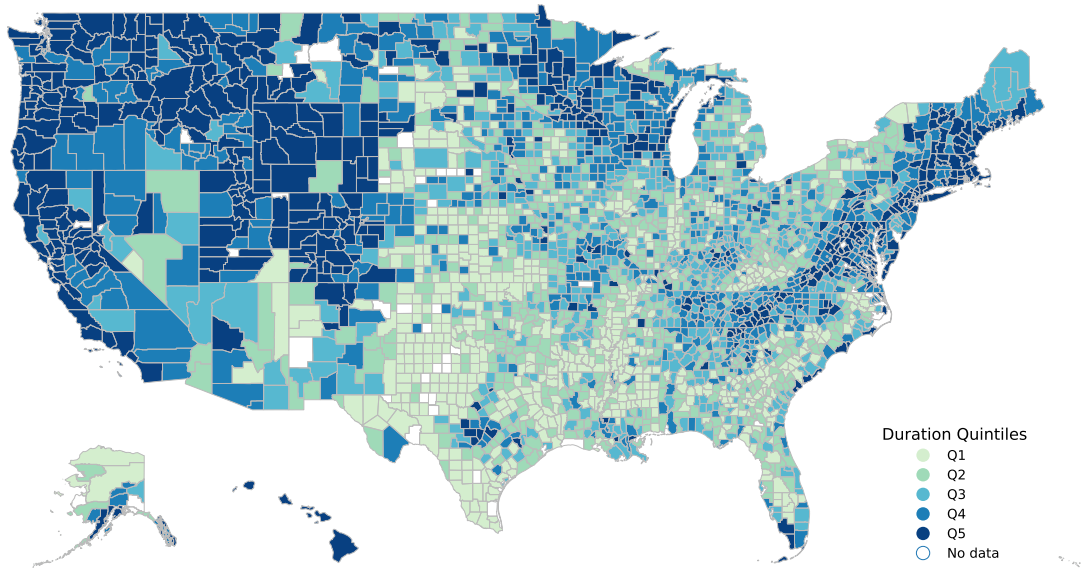


Figure IA.C1 presents county-level geographic heterogeneity in housing duration constructed from all predictors (Panel A) and the duration constructed using the LASSO-selected predictors (Panel B). Both panels categorize counties into quintiles (Q1 to Q5), with darker shading indicating higher quintile values. The detailed estimation procedures for housing duration at the zip-code level are provided in Section II.B. The county-level housing duration is computed by averaging the estimated duration values across all available zip codes and years within each county. Counties without sufficient data are shown in white.

Figure IA.C2. Heterogeneity in House Price Sensitivity to Federal Funds Rate and 30-Year Mortgage Rate across Housing Duration Quintiles

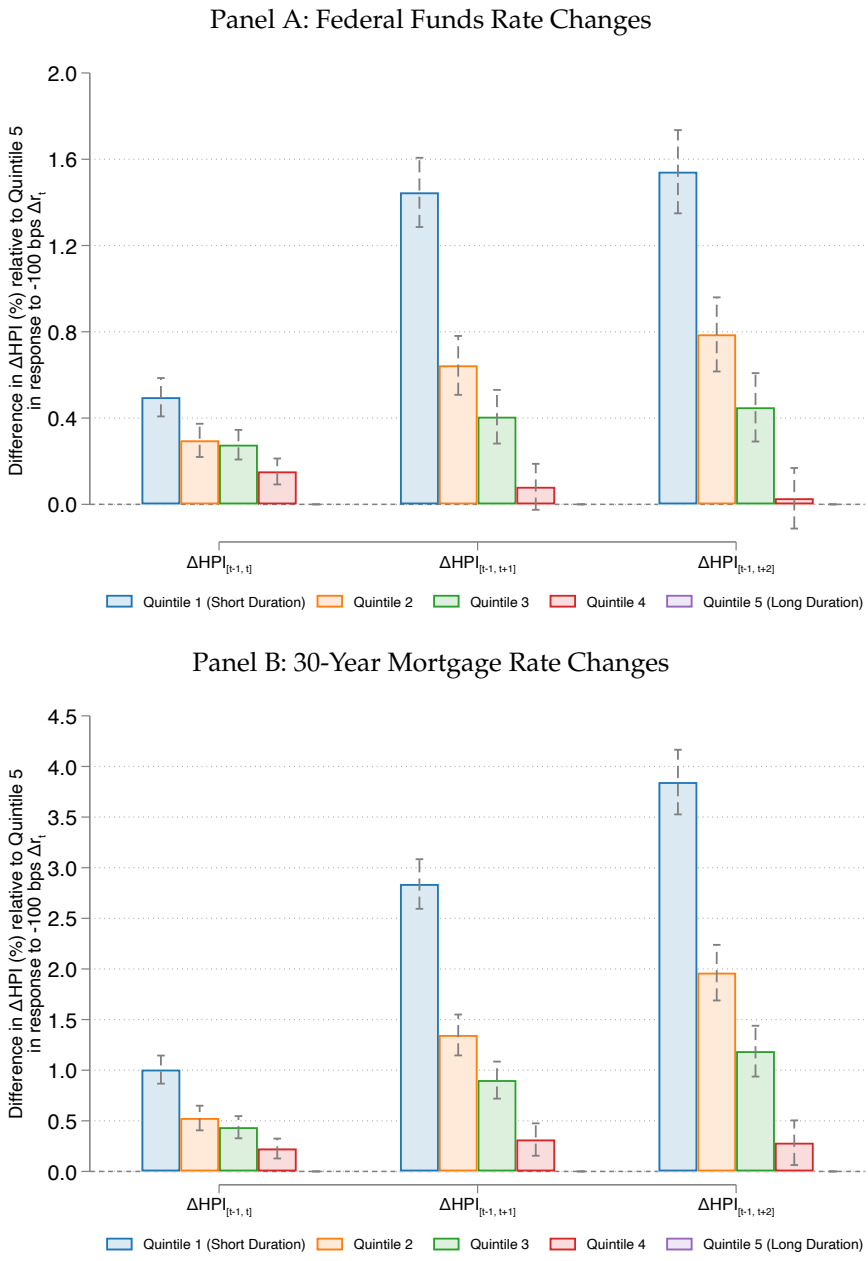


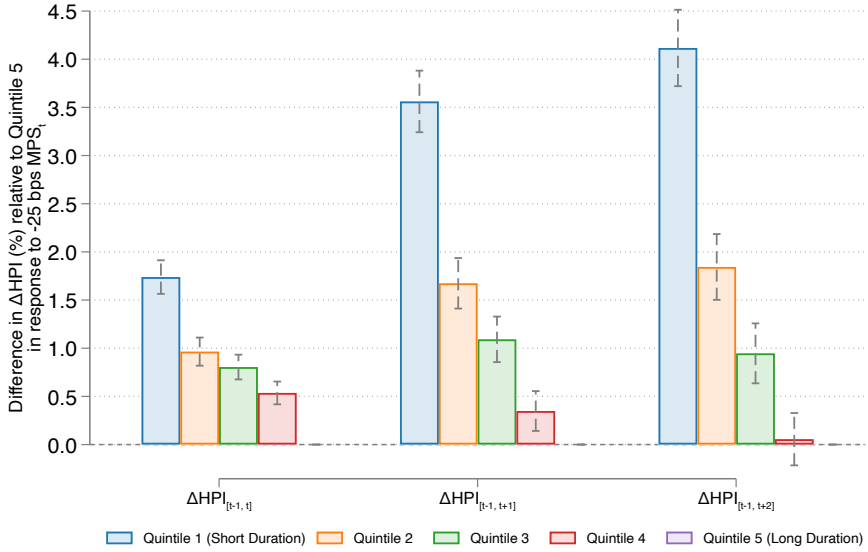
Figure IA.C2 illustrates the differences in house price responses across zip-code housing cash flow duration quintiles following a 100 basis-point (bps) decrease in the interest rate, compared to quintile 5 (baseline group). Each year, zip codes are categorized into five housing duration quintiles. Quintile 1 represents zip codes with the shortest housing cash flow durations, while quintile 5 includes those with the longest housing durations. Panel A uses the federal funds rate changes as the interest rate change measure, while Panel B uses the 30-year mortgage rate changes. The interest rate shock is introduced at horizon 0, representing the period from year $t-1$ to t. The x-axis represents the response horizon h in years following the interest rate change, while the y-axis shows the difference in the cumulative percentage change in house prices over 1-, 2-, and 3-year horizons relative to the quintile 5 (long duration) group. The analysis employs the same regression specification as Column 5 of Table 2 Panel A for each horizon, as presented in the following:

$$\Delta HPI_{z,c,[t-1,t+h]} = \alpha_h + \beta_{1,h}\,\Delta r_{[t-1,t]} \times \text{Duration Quintile}_{z,t-1} + \beta_{2,h}\,\text{Duration Quintile}_{z,t-1} + \zeta_c \times \theta_t + \lambda_z + \epsilon_{z,c,t},$$

where $\Delta HPI_{z,c,[t-1,t+h]}$ is the cumulative house price change of zip code z in county c from year $t-1$ to $t+h$. $\Delta r_{[t-1,t]}$ indicates the annual change in the federal funds rate from year $t-1$ to t. $\text{Duration Quintile}_{z,t-1}$ is a categorical variable ranging from 1 to 5, indicating the quintile ranking of housing cash flow duration for zip code z in year $t-1$. The term $\zeta_c \times \theta_t$ represents the county-year fixed effects, and λ_z denotes the zip code fixed effects. The gray-capped error bars indicate 95% confidence intervals. Standard errors are clustered at the zip code level.

Figure IA.C3. Heterogeneity in House Price Sensitivity to Monetary Policy Shock (MPS) across Housing Duration Quintiles

Panel A: Bauer and Swanson (2023a) MPS



Panel B: Bauer and Swanson (2023a) MPS_ORTH

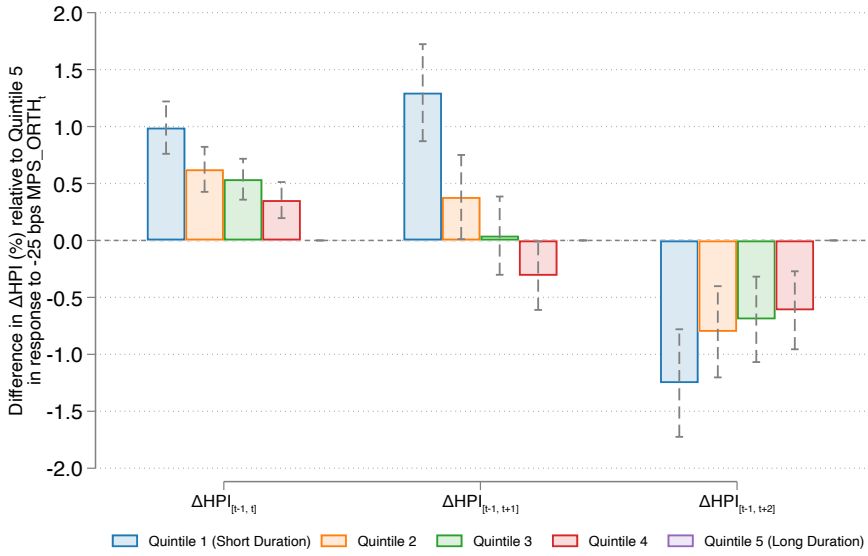


Figure IA.C3 illustrates the differences in house price responses across zip-code housing cash flow duration quintiles following a negative 25 basis-point (bps) of monetary policy shocks (MPS), compared to quintile 5 (baseline group). Each year, zip codes are categorized into five housing duration quintiles. Quintile 1 represents zip codes with the shortest housing cash flow durations, while quintile 5 includes those with the longest housing durations. Panel A uses the standard MPS constructed by Bauer and Swanson (2023a) as the shock measure, while Panel B uses their orthogonalized MPS. The shock is introduced at horizon 0, representing the period from year $t-1$ to t. The x-axis represents the response horizon h in years following the MPS, while the y-axis shows the difference in the cumulative percentage change in house prices over 1-, 2-, and 3-year horizons relative to the quintile 5 (long duration) group. The analysis employs the same regression specification as Column 5 of Table 2 Panel A for each horizon, as presented in the following:

$$\Delta HPI_{z,c,[t-1,t+h]} = \alpha_h + \beta_{1,h}\, MPS_t \times \text{Duration Quintile}_{z,t-1} + \beta_{2,h}\, \text{Duration Quintile}_{z,t-1} + \zeta_c \times \theta_t + \lambda_z + \epsilon_{z,c,t},$$

where $\Delta HPI_{z,c,[t-1,t+h]}$ is the cumulative house price change of zip code z in county c from year $t-1$ to $t+h$. MPS_t indicates the aggregated annual MPS from the end of year $t-1$ to t. Duration Quintile$_{z,t-1}$ is a categorical variable ranging from 1 to 5, indicating the quintile ranking of housing cash flow duration for zip code z in year $t-1$. The term $\zeta_c \times \theta_t$ represents the county-year fixed effects, and λ_z denotes the zip code fixed effects. The gray-capped error bars indicate 95% confidence intervals. Standard errors are clustered at the zip code level.

Figure IA.C4. Heterogeneity in House Price Response to the Federal Funds Rate and 30-Year Mortgage Rate across Housing Duration and Local Economic Characteristics

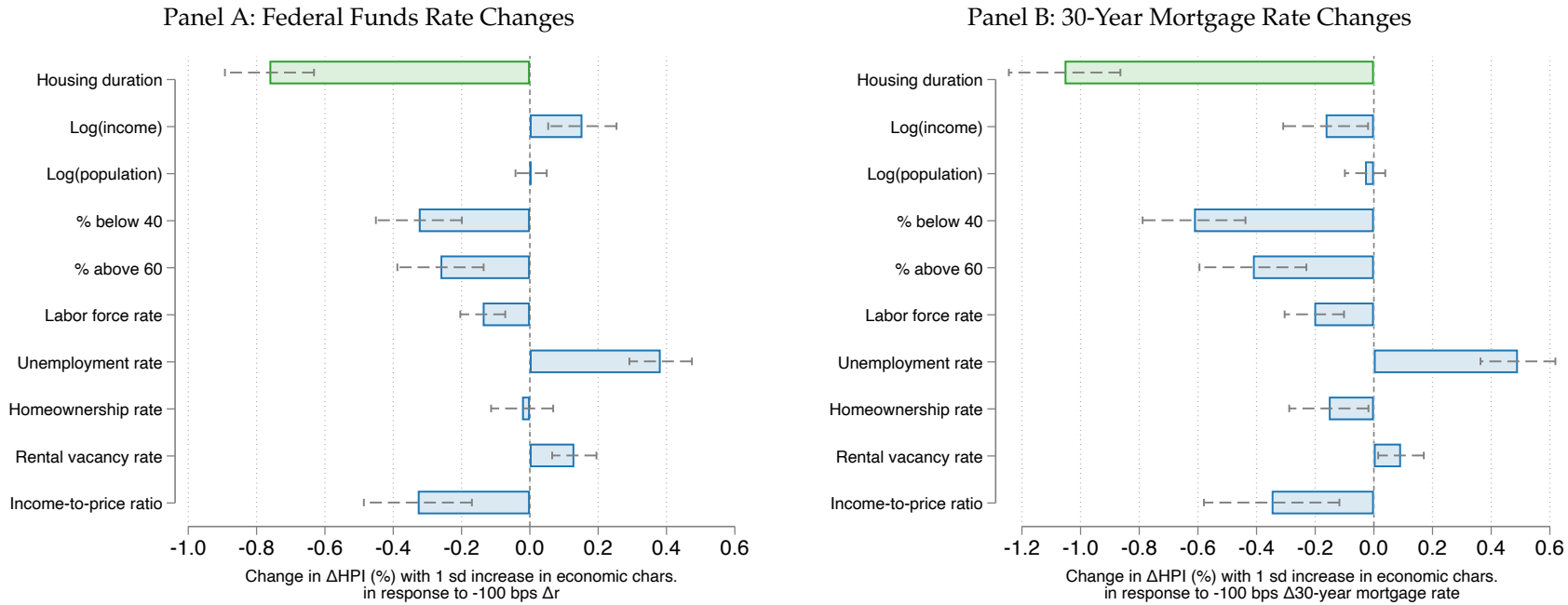


Figure IA.C4 presents the heterogeneous effects of a 100 basis-point (bps) decrease in the federal funds rate (FFR) (Panel A) and the 30-year mortgage rate (Panel B) on two-year house price growth across zip codes with varying housing duration and economic characteristics. The interest rate shock is introduced at horizon 0, representing the period from year $t-1$ to t. The x-axis represents the differential impact on cumulative two-year house price growth, $\Delta HPI_{z,c,[t-1,t+1]}$, associated with a one standard deviation (sd) increase in each specified economic characteristic at the zip-code level. The y-axis lists the economic characteristics analyzed. The heterogeneity is estimated using the regression specification applied in Column 3 of Table 3, as indicated in the following:

$$\begin{aligned}\Delta HPI_{z,c,[t-1,t+1]} = \alpha + \beta_1 \Delta r_{[t-1,t]} \times \text{Duration}_{z,t} + \beta_2 \Delta r_{[t-1,t]} \times \text{Economic Chars}_{z,t} \\ + \delta \, \text{Duration}_{z,t} + \gamma \, \text{Economic Chars}_{z,t} + \zeta_c \times \theta_t + \lambda_z + \epsilon_{z,c,t},\end{aligned}$$

where $\Delta HPI_{z,c,[t-1,t+1]}$ denotes cumulative house price changes in zip code z, county c, from year $t-1$ to $t+1$, and $\Delta r_{[t-1,t]}$ represents the annual change in the FFR (Panel A) or the 30-year mortgage rate (Panel B) from year $t-1$ to t. The variable $\text{Duration}_{z,t}$ captures housing duration at the zip-code-year level. The term $\zeta_c \times \theta_t$ represents the county-year fixed effects, and λ_z denotes the zip code fixed effects. The gray-capped error bars indicate 95% confidence intervals. Standard errors are clustered at the zip code level.

Figure IA.C5. Heterogeneity in House Price Response to Monetary Policy Shocks across Housing Duration and Local Economic Characteristics

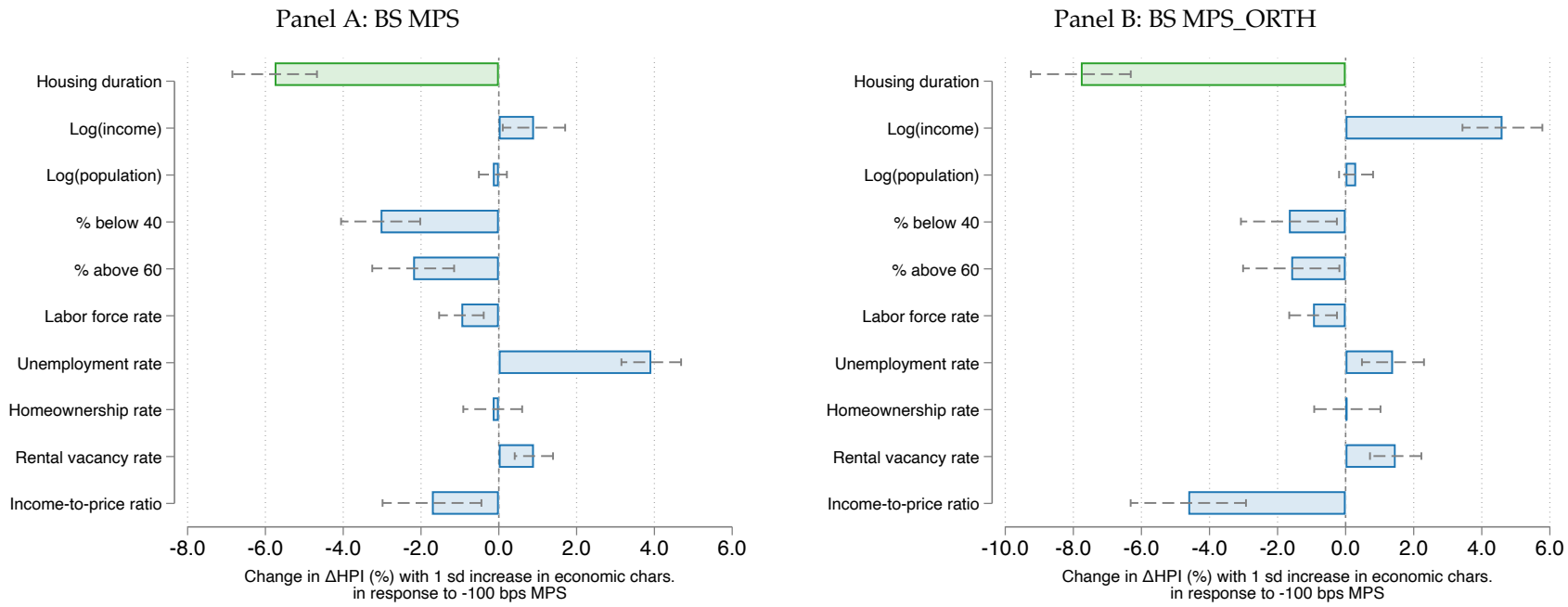


Figure IA.C5 presents the heterogeneous effects of a 100 basis-point (bps) decrease in the standard monetary policy shocks (MPS) (Panel A) and the orthogonalized MPS (Panel B) constructed by Bauer and Swanson (2023a) on two-year house price growth across zip codes with varying housing duration and economic characteristics. The shock is introduced at horizon 0, representing the period from year $t-1$ to t. The x-axis represents the differential impact on cumulative two-year house price growth, $\Delta HPI_{z,c,[t-1,t+1]}$, associated with a one standard deviation (sd) increase in each specified economic characteristic at the zip-code level. The y-axis lists the economic characteristics analyzed. The heterogeneity is estimated using the regression specification applied in Column 3 of Table 3, as indicated in the following:

$$\begin{aligned}\Delta HPI_{z,c,[t-1,t+1]} = \alpha + \beta_1 MPS_t \times \text{Duration}_{z,t} + \beta_2 MPS_t \times \text{Economic Chars}_{z,t} \\ + \delta\, \text{Duration}_{z,t} + \gamma\, \text{Economic Chars}_{z,t} + \zeta_c \times \theta_t + \lambda_z + \epsilon_{z,c,t},\end{aligned}$$

where $\Delta HPI_{z,c,[t-1,t+1]}$ denotes cumulative house price changes in zip code z, county c, from year $t-1$ to $t+1$, and MPS_t represents the aggregated annual MPS from year $t-1$ to t. The variable $\text{Duration}_{z,t}$ captures housing duration at the zip-code-year level. The term $\zeta_c \times \theta_t$ represents the county-year fixed effects, and λ_z denotes the zip code fixed effects. The gray-capped error bars indicate 95% confidence intervals. Standard errors are clustered at the zip code level.

Table IA.C3. 5- and 10-Year Housing Duration and Monetary Policy Transmission to House Prices in 1, 2, and 3-year Horizons

Panel A: Duration (5-year)

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta r_{[t-1,t]}\times$ Duration$_{z,t-1}$	1.073***	0.939***	3.089***	3.314***	2.897***	3.084***
	(0.084)	(0.170)	(0.152)	(0.289)	(0.164)	(0.340)
Duration$_{z,t-1}$	-0.152***	-0.012	-0.308***	-0.056***	-0.426***	-0.101***
	(0.009)	(0.010)	(0.018)	(0.022)	(0.029)	(0.035)
Δ HPI$_{z,[t-2,t-1]}$		0.127***		0.129***		0.075***
		(0.008)		(0.013)		(0.017)
Adjusted R^2	0.773	0.787	0.805	0.820	0.805	0.821
Observations	60,947	60,947	60,920	60,920	55,292	55,292
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
$\Delta r_{[t-1,t]}\times$ Zip Economic Chars		Yes		Yes		Yes

Panel B: Duration (10-year)

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta r_{[t-1,t]}\times$ Duration$_{z,t-1}$	0.302***	0.215***	0.868***	0.909***	0.822***	0.908***
	(0.024)	(0.049)	(0.043)	(0.087)	(0.046)	(0.101)
Duration$_{z,t-1}$	-0.044***	0.000	-0.088***	-0.008	-0.119***	-0.013
	(0.003)	(0.003)	(0.005)	(0.006)	(0.008)	(0.010)
Δ HPI$_{z,[t-2,t-1]}$		0.126***		0.129***		0.075***
		(0.008)		(0.013)		(0.017)
Adjusted R^2	0.772	0.787	0.803	0.819	0.803	0.820
Observations	60,947	60,947	60,920	60,920	55,292	55,292
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
$\Delta r_{[t-1,t]}\times$ Zip Economic Chars		Yes		Yes		Yes

Table IA.C3 presents the heterogeneous effects of interest rate changes on house price growth over 1-, 2-, and 3-year horizons across zip codes with varying housing duration levels. Panel A uses the duration measure with a 5-year property holding horizon assumed, while Panel B employs the 10-year horizon version of housing duration. The dependent variable in each column is the cumulative change in house prices, $\Delta HPI_{z,[t-1,t+h]}$, from the end of year $t-1$ to $t+h$, where $h \in \{0,1,2\}$ denotes the ex-post horizon in years. The key explanatory variable, $\Delta r_{[t-1,t]} \times Duration_{z,t-1}$, captures the heterogeneous house price sensitivity to FFR changes based on the zip-code housing duration. $\Delta r_{[t-1,t]}$ measures the annual change in the FFR from the end of year $t-1$ to t. Section II.B provides details on the estimation of housing duration. All specifications include county-year and zip-code fixed effects. Columns 2, 4, and 6 additionally control for time-varying zip-code economic characteristics and their interactions with the interest rate change, consistent with Column 3 of Table 3. Standard errors are clustered at the zip code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table IA.C4. 5- and 10-Year Housing Duration and Heterogeneous House Price Responses to 30-Year Mortgage Rate Changes over 1-, 2-, and 3-Year Horizons

Panel A: Duration (5-year)

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta r^{30Y}_{[t-1,t]}\times$ Duration$_{z,t-1}$	1.830***	1.127***	5.488***	4.584***	6.769***	5.679***
	(0.120)	(0.240)	(0.225)	(0.422)	(0.275)	(0.553)
Duration$_{z,t-1}$	-0.149***	-0.009	-0.302***	-0.048**	-0.423***	-0.094***
	(0.009)	(0.010)	(0.018)	(0.021)	(0.028)	(0.034)
Δ HPI$_{z,[t-2,t-1]}$		0.119***		0.110***		0.053***
		(0.008)		(0.013)		(0.017)
Adjusted R^2	0.773	0.788	0.806	0.822	0.808	0.824
Observations	60,947	60,947	60,920	60,920	55,292	55,292
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
$\Delta r^{30Y}_{[t-1,t]}\times$ Zip Economic Chars		Yes		Yes		Yes

Panel B: Duration (10-year)

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta r^{30Y}_{[t-1,t]}\times$ Duration$_{z,t-1}$	0.532***	0.267***	1.569***	1.245***	1.955***	1.687***
	(0.034)	(0.071)	(0.064)	(0.127)	(0.078)	(0.164)
Duration$_{z,t-1}$	-0.044***	0.001	-0.087***	-0.006	-0.118***	-0.012
	(0.002)	(0.003)	(0.005)	(0.006)	(0.008)	(0.010)
Δ HPI$_{z,[t-2,t-1]}$		0.118***		0.110***		0.053***
		(0.008)		(0.013)		(0.017)
Adjusted R^2	0.773	0.788	0.805	0.821	0.806	0.824
Observations	60,947	60,947	60,920	60,920	55,292	55,292
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
$\Delta r^{30Y}_{[t-1,t]}\times$ Zip Economic Chars		Yes		Yes		Yes

Table IA.C4 presents the heterogeneous effects of 30-year mortgage rate changes on house price growth over 1-, 2-, and 3-year horizons across zip codes with varying housing duration levels. Panel A uses the duration measure with a 5-year property holding horizon assumed, while Panel B employs the 10-year horizon version of housing duration. The dependent variable in each column is the cumulative change in house prices, $\Delta HPI_{z,[t-1,t+h]}$, from the end of year $t-1$ to $t+h$, where $h \in \{0,1,2\}$ denotes the ex-post horizon in years. The key explanatory variable, $\Delta r_{[t-1,t]} \times Duration_{z,t-1}$, captures the heterogeneous house price sensitivity to 30-year mortgage rate changes based on the zip-code housing duration. $\Delta r_{[t-1,t]}$ measures the annual change in the 30-year mortgage rate from the end of year $t-1$ to t. Section II.B provides details on the estimation of housing duration. All specifications include county-year and zip-code fixed effects. Columns 2, 4, and 6 additionally control for time-varying zip-code economic characteristics and their interactions with the interest rate change, consistent with Column 3 of Table 3. Standard errors are clustered at the zip code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table IA.C5. 5-Year Housing Duration, Bauer and Swanson (2023a) Monetary Policy Shocks, and House Prices in 1, 2, and 3-year Horizons

Panel A: BS MPS

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
MPS$_t$ × Duration$_{z,t-1}$	12.500***	4.522***	27.539***	25.053***	29.757***	29.155***
	(0.676)	(1.349)	(1.240)	(2.412)	(1.364)	(2.812)
Duration$_{z,t-1}$	-0.147***	-0.004	-0.293***	-0.039*	-0.411***	-0.085**
	(0.009)	(0.010)	(0.017)	(0.021)	(0.028)	(0.034)
Δ HPI$_{z,[t-2,t-1]}$		0.123***		0.129***		0.078***
		(0.008)		(0.013)		(0.017)
Adjusted R^2	0.775	0.789	0.806	0.821	0.806	0.823
Observations	60,947	60,947	60,920	60,920	55,292	55,292
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
MPS$_t$ × Zip Economic Chars		Yes		Yes		Yes

Panel B: BS MPS_ORTH

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
MPS$_t$ × Duration$_{z,t-1}$	10.368***	13.569***	15.373***	33.825***	-4.239***	14.108***
	(0.950)	(1.937)	(1.631)	(3.252)	(1.519)	(3.268)
Duration$_{z,t-1}$	-0.154***	-0.016	-0.304***	-0.063***	-0.406***	-0.092***
	(0.009)	(0.010)	(0.018)	(0.022)	(0.029)	(0.035)
Δ HPI$_{z,[t-2,t-1]}$		0.134***		0.142***		0.076***
		(0.008)		(0.013)		(0.017)
Adjusted R^2	0.772	0.786	0.801	0.816	0.803	0.818
Observations	60,947	60,947	60,920	60,920	55,292	55,292
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
MPS$_t$ × Zip Economic Chars		Yes		Yes		Yes

Table IA.C5 presents the heterogeneous effects of monetary policy shocks (MPS) on house price growth over 1-, 2-, and 3-year horizons across zip codes with varying 5-year housing duration levels. Panel A uses the standard MPS constructed by Bauer and Swanson (2023a), while Panel B employs their orthogonalized MPS. The dependent variable in each column is the cumulative change in house prices, $\Delta HPI_{z,[t-1,t+h]}$, from the end of year $t-1$ to $t+h$, where $h \in \{0,1,2\}$ denotes the ex-post horizon in years. The key explanatory variable, $MPS_t \times Duration_{z,t-1}$, captures the heterogeneous house price sensitivity to FFR changes based on the zip-code 5-year housing duration. MPS_t measures the aggregated annual MPS from the end of year $t-1$ to t. Section II.B provides details on the estimation of housing duration. All specifications include county-year and zip-code fixed effects. Columns 2, 4, and 6 additionally control for time-varying zip-code economic characteristics and their interactions with the interest rate change, consistent with Column 3 of Table 3. Standard errors are clustered at the zip code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table IA.C6. 10-Year Housing Duration, Bauer and Swanson (2023a) Monetary Policy Shocks, and House Prices in 1, 2, and 3-year Horizons

Panel A: BS MPS

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
MPS$_t$ × Duration$_{z,t-1}$	3.622***	0.742*	7.816***	6.798***	8.499***	8.637***
	(0.188)	(0.394)	(0.350)	(0.711)	(0.386)	(0.834)
Duration$_{z,t-1}$	-0.043***	0.002	-0.084***	-0.004	-0.115***	-0.009
	(0.002)	(0.003)	(0.005)	(0.006)	(0.008)	(0.010)
Δ HPI$_{z,[t-2,t-1]}$		0.122***		0.128***		0.077***
		(0.008)		(0.013)		(0.017)
Adjusted R^2	0.774	0.789	0.804	0.821	0.805	0.823
Observations	60,947	60,947	60,920	60,920	55,292	55,292
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
MPS$_t$ × Zip Economic Chars		Yes		Yes		Yes

Panel B: BS MPS_ORTH

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
MPS$_t$ × Duration$_{z,t-1}$	2.837***	3.317***	4.083***	9.488***	-1.562***	3.898***
	(0.264)	(0.560)	(0.457)	(0.969)	(0.425)	(0.995)
Duration$_{z,t-1}$	-0.045***	-0.001	-0.087***	-0.010	-0.113***	-0.010
	(0.003)	(0.003)	(0.005)	(0.006)	(0.008)	(0.010)
Δ HPI$_{z,[t-2,t-1]}$		0.134***		0.142***		0.076***
		(0.008)		(0.013)		(0.017)
Adjusted R^2	0.772	0.786	0.800	0.816	0.801	0.818
Observations	60,947	60,947	60,920	60,920	55,292	55,292
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
MPS$_t$ × Zip Economic Chars		Yes		Yes		Yes

Table IA.C6 presents the heterogeneous effects of monetary policy shocks (MPS) on house price growth over 1-, 2-, and 3-year horizons across zip codes with varying 10-year housing duration levels. Panel A uses the standard MPS constructed by Bauer and Swanson (2023a), while Panel B employs their orthogonalized MPS. The dependent variable in each column is the cumulative change in house prices, $\Delta HPI_{z,[t-1,t+h]}$, from the end of year $t-1$ to $t+h$, where $h \in \{0,1,2\}$ denotes the ex-post horizon in years. The key explanatory variable, $MPS_t \times Duration_{z,t-1}$, captures the heterogeneous house price sensitivity to FFR changes based on the zip-code 10-year housing duration. MPS_t measures the aggregated annual MPS from the end of year $t-1$ to t. Section II.B provides details on the estimation of housing duration. All specifications include county-year and zip-code fixed effects. Columns 2, 4, and 6 additionally control for time-varying zip-code economic characteristics and their interactions with the interest rate change, consistent with Column 3 of Table 3. Standard errors are clustered at the zip code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table IA.C7. Monetary Policy Shocks, 10-Year Housing Duration, and House Price Growth

	Δ HPI$_{i,[t-1,t+1]}$									
	1-Year Yield Surprise$_t$		BS MPS$_t$		BS MPS_ORTH $_t$		JK PM MPS$_t$		JK Median MPS$_t$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MPS$_t$ × Duration$_{z,t-1}$	1.106***	0.946***	7.816***	6.798***	4.083***	9.488***	0.093***	0.071***	0.087***	0.071***
	(0.047)	(0.095)	(0.350)	(0.711)	(0.457)	(0.969)	(0.004)	(0.008)	(0.004)	(0.008)
Duration$_{z,t-1}$	-0.086***	-0.004	-0.084***	-0.004	-0.087***	-0.010	-0.083***	-0.002	-0.082***	-0.001
	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)
Δ HPI$_{z,[t-2,t-1]}$		0.125***		0.128***		0.142***		0.120***		0.125***
		(0.013)		(0.013)		(0.013)		(0.013)		(0.013)
Adjusted R^2	0.805	0.821	0.804	0.821	0.800	0.816	0.805	0.821	0.804	0.820
Observations	60,920	60,920	60,920	60,920	60,920	60,920	60,920	60,920	60,920	60,920
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes		Yes		Yes
MPS$_t$ × Zip Economic Chars		Yes		Yes		Yes		Yes		Yes

Table IA.C7 examines how alternative measurements of monetary policy shocks (MPS) affect house price growth differently across zip codes with varying housing durations. The specific MPS measure used in each column is indicated at the top. The dependent variable, $\Delta HPI_{z,[t-1,t+1]}$, is the cumulative house price growth from the end of year $t-1$ to $t+1$. The primary explanatory variable, $MPS_t \times Duration_{z,t-1}$, captures the heterogeneous house price sensitivity to MPS based on the zip-code housing duration. Section II.B provides details on the estimation of housing duration. The MPS variable, MPS_t, aggregates monetary policy shocks occurring between the end of year $t-1$ and t. Columns 1 and 2 employ the 1-year treasury yield surprise as the MPS measure. Columns 3 and 4 utilize the standard MPS measure developed by Bauer and Swanson (2023a), while columns 5 and 6 apply the orthogonalized version from Bauer and Swanson (2023a). Columns 7 and 8 incorporate the PM MPS measure from Jarociński and Karadi (2020), and columns 9 and 10 use their median MPS measure. All specifications include county-year and zip-code fixed effects. Columns 2, 4, 6, 8, and 10 additionally control for time-varying zip-code economic characteristics and their interactions with MPS, consistent with Column 3 of Table 3. Standard errors are clustered at the zip code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table IA.C8. 5- and 10-Year Housing Duration (LASSO) and Monetary Policy Transmission to House Prices in 1, 2, and 3-year Horizons

Panel A: Duration (5-year)

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta r_{[t-1,t]}\times$ Duration$_{z,t-1}$	1.069***	0.952***	3.088***	3.344***	2.892***	3.101***
	(0.085)	(0.171)	(0.153)	(0.292)	(0.165)	(0.343)
Duration$_{z,t-1}$	-0.154***	-0.014	-0.314***	-0.061***	-0.437***	-0.111***
	(0.009)	(0.010)	(0.018)	(0.022)	(0.029)	(0.036)
Δ HPI$_{z,[t-2,t-1]}$		0.127***		0.129***		0.076***
		(0.008)		(0.013)		(0.017)
Adjusted R^2	0.773	0.787	0.805	0.820	0.805	0.821
Observations	60,947	60,947	60,920	60,920	55,292	55,292
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
$\Delta r_{[t-1,t]}\times$ Zip Economic Chars		Yes		Yes		Yes

Panel B: Duration (10-year)

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta r_{[t-1,t]}\times$ Duration$_{z,t-1}$	0.302***	0.224***	0.869***	0.929***	0.822***	0.923***
	(0.024)	(0.050)	(0.044)	(0.087)	(0.047)	(0.102)
Duration$_{z,t-1}$	-0.045***	-0.000	-0.091***	-0.010	-0.124***	-0.017*
	(0.003)	(0.003)	(0.005)	(0.006)	(0.008)	(0.010)
Δ HPI$_{z,[t-2,t-1]}$		0.126***		0.129***		0.075***
		(0.008)		(0.013)		(0.017)
Adjusted R^2	0.772	0.787	0.804	0.819	0.804	0.820
Observations	60,947	60,947	60,920	60,920	55,292	55,292
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
$\Delta r_{[t-1,t]}\times$ Zip Economic Chars		Yes		Yes		Yes

Table IA.C8 presents the heterogeneous effects of interest rate changes on house price growth over 1-, 2-, and 3-year horizons across zip codes with varying housing duration levels, which are estimated with LASSO selected predictors. Panel A uses the duration measure with a 5-year property holding horizon assumed, while Panel B employs the 10-year horizon version of housing duration. The dependent variable in each column is the cumulative change in house prices, $\Delta HPI_{z,[t-1,t+h]}$, from the end of year $t-1$ to $t+h$, where $h \in \{0,1,2\}$ denotes the ex-post horizon in years. The key explanatory variable, $\Delta r_{[t-1,t]} \times Duration_{z,t-1}$, captures the heterogeneous house price sensitivity to FFR changes based on the zip-code housing duration, which is estimated with LASSO selected predictors. The LASSO prediction regression results are presented in Table IA.C2. $\Delta r_{[t-1,t]}$ measures the annual change in the FFR from the end of year $t-1$ to t. Section II.B provides details on the estimation of housing duration. All specifications include county-year and zip-code fixed effects. Columns 2, 4, and 6 additionally control for time-varying zip-code economic characteristics and their interactions with the interest rate change, consistent with Column 3 of Table 3. Standard errors are clustered at the zip code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table IA.C9. 5- and 10-Year Housing Duration (LASSO) and Heterogeneous House Price Responses to 30-Year Mortgage Rate Changes over 1-, 2-, and 3-Year Horizons

Panel A: Duration (5-year)

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta r^{30Y}_{[t-1,t]}\times$ Duration$_{z,t-1}$	1.818***	1.120***	5.479***	4.589***	6.759***	5.683***
	(0.121)	(0.242)	(0.226)	(0.426)	(0.277)	(0.558)
Duration$_{z,t-1}$	-0.152***	-0.011	-0.308***	-0.053**	-0.434***	-0.103***
	(0.009)	(0.010)	(0.018)	(0.022)	(0.029)	(0.035)
Δ HPI$_{z,[t-2,t-1]}$		0.119***		0.111***		0.054***
		(0.008)		(0.013)		(0.017)
Adjusted R^2	0.773	0.788	0.807	0.822	0.808	0.824
Observations	60,947	60,947	60,920	60,920	55,292	55,292
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
$\Delta r^{30Y}_{[t-1,t]}\times$ Zip Economic Chars		Yes		Yes		Yes

Panel B: Duration (10-year)

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta r^{30Y}_{[t-1,t]}\times$ Duration$_{z,t-1}$	0.528***	0.267***	1.568***	1.258***	1.953***	1.702***
	(0.034)	(0.072)	(0.064)	(0.128)	(0.079)	(0.166)
Duration$_{z,t-1}$	-0.045***	0.000	-0.090***	-0.008	-0.123***	-0.015
	(0.003)	(0.003)	(0.005)	(0.006)	(0.008)	(0.010)
Δ HPI$_{z,[t-2,t-1]}$		0.118***		0.110***		0.053***
		(0.008)		(0.013)		(0.017)
Adjusted R^2	0.773	0.788	0.806	0.822	0.807	0.824
Observations	60,947	60,947	60,920	60,920	55,292	55,292
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
$\Delta r^{30Y}_{[t-1,t]}\times$ Zip Economic Chars		Yes		Yes		Yes

Table IA.C9 presents the heterogeneous effects of 30-year mortgage rate changes on house price growth over 1-, 2-, and 3-year horizons across zip codes with varying housing duration levels, which are estimated with LASSO selected predictors. Panel A uses the duration measure with a 5-year property holding horizon assumed, while Panel B employs the 10-year horizon version of housing duration. The dependent variable in each column is the cumulative change in house prices, $\Delta HPI_{z,[t-1,t+h]}$, from the end of year $t-1$ to $t+h$, where $h \in \{0,1,2\}$ denotes the ex-post horizon in years. The key explanatory variable, $\Delta r_{[t-1,t]} \times Duration_{z,t-1}$, captures the heterogeneous house price sensitivity to 30-year mortgage rate changes based on the zip-code housing duration, which is estimated with LASSO selected predictors. The LASSO prediction regression results are presented in Table IA.C2. $\Delta r_{[t-1,t]}$ measures the annual change in the 30-year mortgage rate from the end of year $t-1$ to t. Section II.B provides details on the estimation of housing duration. All specifications include county-year and zip-code fixed effects. Columns 2, 4, and 6 additionally control for time-varying zip-code economic characteristics and their interactions with the interest rate change, consistent with Column 3 of Table 3. Standard errors are clustered at the zip code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table IA.C10. 5-Year Housing Duration (LASSO), Bauer and Swanson (2023a) Monetary Policy Shocks, and House Prices in 1, 2, and 3-year Horizons

Panel A: BS MPS

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
MPS$_t$ × Duration$_{z,t-1}$	12.486***	4.552***	27.541***	25.226***	29.758***	29.320***
	(0.681)	(1.361)	(1.249)	(2.432)	(1.376)	(2.839)
Duration$_{z,t-1}$	-0.149***	-0.006	-0.300***	-0.044**	-0.422***	-0.095***
	(0.009)	(0.010)	(0.018)	(0.022)	(0.029)	(0.035)
Δ HPI$_{z,[t-2,t-1]}$		0.123***		0.129***		0.078***
		(0.008)		(0.013)		(0.017)
Adjusted R^2	0.775	0.789	0.806	0.821	0.806	0.823
Observations	60,947	60,947	60,920	60,920	55,292	55,292
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
MPS$_t$ × Zip Economic Chars		Yes		Yes		Yes

Panel B: BS MPS_ORTH

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
MPS$_t$ × Duration$_{z,t-1}$	10.346***	13.760***	15.294***	34.090***	-4.301***	14.310***
	(0.955)	(1.950)	(1.639)	(3.271)	(1.531)	(3.296)
Duration$_{z,t-1}$	-0.157***	-0.018*	-0.311***	-0.069***	-0.418***	-0.104***
	(0.009)	(0.011)	(0.018)	(0.023)	(0.030)	(0.036)
Δ HPI$_{z,[t-2,t-1]}$		0.134***		0.142***		0.077***
		(0.008)		(0.013)		(0.017)
Adjusted R^2	0.773	0.786	0.802	0.816	0.803	0.818
Observations	60,947	60,947	60,920	60,920	55,292	55,292
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
MPS$_t$ × Zip Economic Chars		Yes		Yes		Yes

Table IA.C10 presents the heterogeneous effects of monetary policy shocks (MPS) on house price growth over 1-, 2-, and 3-year horizons across zip codes with varying 5-year housing duration levels, which are estimated with LASSO selected predictors. Panel A uses the standard MPS constructed by Bauer and Swanson (2023a), while Panel B employs their orthogonalized MPS. The dependent variable in each column is the cumulative change in house prices, $\Delta HPI_{z,[t-1,t+h]}$, from the end of year $t-1$ to $t+h$, where $h \in \{0,1,2\}$ denotes the ex-post horizon in years. The key explanatory variable, $MPS_t \times Duration_{z,t-1}$, captures the heterogeneous house price sensitivity to FFR changes based on the zip-code 5-year housing duration, which is estimated with LASSO selected predictors. The LASSO prediction regression results are presented in Table IA.C2. MPS_t measures the aggregated annual MPS from the end of year $t-1$ to t. Section II.B provides details on the estimation of housing duration. All specifications include county-year and zip-code fixed effects. Columns 2, 4, and 6 additionally control for time-varying zip-code economic characteristics and their interactions with the interest rate change, consistent with Column 3 of Table 3. Standard errors are clustered at the zip code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table IA.C11. 10-Year Housing Duration (LASSO), Bauer and Swanson (2023a) Monetary Policy Shocks, and House Prices in 1, 2, and 3-year Horizons

Panel A: BS MPS

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
MPS$_t$ × Duration$_{z,t-1}$	3.620***	0.780*	7.827***	6.931***	8.509***	8.766***
	(0.190)	(0.399)	(0.353)	(0.717)	(0.390)	(0.843)
Duration$_{z,t-1}$	-0.044***	0.002	-0.087***	-0.005	-0.120***	-0.013
	(0.003)	(0.003)	(0.005)	(0.006)	(0.008)	(0.010)
Δ HPI$_{z,[t-2,t-1]}$		0.122***		0.128***		0.078***
		(0.008)		(0.013)		(0.017)
Adjusted R^2	0.774	0.789	0.805	0.821	0.805	0.823
Observations	60,947	60,947	60,920	60,920	55,292	55,292
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
MPS$_t$ × Zip Economic Chars		Yes		Yes		Yes

Panel B: BS MPS_ORTH

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
MPS$_t$ × Duration$_{z,t-1}$	2.841***	3.447***	4.078***	9.680***	-1.562***	4.034***
	(0.266)	(0.566)	(0.460)	(0.977)	(0.429)	(1.004)
Duration$_{z,t-1}$	-0.046***	-0.001	-0.090***	-0.012*	-0.119***	-0.015
	(0.003)	(0.003)	(0.005)	(0.006)	(0.009)	(0.010)
Δ HPI$_{z,[t-2,t-1]}$		0.134***		0.143***		0.077***
		(0.008)		(0.013)		(0.017)
Adjusted R^2	0.772	0.786	0.801	0.816	0.802	0.818
Observations	60,947	60,947	60,920	60,920	55,292	55,292
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
MPS$_t$ × Zip Economic Chars		Yes		Yes		Yes

Table IA.C11 presents the heterogeneous effects of monetary policy shocks (MPS) on house price growth over 1-, 2-, and 3-year horizons across zip codes with varying 10-year housing duration levels, which are estimated with LASSO selected predictors. Panel A uses the standard MPS constructed by Bauer and Swanson (2023a), while Panel B employs their orthogonalized MPS. The dependent variable in each column is the cumulative change in house prices, $\Delta HPI_{z,[t-1,t+h]}$, from the end of year $t-1$ to $t+h$, where $h \in \{0,1,2\}$ denotes the ex-post horizon in years. The key explanatory variable, $MPS_t \times Duration_{z,t-1}$, captures the heterogeneous house price sensitivity to FFR changes based on the zip-code 10-year housing duration, which is estimated with LASSO selected predictors. The LASSO prediction regression results are presented in Table IA.C2. MPS_t measures the aggregated annual MPS from the end of year $t-1$ to t. Section II.B provides details on the estimation of housing duration. All specifications include county-year and zip-code fixed effects. Columns 2, 4, and 6 additionally control for time-varying zip-code economic characteristics and their interactions with the interest rate change, consistent with Column 3 of Table 3. Standard errors are clustered at the zip code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table IA.C12. Monetary Policy Shocks, 5-Year Housing Duration (LASSO), and House Price Growth

	Δ HPI$_{i,[t-1,t+1]}$									
	1-Year Yield Surprise$_t$		BS MPS$_t$		BS MPS_ORTH $_t$		JK PM MPS$_t$		JK Median MPS$_t$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MPS$_t$ × Duration$_{z,t-1}$	3.865***	3.457***	27.541***	25.226***	15.294***	34.090***	0.323***	0.263***	0.303***	0.263***
	(0.167)	(0.315)	(1.249)	(2.432)	(1.639)	(3.271)	(0.013)	(0.025)	(0.013)	(0.025)
Duration$_{z,t-1}$	-0.304***	-0.047**	-0.300***	-0.044**	-0.311***	-0.069***	-0.295***	-0.039*	-0.291***	-0.036*
	(0.018)	(0.022)	(0.018)	(0.022)	(0.018)	(0.023)	(0.018)	(0.022)	(0.018)	(0.022)
Δ HPI$_{z,[t-2,t-1]}$		0.125***		0.129***		0.142***		0.120***		0.126***
		(0.013)		(0.013)		(0.013)		(0.013)		(0.013)
Adjusted R^2	0.806	0.821	0.806	0.821	0.802	0.816	0.806	0.821	0.805	0.820
Observations	60,920	60,920	60,920	60,920	60,920	60,920	60,920	60,920	60,920	60,920
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes		Yes		Yes
MPS$_t$ × Zip Economic Chars		Yes		Yes		Yes		Yes		Yes

Table IA.C12 examines how alternative measurements of monetary policy shocks (MPS) affect house price growth differently across zip codes with varying 5-year housing durations, which are estimated with LASSO selected predictors. The specific MPS measure used in each column is indicated at the top. The dependent variable, $\Delta HPI_{z,[t-1,t+1]}$, is the cumulative house price growth from the end of year $t-1$ to $t+1$. The primary explanatory variable, $MPS_t \times Duration_{z,t-1}$, captures the heterogeneous house price sensitivity to MPS based on the zip-code 5-year housing duration, which is estimated with LASSO selected predictors. The LASSO prediction regression results are presented in Table IA.C2. Section II.B provides details on the estimation of housing duration. The MPS variable, MPS_t, aggregates monetary policy shocks occurring between the end of year $t-1$ and t. Columns 1 and 2 employ the 1-year treasury yield surprise as the MPS measure. Columns 3 and 4 utilize the standard MPS measure developed by Bauer and Swanson (2023a), while columns 5 and 6 apply the orthogonalized version from Bauer and Swanson (2023a). Columns 7 and 8 incorporate the PM MPS measure from Jarociński and Karadi (2020), and columns 9 and 10 use their median MPS measure. All specifications include county-year and zip-code fixed effects. Columns 2, 4, 6, 8, and 10 additionally control for time-varying zip-code economic characteristics and their interactions with MPS, consistent with Column 3 of Table 3. Standard errors are clustered at the zip code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table IA.C13. Monetary Policy Shocks, 10-Year Housing Duration (LASSO), and House Price Growth

	Δ HPI$_{i,[t-1,t+1]}$									
	1-Year Yield Surprise$_t$		BS MPS$_t$		BS MPS_ORTH $_t$		JK PM MPS$_t$		JK Median MPS$_t$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MPS$_t$ × Duration$_{z,t-1}$	1.105***	0.968***	7.827***	6.931***	4.078***	9.680***	0.093***	0.073***	0.087***	0.073***
	(0.048)	(0.096)	(0.353)	(0.717)	(0.460)	(0.977)	(0.004)	(0.008)	(0.004)	(0.008)
Duration$_{z,t-1}$	-0.089***	-0.006	-0.087***	-0.005	-0.090***	-0.012*	-0.086***	-0.004	-0.085***	-0.003
	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)
Δ HPI$_{z,[t-2,t-1]}$		0.125***		0.128***		0.143***		0.120***		0.126***
		(0.013)		(0.013)		(0.013)		(0.013)		(0.013)
Adjusted R^2	0.805	0.821	0.805	0.821	0.801	0.816	0.805	0.821	0.804	0.820
Observations	60,920	60,920	60,920	60,920	60,920	60,920	60,920	60,920	60,920	60,920
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes		Yes		Yes
MPS$_t$ × Zip Economic Chars		Yes		Yes		Yes		Yes		Yes

Table IA.C13 examines how alternative measurements of monetary policy shocks (MPS) affect house price growth differently across zip codes with varying 10-year housing durations, which are estimated with LASSO selected predictors. The specific MPS measure used in each column is indicated at the top. The dependent variable, $\Delta HPI_{z,[t-1,t+1]}$, is the cumulative house price growth from the end of year $t-1$ to $t+1$. The primary explanatory variable, $MPS_t \times Duration_{z,t-1}$, captures the heterogeneous house price sensitivity to MPS based on the zip-code 10-year housing duration, which is estimated with LASSO selected predictors. The LASSO prediction regression results are presented in Table IA.C2. Section II.B provides details on the estimation of housing duration. The MPS variable, MPS_t, aggregates monetary policy shocks occurring between the end of year $t-1$ and t. Columns 1 and 2 employ the 1-year treasury yield surprise as the MPS measure. Columns 3 and 4 utilize the standard MPS measure developed by Bauer and Swanson (2023a), while columns 5 and 6 apply the orthogonalized version from Bauer and Swanson (2023a). Columns 7 and 8 incorporate the PM MPS measure from Jarociński and Karadi (2020), and columns 9 and 10 use their median MPS measure. All specifications include county-year and zip-code fixed effects. Columns 2, 4, 6, 8, and 10 additionally control for time-varying zip-code economic characteristics and their interactions with MPS, consistent with Column 3 of Table 3. Standard errors are clustered at the zip code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

C.3. Rental Yield, Δr, Δ30-Year Mortgage Rate, and Monetary Policy Shocks

Figure IA.C6. Heterogeneity in House Price Responses by Rental Yield Following a 100 bps Decrease in the Federal Funds Rate and 30-Year Mortgage Rate

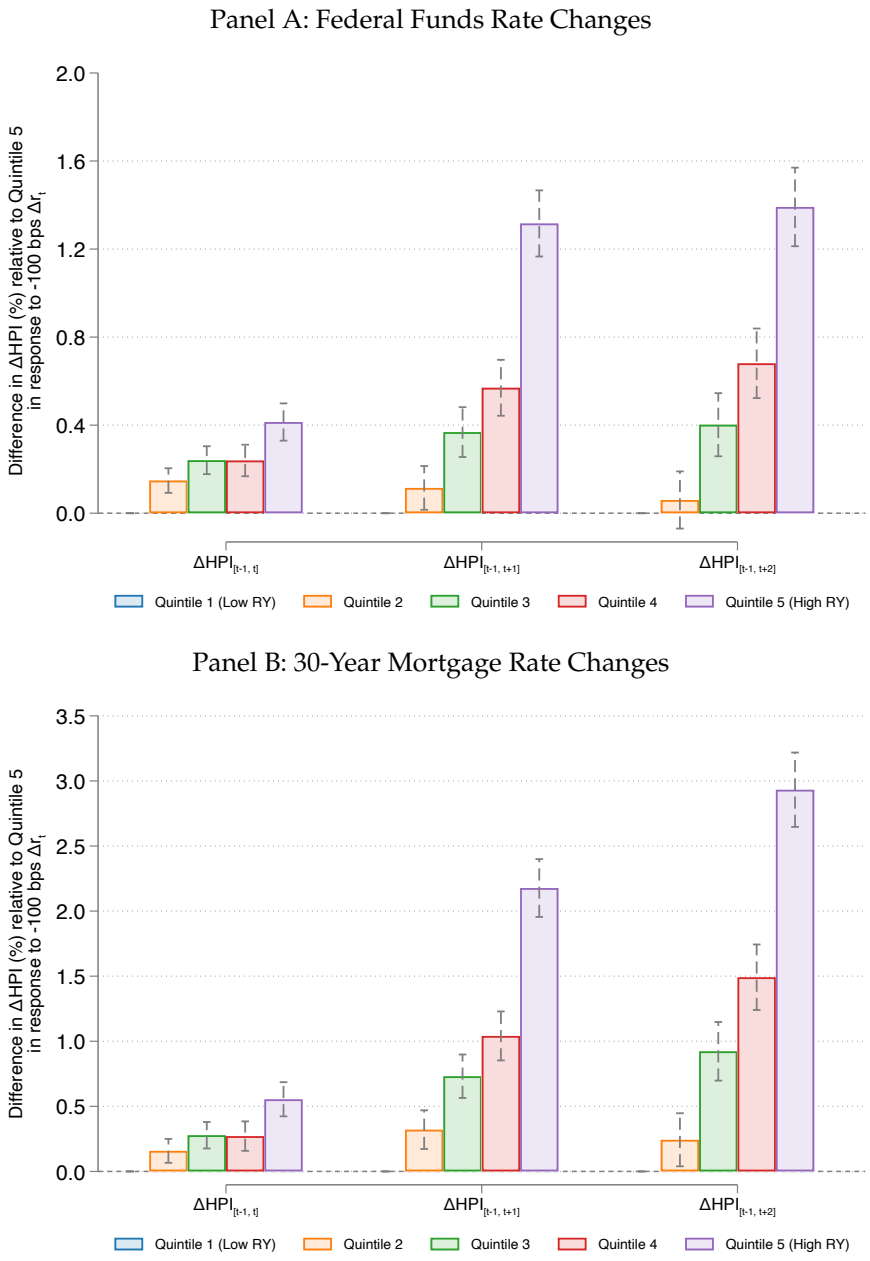


Figure IA.C6 illustrates the differences in house price responses across zip-code rental yield quintiles following a 100 basis-point (bps) decrease in the interest rate, compared to quintile 1 (baseline group). Each year, zip codes are categorized into five rental yield quintiles, which are represented by five bars respectively. Quintile 1 represents zip codes with the lowest rental yield, while quintile 5 includes those with the highest rental yield. Panel A uses the federal funds rate changes as the interest rate change measure, while Panel B uses the 30-year mortgage rate changes. The interest rate shock is introduced at horizon 0, representing the period from year $t-1$ to t. The x-axis represents the response horizon h in years following the interest rate change, while the y-axis shows the difference in the cumulative percentage change in house prices over 1-, 2-, and 3-year horizons relative to the quintile 5 (long duration) group. The analysis employs the same regression specification as Column 5 of Table 2 Panel A for each horizon, as presented in the following:

$$\Delta HPI_{z,c,[t-1,t+h]} = \alpha_h + \beta_{1,h}\,\Delta r_{[t-1,t]} \times \mathrm{RY}_{z,t-1} + \beta_{2,h}\,\mathrm{RY}_{z,t-1} + \zeta_c \times \theta_t + \lambda_z + \epsilon_{z,c,t},$$

where $\Delta HPI_{z,c,[t-1,t+h]}$ is the cumulative house price change of zip code z in county c from year $t-1$ to $t+h$. $\Delta r_{[t-1,t]}$ indicates the annual change in the federal funds rate from year $t-1$ to t. $\mathrm{RY}_{z,t-1}$ is a categorical variable ranging from 1 to 5, indicating the quintile ranking of rental yield for zip code z in year $t-1$. The term $\zeta_c \times \theta_t$ represents the county-year fixed effects, and λ_z denotes the zip code fixed effects. The gray-shaded error bars indicate 95% confidence intervals. Standard errors are clustered at the zip code level.

Figure IA.C7. Heterogeneity in House Price Responses by Rental Yield Following a 25 bps of Negative Monetary Policy Shock (MPS)

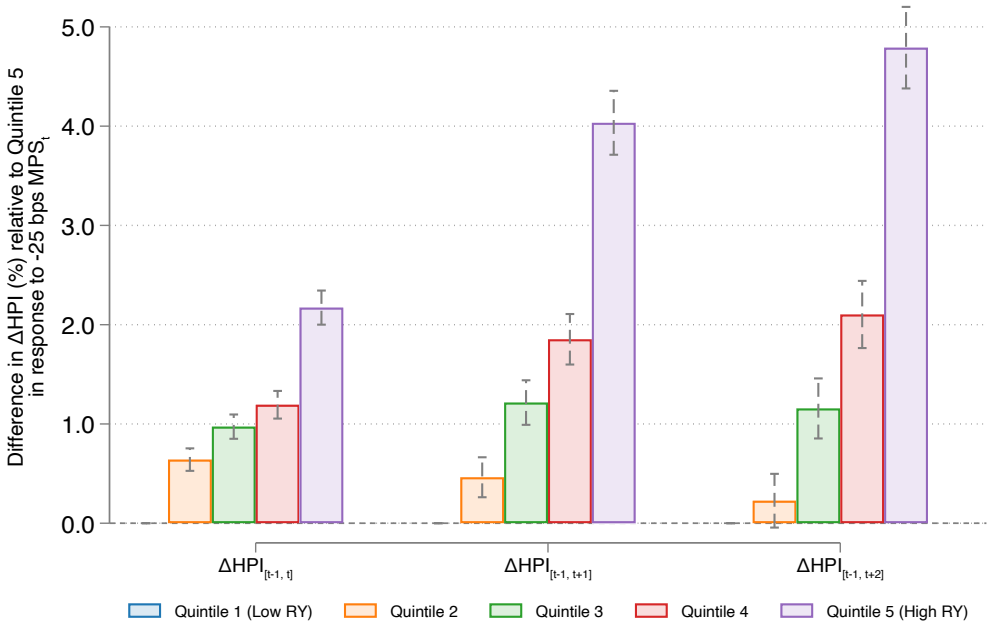


Figure IA.C7 illustrates the differences in house price responses across zip-code rental yield quintiles following a negative 25 basis-point (bps) of monetary policy shocks (MPS), compared to quintile 1 (baseline group). Each year, zip codes are categorized into five rental yield quintiles, which are represented by five bars respectively. Quintile 1 represents zip codes with the lowest rental yield, while quintile 5 includes those with the highest rental yield. The figure uses the standard MPS constructed by Bauer and Swanson (2023a) as the shock measure. The shock is introduced at horizon 0, representing the period from year $t-1$ to t. The x-axis represents the response horizon h in years following the MPS, while the y-axis shows the difference in the cumulative percentage change in house prices over 1-, 2-, and 3-year horizons relative to the quintile 5 (long duration) group. The analysis employs the same regression specification as Column 5 of Table 2 Panel A for each horizon, as presented in the following:

$$\Delta HPI_{z,c,[t-1,t+h]} = \alpha_h + \beta_{1,h}\, MPS_t \times \text{Duration Quintile}_{z,t-1} + \beta_{2,h}\, \text{Duration Quintile}_{z,t-1} + \zeta_c \times \theta_t + \lambda_z + \epsilon_{z,c,t},$$

where $\Delta HPI_{z,c,[t-1,t+h]}$ is the cumulative house price change of zip code z in county c from year $t-1$ to $t+h$. MPS_t indicates the aggregated annual MPS from the end of year $t-1$ to t. $\text{Duration Quintile}_{z,t-1}$ is a categorical variable ranging from 1 to 5, indicating the quintile ranking of housing cash flow duration for zip code z in year $t-1$. The term $\zeta_c \times \theta_t$ represents the county-year fixed effects, and λ_z denotes the zip code fixed effects. The gray-capped error bars indicate 95% confidence intervals. Standard errors are clustered at the zip code level.

Figure IA.C8. Heterogeneity in House Price Response to the Federal Funds Rate and 30-Year Mortgage Rate across Rental Yield and Local Economic Characteristics

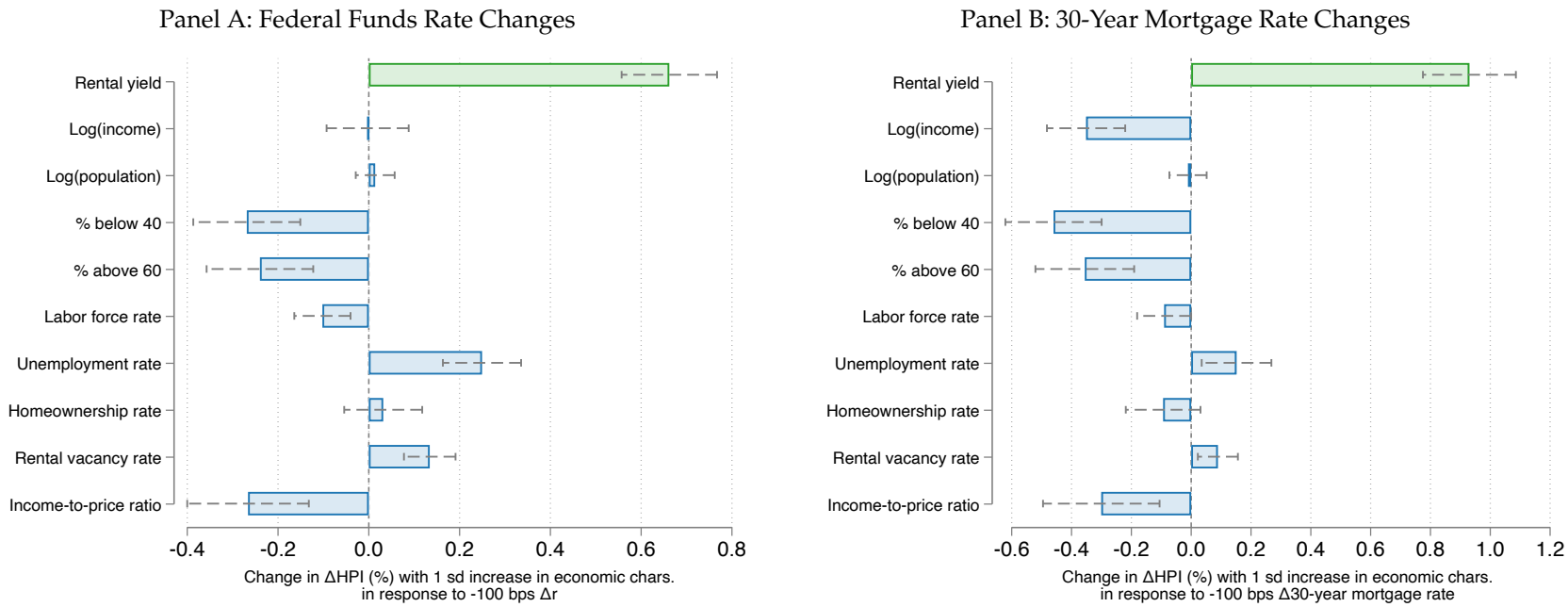


Figure IA.C8 presents the heterogeneous effects of a 100 basis-point (bps) decrease in the federal funds rate (FFR) (Panel A) and the 30-year mortgage rate (Panel B) on two-year house price growth across zip codes with varying rental yield and economic characteristics. The interest rate shock is introduced at horizon 0, representing the period from year $t-1$ to t. The x-axis represents the differential impact on cumulative two-year house price growth, $\Delta HPI_{z,c,[t-1,t+1]}$, associated with a one standard deviation (sd) increase in each specified economic characteristic at the zip-code level. The y-axis lists the economic characteristics analyzed. The heterogeneity is estimated using the regression specification applied in Column 3 of Table 3, as indicated in the following:

$$\begin{aligned}\Delta HPI_{z,c,[t-1,t+1]} = \alpha + \beta_1 \Delta r_{[t-1,t]} \times \mathrm{RY}_{z,t} + \beta_2 \Delta r_{[t-1,t]} \times \text{Economic Chars}_{z,t} \\ + \delta\, \mathrm{RY}_{z,t} + \gamma\, \text{Economic Chars}_{z,t} + \zeta_c \times \theta_t + \lambda_z + \epsilon_{z,c,t},\end{aligned}$$

where $\Delta HPI_{z,c,[t-1,t+1]}$ denotes cumulative house price changes in zip code z, county c, from year $t-1$ to $t+1$, and $\Delta r_{[t-1,t]}$ represents the annual change in the FFR (Panel A) or the 30-year mortgage rate (Panel B) from year $t-1$ to t. The variable $\mathrm{RY}_{z,t}$ captures rental yield at the zip-code-year level. The term $\zeta_c \times \theta_t$ represents the county-year fixed effects, and λ_z denotes the zip code fixed effects. The gray-capped error bars indicate 95% confidence intervals. Standard errors are clustered at the zip code level.

Figure IA.C9. Heterogeneity in House Price Response to Monetary Policy Shocks across Rental Yield and Local Economic Characteristics

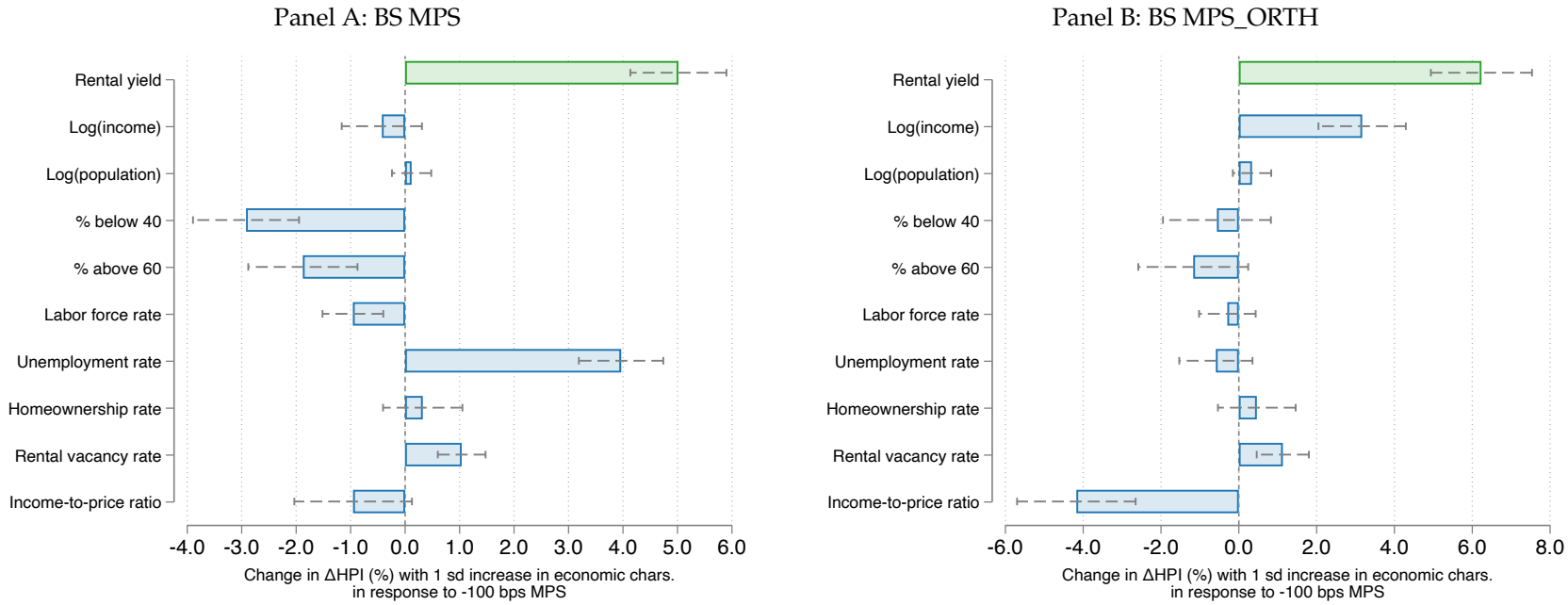


Figure IA.C9 presents the heterogeneous effects of a 100 basis-point (bps) decrease in the standard monetary policy shocks (MPS) (Panel A) and the orthogonalized MPS (Panel B) constructed by Bauer and Swanson (2023a) on two-year house price growth across zip codes with varying rental yield and economic characteristics. The shock is introduced at horizon 0, representing the period from year $t-1$ to t. The x-axis represents the differential impact on cumulative two-year house price growth, $\Delta HPI_{z,c,[t-1,t+1]}$, associated with a one standard deviation (sd) increase in each specified economic characteristic at the zip-code level. The y-axis lists the economic characteristics analyzed. The heterogeneity is estimated using the regression specification applied in Column 3 of Table 3, as indicated in the following:

$$\begin{aligned}\Delta HPI_{z,c,[t-1,t+1]} = \alpha + \beta_1 MPS_t \times \mathrm{RY}_{z,t} + \beta_2 MPS_t \times \text{Economic Chars}_{z,t} \\ + \delta\, \mathrm{RY}_{z,t} + \gamma\, \text{Economic Chars}_{z,t} + \zeta_c \times \theta_t + \lambda_z + \epsilon_{z,c,t},\end{aligned}$$

where $\Delta HPI_{z,c,[t-1,t+1]}$ denotes cumulative house price changes in zip code z, county c, from year $t-1$ to $t+1$, and MPS_t represents the aggregated annual MPS from year $t-1$ to t. The variable $\mathrm{RY}_{z,t}$ captures housing duration at the zip-code-year level. The term $\zeta_c \times \theta_t$ represents the county-year fixed effects, and λ_z denotes the zip code fixed effects. The gray-capped error bars indicate 95% confidence intervals. Standard errors are clustered at the zip code level.

Table IA.C14. Rental Yield and Monetary Policy Transmission to House Prices

Panel A: Baseline results

	Δ HPI$_{z,[t-1,t+1]}$				
	(1)	(2)	(3)	(4)	(5)
$\Delta r_{[t-1,t]}\times$ RY$_{z,t-1}$		-11.611***	-11.806***	-21.459***	-19.826***
		(1.041)	(1.042)	(0.932)	(0.936)
$\Delta r_{[t-1,t]}$	-1.774***	-1.054***			
	(0.027)	(0.066)			
RY$_{z,t-1}$	0.719***	0.772***	0.770***	1.042***	1.724***
	(0.027)	(0.027)	(0.028)	(0.031)	(0.107)
Adjusted R^2	0.082	0.084	0.207	0.742	0.795
Observations	72,334	72,334	72,334	72,334	72,334
Year FE			Yes		
County × Year FE				Yes	Yes
Zip FE					Yes

Panel B: Robustness results

	Δ HPI$_{z,[t-1,t+1]}$		
	(1)	(2)	(3)
$\Delta r_{[t-1,t]}\times$ RY$_{z,t-1}$	-19.572***	-19.472***	-20.063***
	(0.976)	(0.988)	(1.625)
RY$_{z,t-1}$	1.525***	0.424***	0.439***
	(0.100)	(0.113)	(0.115)
Δ HPI$_{z,[t-2,t-1]}$	0.211***	0.154***	0.158***
	(0.013)	(0.013)	(0.013)
$\Delta r_{[t-1,t]}\times$ log(income)$_{z,t-1}$			0.006
			(0.100)
$\Delta r_{[t-1,t]}\times$ log(population)$_{z,t-1}$			-0.016
			(0.025)
$\Delta r_{[t-1,t]}\times$ % below 40$_{z,t-1}$			2.875***
			(0.643)
$\Delta r_{[t-1,t]}\times$ % above 60$_{z,t-1}$			2.980***
			(0.744)
$\Delta r_{[t-1,t]}\times$ labor force rate$_{z,t-1}$			1.326***
			(0.410)
$\Delta r_{[t-1,t]}\times$ unemployment rate$_{z,t-1}$			-5.894***
			(1.039)
$\Delta r_{[t-1,t]}\times$ homeownership rate$_{z,t-1}$			-0.167
			(0.231)
$\Delta r_{[t-1,t]}\times$ rental vacancy rate$_{z,t-1}$			-2.268***
			(0.490)
$\Delta r_{[t-1,t]}\times$ income-to-price ratio$_{z,t-1}$			0.553***
			(0.142)
Adjusted R^2	0.799	0.809	0.810
Observations	72,334	72,334	72,334
County × Year FE	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes
Zip Economic Chars		Yes	Yes

Table IA.C14 illustrates the heterogeneous price responses to federal funds rate (FFR) changes across zip codes with varying rental yield. The dependent variable is the cumulative change in house prices, $\Delta HPI_{z,[t-1,t+1]}$, from the end of year $t-1$ to $t+1$. The variable, $\Delta r_{[t-1,t]} \times RY_{z,t-1}$, captures the heterogeneous house price sensitivity to FFR changes based on the zip-code rental yield. $\Delta r_{[t-1,t]}$ measures the annual change in the FFR from the end of year $t-1$ to t. We include different combinations of fixed effects indicated at the bottom of the table. Standard errors are clustered at the individual asset level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table IA.C15. Rental Yield and Heterogeneous House Price Responses to Interest Rate Changes over 1-, 2-, and 3-Year Horizons

Panel A: Federal Funds Rate Changes

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta r_{[t-1,t]} \times$ RY$_{z,t-1}$	-6.936***	-7.340***	-19.826***	-20.063***	-18.540***	-18.561***
	(0.558)	(0.988)	(0.936)	(1.625)	(1.059)	(1.944)
RY$_{z,t-1}$	0.856***	0.153***	1.724***	0.439***	2.453***	0.762***
	(0.053)	(0.055)	(0.107)	(0.115)	(0.166)	(0.177)
Δ HPI$_{z,[t-2,t-1]}$		0.151***		0.158***		0.117***
		(0.008)		(0.013)		(0.017)
Adjusted R^2	0.758	0.773	0.795	0.810	0.798	0.812
Observations	72,371	72,371	72,334	72,334	66,037	66,037
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
$\Delta r_{[t-1,t]} \times$ Zip Economic Chars		Yes		Yes		Yes

Panel B: 30-Year Mortgage Rate Changes

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta r^{30Y}_{[t-1,t]} \times$ RY$_{z,t-1}$	-9.142***	-9.750***	-31.156***	-28.188***	-37.882***	-33.313***
	(0.845)	(1.494)	(1.418)	(2.403)	(1.798)	(3.186)
RY$_{z,t-1}$	0.840***	0.139***	1.693***	0.394***	2.456***	0.739***
	(0.053)	(0.054)	(0.107)	(0.113)	(0.165)	(0.174)
Δ HPI$_{z,[t-2,t-1]}$		0.148***		0.151***		0.110***
		(0.008)		(0.013)		(0.017)
Adjusted R^2	0.757	0.774	0.796	0.810	0.799	0.814
Observations	72,371	72,371	72,334	72,334	66,037	66,037
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
$\Delta r^{30Y}_{[t-1,t]} \times$ Zip Economic Chars		Yes		Yes		Yes

Table IA.C15 presents the heterogeneous effects of interest rate changes on house price growth over 1-, 2-, and 3-year horizons across zip codes with varying rental yield. Panel A uses the federal funds rate (FFR) as the interest rate measure, while Panel B employs the 30-year mortgage rate. The dependent variable in each column is the cumulative change in house prices, $\Delta HPI_{z,[t-1,t+h]}$, from the end of year $t-1$ to $t+h$, where $h \in \{0,1,2\}$ denotes the ex-post horizon in years. The key explanatory variable, $\Delta r_{[t-1,t]} \times$ RY$_{z,t-1}$, captures the heterogeneous house price sensitivity to FFR changes based on the zip-code rental yield. $\Delta r_{[t-1,t]}$ measures the annual change in the FFR (Panel A) or 30-year mortgage rate (Panel B) from the end of year $t-1$ to t. All specifications include county-year and zip-code fixed effects. Columns 2, 4, and 6 additionally control for time-varying zip-code economic characteristics and their interactions with the interest rate change, consistent with Column 3 of Table 3. Standard errors are clustered at the zip code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table IA.C16. Rental Yield and Heterogeneous House Price Responses to Bauer and Swanson (2023a) Monetary Policy Shocks over 1-, 2-, and 3-Year Horizons

Panel A: BS MPS

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
MPS$_t$ × RY$_{z,t-1}$	-95.905***	-33.930***	-200.577***	-152.017***	-220.898***	-166.387***
	(4.586)	(7.658)	(8.092)	(13.633)	(9.552)	(16.806)
RY$_{z,t-1}$	0.830***	0.092*	1.634***	0.320***	2.365***	0.652***
	(0.050)	(0.053)	(0.102)	(0.110)	(0.159)	(0.168)
Δ HPI$_{z,[t-2,t-1]}$		0.140***		0.145***		0.106***
		(0.008)		(0.013)		(0.016)
Adjusted R^2	0.760	0.777	0.797	0.813	0.800	0.815
Observations	72,371	72,371	72,334	72,334	66,037	66,037
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
MPS$_t$ × Zip Economic Chars		Yes		Yes		Yes

Panel B: BS MPS_ORTH

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
MPS$_t$ × RY$_{z,t-1}$	-42.181***	-98.647***	-63.745***	-188.961***	68.177***	-81.357***
	(6.801)	(11.436)	(11.586)	(20.090)	(12.499)	(20.886)
RY$_{z,t-1}$	0.850***	0.179***	1.654***	0.456***	2.258***	0.655***
	(0.054)	(0.057)	(0.112)	(0.118)	(0.171)	(0.177)
Δ HPI$_{z,[t-2,t-1]}$		0.154***		0.162***		0.105***
		(0.008)		(0.013)		(0.016)
Adjusted R^2	0.757	0.773	0.792	0.806	0.796	0.811
Observations	72,371	72,371	72,334	72,334	66,037	66,037
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
MPS$_t$ × Zip Economic Chars		Yes		Yes		Yes

Table IA.C16 presents the heterogeneous effects of monetary policy shocks (MPS) on house price growth over 1-, 2-, and 3-year horizons across zip codes with varying rental yield. Panel A uses the standard MPS constructed by Bauer and Swanson (2023a), while Panel B employs their orthogonalized MPS. The dependent variable in each column is the cumulative change in house prices, $\Delta HPI_{z,[t-1,t+h]}$, from the end of year $t-1$ to $t+h$, where $h \in \{0,1,2\}$ denotes the ex-post horizon in years. The key explanatory variable, $MPS_t \times RY_{z,t-1}$, captures the heterogeneous house price sensitivity to FFR changes based on the zip-code rental yield. MPS_t measures the aggregated annual MPS from the end of year $t-1$ to t. All specifications include county-year and zip-code fixed effects. Columns 2, 4, and 6 additionally control for time-varying zip-code economic characteristics and their interactions with the interest rate change, consistent with Column 3 of Table 3. Standard errors are clustered at the zip code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table IA.C17. Monetary Policy Shocks, Rental Yield, and House Price Growth

	Δ HPI$_{i,[t-1,t+1]}$									
	1-Year Yield Surprise$_t$		BS MPS$_t$		BS MPS_ORTH $_t$		JK PM MPS$_t$		JK Median MPS$_t$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MPS$_t$ × RY$_{z,t-1}$	-24.352***	-20.159***	-200.577***	-152.017***	-63.745***	-188.961***	-2.161***	-1.517***	-1.969***	-1.550***
	(1.033)	(1.722)	(8.092)	(13.633)	(11.586)	(20.090)	(0.081)	(0.136)	(0.081)	(0.136)
RY$_{z,t-1}$	1.664***	0.354***	1.634***	0.320***	1.654***	0.456***	1.602***	0.297***	1.574***	0.283**
	(0.106)	(0.113)	(0.102)	(0.110)	(0.112)	(0.118)	(0.105)	(0.111)	(0.106)	(0.111)
Δ HPI$_{z,[t-2,t-1]}$		0.153***		0.145***		0.162***		0.143***		0.152***
		(0.013)		(0.013)		(0.013)		(0.013)		(0.013)
Adjusted R^2	0.796	0.811	0.797	0.813	0.792	0.806	0.797	0.812	0.796	0.811
Observations	72,334	72,334	72,334	72,334	72,334	72,334	72,334	72,334	72,334	72,334
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes		Yes		Yes
MPS$_t$ × Zip Economic Chars		Yes		Yes		Yes		Yes		Yes

Table IA.C17 examines how alternative measurements of monetary policy shocks (MPS) affect house price growth differently across zip codes with varying rental yield. The specific MPS measure used in each column is indicated at the top. The dependent variable, $\Delta HPI_{z,[t-1,t+1]}$, is the cumulative house price growth from the end of year $t-1$ to $t+1$. The primary explanatory variable, $MPS_t \times \text{RY}_{z,t-1}$, captures the heterogeneous house price sensitivity to MPS based on the zip-code rental yield. The MPS variable, MPS_t, aggregates monetary policy shocks occurring between the end of year $t-1$ and t. Columns 1 and 2 employ the 1-year treasury yield surprise as the MPS measure. Columns 3 and 4 utilize the standard MPS measure developed by Bauer and Swanson (2023a), while columns 5 and 6 apply the orthogonalized version from Bauer and Swanson (2023a). Columns 7 and 8 incorporate the PM MPS measure from Jarociński and Karadi (2020), and columns 9 and 10 use their median MPS measure. All specifications include county-year and zip-code fixed effects. Columns 2, 4, 6, 8, and 10 additionally control for time-varying zip-code economic characteristics and their interactions with MPS, consistent with Column 3 of Table 3. Standard errors are clustered at the zip code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

D Reaching-for-Income Evidence

Table IA.D1. Impact of 30-Year Mortgage Rate Changes on Buy-to-Rent (BTR) Probability

	$\mathbb{1}\{\text{BTR}\}_{i,t}$							
	Δ30-Year Mortgage Rate				Δ30-Year Mortgage Rate Instrumented by MPS			
	$h=0$		$h=1$		$h=0$		$h=1$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta r^{30Y}_{[t-h-1,t-h]} \times \text{RY}_{i,t-h-1}$	-16.751***	-18.846***	-16.800***	-17.695***	-23.289***	-22.678***	-19.978***	-19.720***
	(0.133)	(0.143)	(0.142)	(0.152)	(0.236)	(0.236)	(0.254)	(0.250)
$\text{RY}_{i,t-h-1}$	0.582***	0.610***	0.565***	0.571***	0.651***	0.636***	0.596***	0.581***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
$\Delta r^{30Y}_{[t-h-1,t-h]} \times \text{Log(Income)}_{z,t-h-1}$		-0.775***		-0.352***		-0.515***		-1.079***
		(0.052)		(0.063)		(0.149)		(0.227)
$\Delta r^{30Y}_{[t-h-1,t-h]} \times \text{Log(Population)}_{z,t-h-1}$		-0.006		-0.158***		-0.226***		-0.646***
		(0.015)		(0.018)		(0.047)		(0.079)
$\Delta r^{30Y}_{[t-h-1,t-h]} \times$ % Below $40_{z,t-h-1}$		-0.587*		-2.187***		-18.761***		-47.838***
		(0.320)		(0.376)		(1.189)		(2.326)
$\Delta r^{30Y}_{[t-h-1,t-h]} \times$ % Above $60_{z,t-h-1}$		-2.151***		-1.189***		-13.834***		-35.786***
		(0.344)		(0.406)		(1.153)		(2.232)
$\Delta r^{30Y}_{[t-h-1,t-h]} \times \text{Labor Force Rate}_{z,t-h-1}$		0.407*		-0.366		-0.191		-16.112***
		(0.215)		(0.255)		(0.708)		(1.297)
$\Delta r^{30Y}_{[t-h-1,t-h]} \times \text{Unemployment Rate}_{z,t-h-1}$		9.297***		5.429***		-13.674***		-52.213***
		(0.499)		(0.578)		(2.763)		(6.294)
$\Delta r^{30Y}_{[t-h-1,t-h]} \times \text{Homeownership Rate}_{z,t-h-1}$		0.528***		-0.669***		-2.432***		-9.766***
		(0.118)		(0.141)		(0.352)		(0.600)
$\Delta r^{30Y}_{[t-h-1,t-h]} \times \text{Rental Vacancy Rate}_{z,t-h-1}$		0.224		-0.024		-2.742***		-7.937***
		(0.174)		(0.208)		(0.506)		(0.984)
$\Delta r^{30Y}_{[t-h-1,t-h]} \times \text{Income-to-Price Ratio}_{z,t-h-1}$		1.072***		0.465***		-2.155***		-3.859***
		(0.053)		(0.062)		(0.175)		(0.275)
$\Delta\ \text{HPI}_{z,[t-h-2,t-h-1]}$		0.049***		-0.015***		0.040***		-0.024***
		(0.003)		(0.003)		(0.003)		(0.004)
Adjusted R^2	0.138	0.138	0.138	0.138	0.022	0.022	0.022	0.019
Observations	31,906,343	31,906,343	29,369,961	29,369,961	31,906,343	31,906,343	29,369,961	29,369,961
Property Chars	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes		Yes

Table IA.D1 presents the impact of interest rate changes on the probability of properties being purchased for rental purposes (Buy-to-Rent, BTR) across properties with varying rental yields (RY). The dependent variable is a dummy variable that equals one if the property is purchased for rental purposes, and zero otherwise. The main interaction term, $\Delta r_{[t-h-1,t-h]} \times \text{RY}_{i,t-h-1}$, identifies heterogeneous effects of interest rate changes on the BTR probability across varying property-level rental yields. Columns 1 to 4 report the effects of the Federal Funds Rate (FFR) changes, while Columns 5 to 8 illustrate responses to changes in the 30-year mortgage rate. The table presents the effect within 2 years after a rate change. Specifically, Columns 1, 2, 5, and 6 illustrate the effect within the year of the interest rate change ($h=0$), whereas Columns 3, 4, 7, and 8 show the effect of the rate change from two years ago ($h=1$). All columns control for property-level characteristics and incorporate county-by-year and zip-code fixed effects. Additionally, Columns 2, 4, 6, and 8 further control for zip-code-level economic characteristics and their interactions with interest rate changes. Standard errors are clustered at the property level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

E Baseline Analysis with ATTOM-Altos Sample

In this section, we construct the housing duration measure by combining the Altos and ATTOM datasets.

E.1. Rent Growth Predictive Regression

Table IA.E1. Future Rent Growth Prediction using Local Characteristics

	$\Delta \log(\text{rent})_{i,[t+h-1,t+h]}$					
	(1)	(2)	(3)	(4)	(5)	(6)
log(rental yield)$_{i,t}$	-0.071***	-0.041***	-0.023***	-0.011***	-0.008***	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Δ log(rent)$_{i,t}$	-0.056***	-0.040**	-0.035***	-0.007	-0.006	-0.019***
	(0.007)	(0.018)	(0.011)	(0.011)	(0.009)	(0.005)
Δ log(price)$_{i,t}$	0.143***	0.100***	0.022***	0.025***	0.021**	0.014**
	(0.007)	(0.007)	(0.007)	(0.009)	(0.009)	(0.006)
Income ratio$_{i,t}$	-0.045***	-0.026***	-0.018***	-0.018***	-0.019***	-0.010***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.001)
Income growth$_{i,t}$	0.098***	-0.000	-0.028**	0.018	0.096***	-0.006
	(0.013)	(0.015)	(0.014)	(0.017)	(0.019)	(0.011)
Population ratio$_{i,t}$	-37.078***	-1.322	27.438***	42.462***	41.178***	9.667
	(7.592)	(8.978)	(9.643)	(9.959)	(11.391)	(6.999)
Population growth$_{i,t}$	0.140***	0.079***	-0.272***	-0.330***	0.287***	-0.049*
	(0.030)	(0.029)	(0.036)	(0.051)	(0.044)	(0.027)
% below 40$_{i,t}$	0.087***	0.057***	0.059***	-0.112***	-0.168***	0.011
	(0.015)	(0.015)	(0.018)	(0.022)	(0.021)	(0.012)
% below 40 growth$_{i,t}$	-0.054***	-0.034**	0.142***	0.261***	-0.194***	0.013
	(0.019)	(0.016)	(0.023)	(0.034)	(0.021)	(0.015)
% above 60$_{i,t}$	0.095***	0.073***	0.071***	-0.140***	-0.192***	0.020
	(0.017)	(0.019)	(0.023)	(0.026)	(0.026)	(0.015)
% above 60 growth$_{i,t}$	-0.045***	0.028**	0.181***	0.041***	-0.092***	0.009
	(0.010)	(0.011)	(0.015)	(0.015)	(0.014)	(0.008)
Labor force rate$_{i,t}$	-0.005	-0.022**	-0.032***	-0.053***	-0.047***	-0.017**
	(0.009)	(0.010)	(0.012)	(0.014)	(0.014)	(0.007)
Labor force rate growth$_{i,t}$	-0.001	0.067**	0.118***	-0.126***	-0.045	-0.015
	(0.026)	(0.029)	(0.038)	(0.046)	(0.039)	(0.021)
Unemployment rate$_{i,t}$	0.158***	0.031	-0.022	-0.080***	-0.083***	0.007
	(0.017)	(0.022)	(0.022)	(0.021)	(0.027)	(0.015)
Unemployment rate growth$_{i,t}$	0.001	0.017***	0.010***	-0.013***	-0.023***	-0.015***
	(0.003)	(0.003)	(0.004)	(0.005)	(0.005)	(0.003)
Homeownership rate$_{i,t}$	-0.264	-2.197	2.842	-1.336	7.341***	-0.736
	(1.433)	(1.656)	(1.846)	(2.038)	(2.018)	(1.090)
Homeownership rate growth$_{i,t}$	-0.006	0.008	-0.038	-0.024	-0.069**	-0.080***
	(0.021)	(0.025)	(0.029)	(0.028)	(0.030)	(0.018)
Rental vacancy rate$_{i,t}$	-0.012	0.001	0.008	0.011	0.008	0.039***
	(0.013)	(0.013)	(0.013)	(0.016)	(0.015)	(0.009)
Rental vacancy rate growth$_{i,t}$	-0.003***	-0.001	-0.001	-0.001	-0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
% single family house$_{i,t}$	0.046***	0.050***	0.043***	0.052***	0.052**	-0.021*
	(0.008)	(0.012)	(0.016)	(0.018)	(0.025)	(0.011)
% 2-4 unit house$_{i,t}$	0.056***	0.050***	0.040***	0.049***	0.038	-0.003
	(0.009)	(0.012)	(0.016)	(0.018)	(0.025)	(0.011)
% 5+ unit house$_{i,t}$	0.052***	0.040***	0.030*	0.039**	0.033	-0.022**
	(0.009)	(0.012)	(0.016)	(0.018)	(0.025)	(0.010)
% single family house growth$_{i,t}$	-0.008	-0.002	0.001	0.020	-0.008	0.008
	(0.009)	(0.011)	(0.011)	(0.013)	(0.014)	(0.006)
% 2-4 unit house growth$_{i,t}$	0.001	0.002	-0.003*	-0.002	-0.000	-0.002
	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
% 5+ unit house growth$_{i,t}$	0.002	0.004	-0.002	0.000	0.002	0.002
	(0.002)	(0.003)	(0.003)	(0.003)	(0.004)	(0.002)
Median room number growth$_{i,t}$	-0.053**	0.031	0.129***	0.017	0.005	0.016
	(0.027)	(0.034)	(0.036)	(0.045)	(0.040)	(0.023)
% renter occupied$_{i,t}$	-0.345	-2.222	2.831	-1.338	7.346***	-0.771
	(1.433)	(1.656)	(1.846)	(2.039)	(2.018)	(1.091)
% renter occupied growth$_{i,t}$	-0.014	-0.018	-0.018	-0.043***	-0.034*	-0.007
	(0.013)	(0.014)	(0.016)	(0.016)	(0.018)	(0.010)
Adjusted R^2	0.057	0.017	0.009	0.007	0.007	0.020
Observations	87,182	85,745	78,187	70,561	63,080	32,907

Table IA.E1 presents predictive regression results for future rent growth over short- and long-term horizons using local economic characteristics as predictors. In Columns 1 to 5, the dependent variable is the logarithm of annual rent growth from year $t+h-1$ to $t+h$, where t represents the current year when predictions are made, and h denotes the forecast horizon specified at the top of each column. Therefore, Columns 1 through 5 predict annual rent growth over horizons ranging from one to five years (i.e., $t+1$ to $t+5$). Column 6 focuses on longer-term predictions by using average annual rent growth from years $t+6$ to $t+10$ as the dependent variable. Standard errors are clustered at the zip code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table IA.E2. Future Rent Growth Prediction using Local Characteristics Selected by LASSO

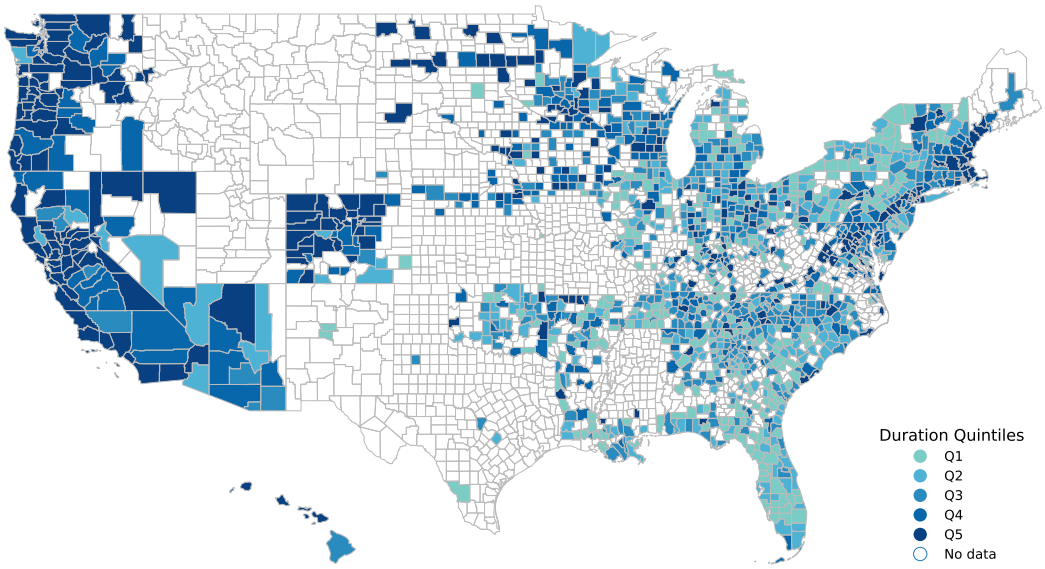
	Δ log(rent)$_{i,[t+h-1,t+h]}$					
	(1)	(2)	(3)	(4)	(5)	(6)
log(rental yield)$_{i,t}$	-0.071***	-0.047***	-0.023***	-0.011***	-0.003**	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Δ log(rent)$_{i,t}$	-0.056***		-0.035***	-0.007		-0.018***
	(0.007)		(0.011)	(0.011)		(0.005)
Δ log(price)$_{i,t}$	0.143***	0.100***	0.022***	0.023***	0.024***	0.013***
	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)	(0.004)
Income ratio$_{i,t}$	-0.045***	-0.024***	-0.018***	-0.014***		-0.011***
	(0.002)	(0.001)	(0.002)	(0.002)		(0.002)
Income growth$_{i,t}$	0.098***		-0.029**	0.014	0.104***	
	(0.013)		(0.014)	(0.017)	(0.016)	
Population ratio$_{i,t}$	-36.635***	-11.934	30.588***	38.269***	44.875***	12.106
	(7.523)	(8.763)	(9.438)	(9.965)	(10.343)	(11.841)
Population growth$_{i,t}$	0.140***	0.037**	-0.269***	-0.303***		-0.031**
	(0.030)	(0.019)	(0.036)	(0.048)		(0.015)
% below 40$_{i,t}$	0.088***		0.065***			
	(0.014)		(0.016)			
% below 40 growth$_{i,t}$	-0.054***		0.142***	0.241***	-0.110***	
	(0.019)		(0.023)	(0.031)	(0.013)	
% above 60$_{i,t}$	0.099***		0.102***	-0.020*		0.012
	(0.015)		(0.017)	(0.011)		(0.013)
% above 60 growth$_{i,t}$	-0.046***	0.025***	0.179***	0.031**		
	(0.010)	(0.010)	(0.014)	(0.015)		
Labor force rate$_{i,t}$		-0.032***		-0.035***	-0.009	-0.020*
		(0.006)		(0.012)	(0.009)	(0.012)
Labor force rate growth$_{i,t}$	-0.002		0.111***	-0.132***		
	(0.026)		(0.038)	(0.046)		
Unemployment rate$_{i,t}$	0.161***	0.042**	-0.011	-0.068***		
	(0.017)	(0.017)	(0.020)	(0.020)		
Unemployment rate growth$_{i,t}$	0.001	0.014***	0.009***	-0.015***	-0.027***	-0.014***
	(0.003)	(0.004)	(0.003)	(0.005)	(0.004)	(0.003)
Homeownership rate$_{i,t}$	0.080***					-0.770
	(0.008)					(1.071)
Homeownership rate growth$_{i,t}$	-0.005		-0.033	-0.016		-0.064***
	(0.021)		(0.029)	(0.028)		(0.015)
Rental vacancy rate$_{i,t}$	-0.012		0.011	0.012		0.039***
	(0.013)		(0.012)	(0.016)		(0.013)
Rental vacancy rate growth$_{i,t}$	-0.003***		-0.001	-0.001		0.000
	(0.001)		(0.001)	(0.001)		(0.001)
% single family house$_{i,t}$	0.045***	0.022***	0.037**	0.052***		
	(0.008)	(0.002)	(0.015)	(0.018)		
% 2-4 unit house$_{i,t}$	0.055***		0.029**	0.046***		
	(0.009)		(0.015)	(0.017)		
% 5+ unit house$_{i,t}$	0.050***		0.016	0.031*		-0.008*
	(0.009)		(0.014)	(0.017)		(0.004)
% single family house growth$_{i,t}$	-0.008			0.021		
	(0.009)			(0.013)		
% 2-4 unit house growth$_{i,t}$	0.001	0.001	-0.003*	-0.002		
	(0.001)	(0.001)	(0.001)	(0.002)		
% 5+ unit house growth$_{i,t}$	0.002	0.001	-0.001	0.000	0.001	
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	
Median room number growth$_{i,t}$	-0.053**		0.129***	0.016		0.002
	(0.027)		(0.036)	(0.045)		(0.021)
% renter occupied$_{i,t}$						-0.793
						(1.072)
% renter occupied growth$_{i,t}$	-0.015		-0.018	-0.040**		
	(0.013)		(0.016)	(0.016)		
Adjusted R^2	0.057	0.016	0.009	0.007	0.003	0.019
Observations	87,182	93,358	78,191	70,561	68,779	33,430

Table IA.E2 presents predictive regression results for future rent growth over short- and long-term horizons using LASSO-selected local economic characteristics as predictors. The table performs LASSO regressions with 10-fold cross validation (CV). In Columns 1 to 5, the dependent variable is the logarithm of annual rent growth from year $t+h-1$ to $t+h$, where t represents the current year when predictions are made, and h denotes the forecast horizon specified at the top of each column. Therefore, Columns 1 through 5 predict annual rent growth over horizons ranging from one to five years (i.e., $t+1$ to $t+5$). Column 6 focuses on longer-term predictions by using average annual rent growth from years $t+6$ to $t+10$ as the dependent variable. Standard errors are clustered at the Zip-code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

E.2. Duration, Δr, Δ30-Year Mortgage Rate, and Monetary Policy Shocks

Figure IA.E1. County-level Geographic Heterogeneity in Housing Duration

Panel A: Duration using all predictors



Panel B: Duration using LASSO-selected predictors

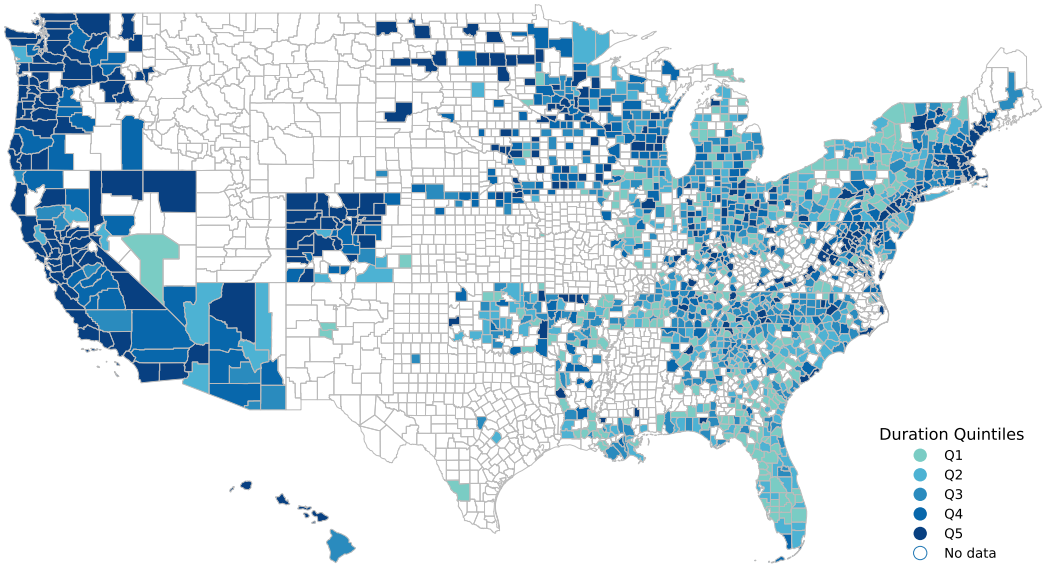


Figure IA.E1 presents county-level geographic heterogeneity in housing duration constructed from all predictors (Panel A) and the duration constructed using the LASSO-selected predictors (Panel B). Both panels categorize counties into quintiles (Q1 to Q5), with darker shading indicating higher quintile values. The detailed estimation procedures for housing duration at the zip-code level are provided in Section II.B. The county-level housing duration is computed by averaging the estimated duration values across all available zip codes and years within each county. Counties without sufficient data are shown in white.

Figure IA.E2. Heterogeneity in House Price Sensitivity to Federal Funds Rate and 30-Year Mortgage Rate across Housing Duration Quintiles

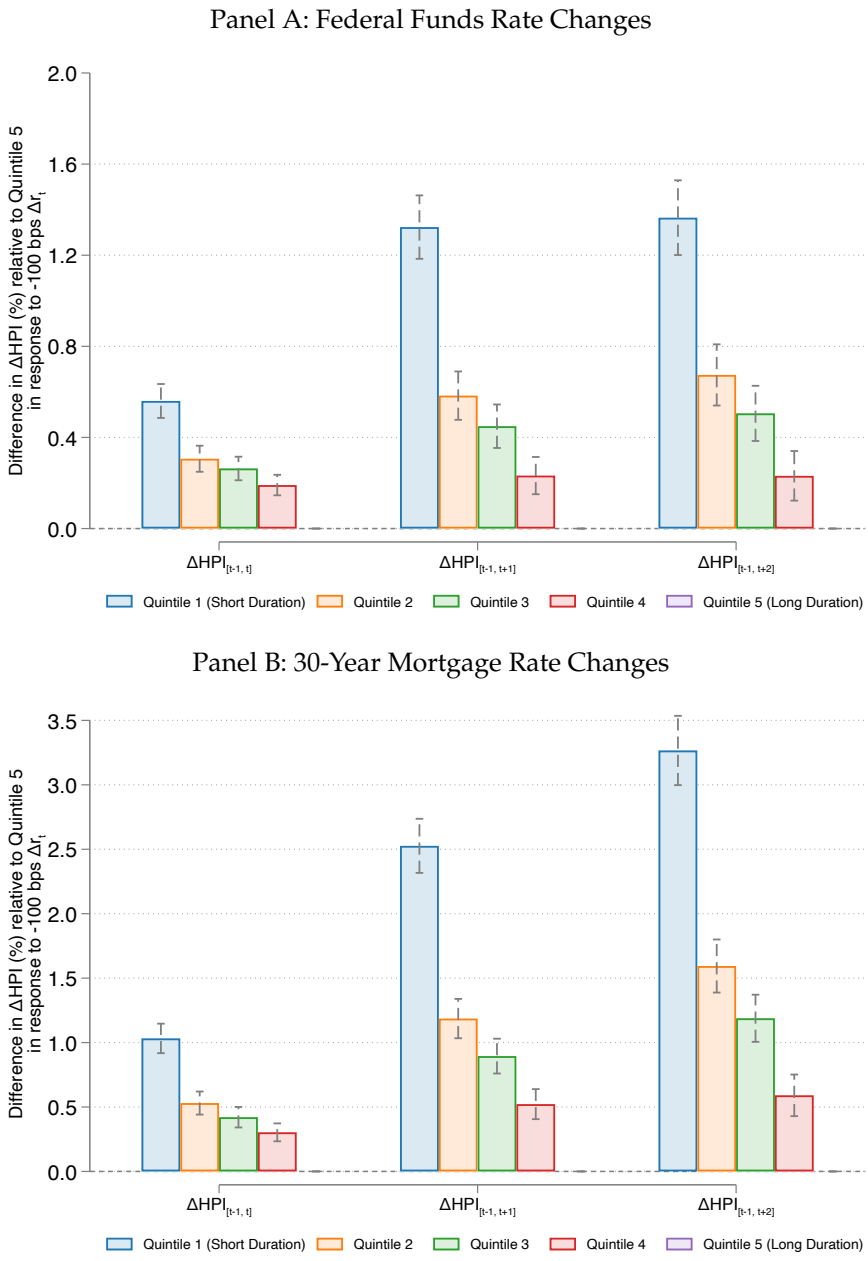


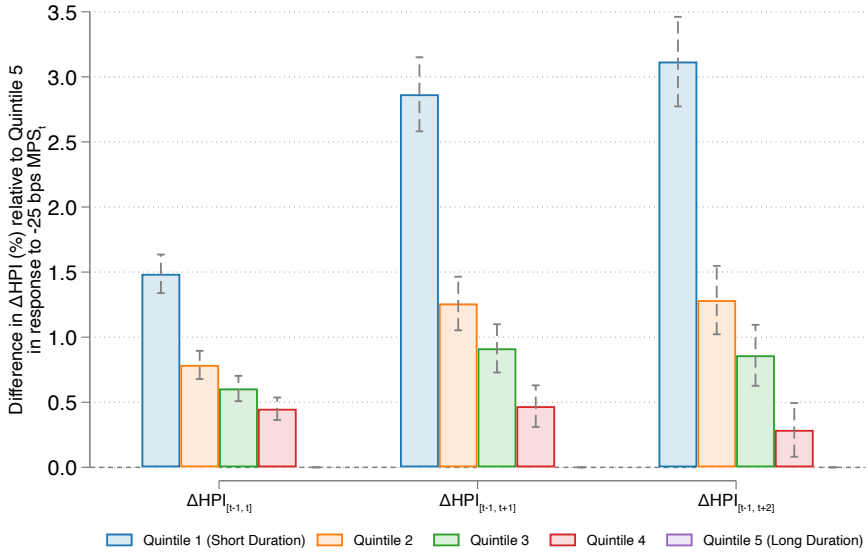
Figure IA.E2 illustrates the differences in house price responses across zip-code housing cash flow duration quintiles following a 100 basis-point (bps) decrease in the interest rate, compared to quintile 5 (baseline group). Each year, zip codes are categorized into five housing duration quintiles. Quintile 1 represents zip codes with the shortest housing cash flow durations, while quintile 5 includes those with the longest housing durations. Panel A uses the federal funds rate changes as the interest rate change measure, while Panel B uses the 30-year mortgage rate changes. The interest rate shock is introduced at horizon 0, representing the period from year $t-1$ to t. The x-axis represents the response horizon h in years following the interest rate change, while the y-axis shows the difference in the cumulative percentage change in house prices over 1-, 2-, and 3-year horizons relative to the quintile 5 (long duration) group. The analysis employs the same regression specification as Column 5 of Table 2 Panel A for each horizon, as presented in the following:

$$\Delta HPI_{z,c,[t-1,t+h]} = \alpha_h + \beta_{1,h}\,\Delta r_{[t-1,t]} \times \text{Duration Quintile}_{z,t-1} + \beta_{2,h}\,\text{Duration Quintile}_{z,t-1} + \zeta_c \times \theta_t + \lambda_z + \epsilon_{z,c,t},$$

where $\Delta HPI_{z,c,[t-1,t+h]}$ is the cumulative house price change of zip code z in county c from year $t-1$ to $t+h$. $\Delta r_{[t-1,t]}$ indicates the annual change in the federal funds rate from year $t-1$ to t. $\text{Duration Quintile}_{z,t-1}$ is a categorical variable ranging from 1 to 5, indicating the quintile ranking of housing cash flow duration for zip code z in year $t-1$. The term $\zeta_c \times \theta_t$ represents the county-year fixed effects, and λ_z denotes the zip code fixed effects. The gray-capped error bars indicate 95% confidence intervals. Standard errors are clustered at the zip code level.

Figure IA.E3. Heterogeneity in House Price Sensitivity to Monetary Policy Shock (MPS) across Housing Duration Quintiles

Panel A: Bauer and Swanson (2023a) MPS



Panel B: Bauer and Swanson (2023a) MPS_ORTH

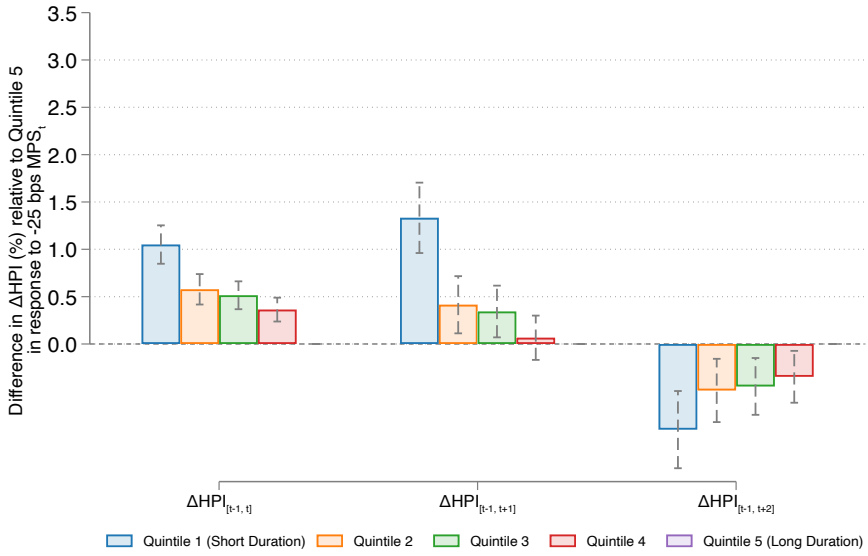


Figure IA.E8 illustrates the differences in house price responses across zip-code housing cash flow duration quintiles following a negative 25 basis-point (bps) of monetary policy shocks (MPS), compared to quintile 5 (baseline group). Each year, zip codes are categorized into five housing duration quintiles. Quintile 1 represents zip codes with the shortest housing cash flow durations, while quintile 5 includes those with the longest housing durations. Panel A uses the standard MPS constructed by Bauer and Swanson (2023a) as the shock measure, while Panel B uses their orthogonalized MPS. The shock is introduced at horizon 0, representing the period from year $t-1$ to t. The x-axis represents the response horizon h in years following the MPS, while the y-axis shows the difference in the cumulative percentage change in house prices over 1-, 2-, and 3-year horizons relative to the quintile 5 (long duration) group. The analysis employs the same regression specification as Column 5 of Table 2 Panel A for each horizon, as presented in the following:

$$\Delta HPI_{z,c,[t-1,t+h]} = \alpha_h + \beta_{1,h}\, MPS_t \times \text{Duration Quintile}_{z,t-1} + \beta_{2,h}\, \text{Duration Quintile}_{z,t-1} + \zeta_c \times \theta_t + \lambda_z + \epsilon_{z,c,t},$$

where $\Delta HPI_{z,c,[t-1,t+h]}$ is the cumulative house price change of zip code z in county c from year $t-1$ to $t+h$. MPS_t indicates the aggregated annual MPS from the end of year $t-1$ to t. Duration Quintile$_{z,t-1}$ is a categorical variable ranging from 1 to 5, indicating the quintile ranking of housing cash flow duration for zip code z in year $t-1$. The term $\zeta_c \times \theta_t$ represents the county-year fixed effects, and λ_z denotes the zip code fixed effects. The gray-capped error bars indicate 95% confidence intervals. Standard errors are clustered at the zip code level.

Figure IA.E4. Heterogeneity in House Price Response to the Federal Funds Rate and 30-Year Mortgage Rate across Housing Duration and Local Economic Characteristics

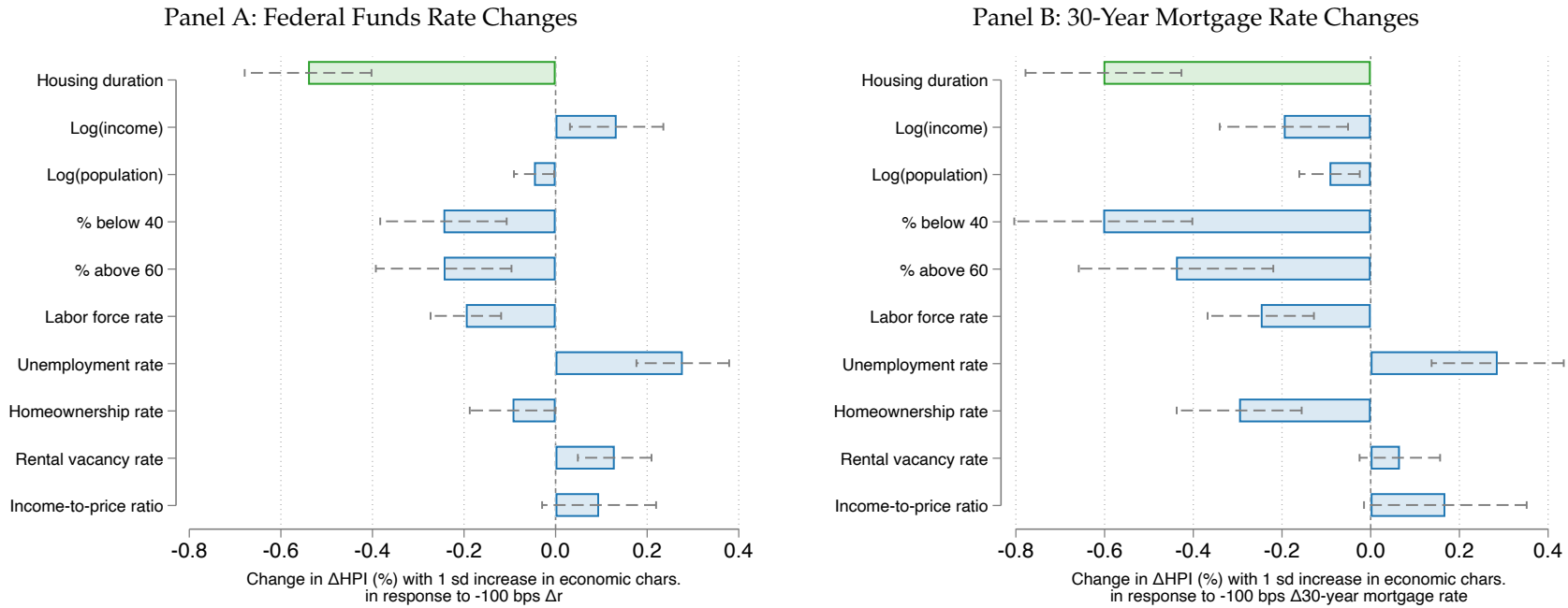


Figure IA.E4 presents the heterogeneous effects of a 100 basis-point (bps) decrease in the federal funds rate (FFR) (Panel A) and the 30-year mortgage rate (Panel B) on two-year house price growth across zip codes with varying housing duration and economic characteristics. The interest rate shock is introduced at horizon 0, representing the period from year $t-1$ to t. The x-axis represents the differential impact on cumulative two-year house price growth, $\Delta HPI_{z,c,[t-1,t+1]}$, associated with a one standard deviation (sd) increase in each specified economic characteristic at the zip-code level. The y-axis lists the economic characteristics analyzed. The heterogeneity is estimated using the regression specification applied in Column 3 of Table 3, as indicated in the following:

$$\begin{aligned}\Delta HPI_{z,c,[t-1,t+1]} = \alpha + \beta_1 \Delta r_{[t-1,t]} \times \text{Duration}_{z,t} + \beta_2 \Delta r_{[t-1,t]} \times \text{Economic Chars}_{z,t} \\ + \delta \, \text{Duration}_{z,t} + \gamma \, \text{Economic Chars}_{z,t} + \zeta_c \times \theta_t + \lambda_z + \epsilon_{z,c,t},\end{aligned}$$

where $\Delta HPI_{z,c,[t-1,t+1]}$ denotes cumulative house price changes in zip code z, county c, from year $t-1$ to $t+1$, and $\Delta r_{[t-1,t]}$ represents the annual change in the FFR (Panel A) or the 30-year mortgage rate (Panel B) from year $t-1$ to t. The variable $\text{Duration}_{z,t}$ captures housing duration at the zip-code-year level. The term $\zeta_c \times \theta_t$ represents the county-year fixed effects, and λ_z denotes the zip code fixed effects. The gray-capped error bars indicate 95% confidence intervals. Standard errors are clustered at the zip code level.

Figure IA.E5. Heterogeneity in House Price Response to Monetary Policy Shocks across Housing Duration and Local Economic Characteristics

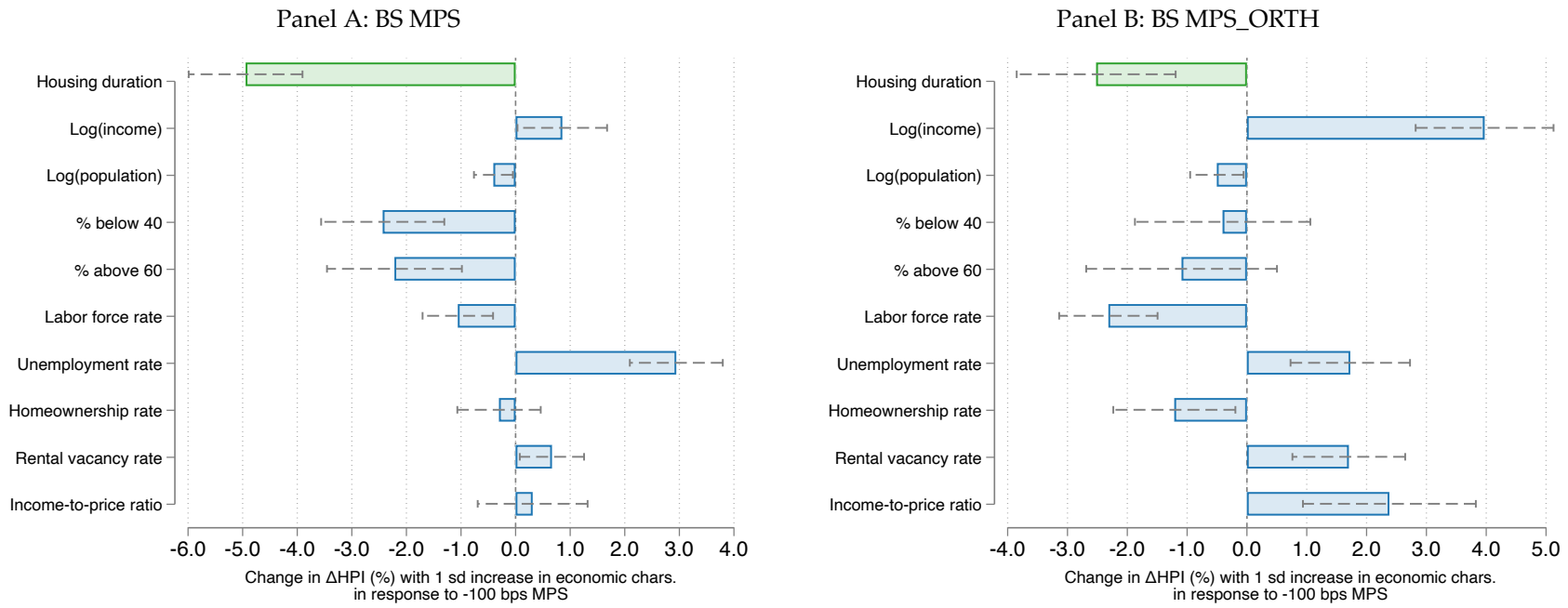


Figure IA.E5 presents the heterogeneous effects of a 100 basis-point (bps) decrease in the standard monetary policy shocks (MPS) (Panel A) and the orthogonalized MPS (Panel B) constructed by Bauer and Swanson (2023a) on two-year house price growth across zip codes with varying housing duration and economic characteristics. The shock is introduced at horizon 0, representing the period from year $t-1$ to t. The x-axis represents the differential impact on cumulative two-year house price growth, $\Delta HPI_{z,c,[t-1,t+1]}$, associated with a one standard deviation (sd) increase in each specified economic characteristic at the zip-code level. The y-axis lists the economic characteristics analyzed. The heterogeneity is estimated using the regression specification applied in Column 3 of Table 3, as indicated in the following:

$$\begin{aligned}\Delta HPI_{z,c,[t-1,t+1]} = \alpha + \beta_1 MPS_t \times \text{Duration}_{z,t} + \beta_2 MPS_t \times \text{Economic Chars}_{z,t} \\ + \delta\, \text{Duration}_{z,t} + \gamma\, \text{Economic Chars}_{z,t} + \zeta_c \times \theta_t + \lambda_z + \epsilon_{z,c,t},\end{aligned}$$

where $\Delta HPI_{z,c,[t-1,t+1]}$ denotes cumulative house price changes in zip code z, county c, from year $t-1$ to $t+1$, and MPS_t represents the aggregated annual MPS from year $t-1$ to t. The variable $\text{Duration}_{z,t}$ captures housing duration at the zip-code-year level. The term $\zeta_c \times \theta_t$ represents the county-year fixed effects, and λ_z denotes the zip code fixed effects. The gray-capped error bars indicate 95% confidence intervals. Standard errors are clustered at the zip code level.

Table IA.E3. Duration and Monetary Policy Transmission to House Prices

Panel A: Baseline results

	Δ HPI$_{z,[t-1,t+1]}$				
	(1)	(2)	(3)	(4)	(5)
$\Delta r_{[t-1,t]}\times$ Duration$_{z,t-1}$		2.104***	1.618***	3.235***	2.662***
		(0.170)	(0.176)	(0.180)	(0.184)
$\Delta r_{[t-1,t]}$	-1.671***	-11.031***			
	(0.030)	(0.762)			
Duration$_{z,t-1}$	-0.092***	-0.100***	-0.101***	-0.137***	-0.144***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.008)
Adjusted R^2	0.101	0.104	0.256	0.767	0.823
Observations	47,297	47,297	47,297	47,297	47,297
Year FE			Yes		
County × Year FE				Yes	Yes
Zip FE					Yes

Panel B: Robustness results

	Δ HPI$_{z,[t-1,t+1]}$		
	(1)	(2)	(3)
$\Delta r_{[t-1,t]}\times$ Duration$_{z,t-1}$	2.570***	2.624***	1.937***
	(0.199)	(0.194)	(0.253)
Duration$_{z,t-1}$	-0.158***	-0.144***	-0.137***
	(0.008)	(0.007)	(0.007)
Δ HPI$_{z,[t-2,t-1]}$	0.325***	0.157***	0.163***
	(0.018)	(0.017)	(0.017)
$\Delta r_{[t-1,t]}\times$ log(income)$_{z,t-1}$			-0.318**
			(0.124)
$\Delta r_{[t-1,t]}\times$ log(population)$_{z,t-1}$			0.085**
			(0.041)
$\Delta r_{[t-1,t]}\times$ % below 40$_{z,t-1}$			2.799***
			(0.805)
$\Delta r_{[t-1,t]}\times$ % above 60$_{z,t-1}$			3.138***
			(0.970)
$\Delta r_{[t-1,t]}\times$ labor force rate$_{z,t-1}$			2.745***
			(0.551)
$\Delta r_{[t-1,t]}\times$ unemployment rate$_{z,t-1}$			-7.122***
			(1.325)
$\Delta r_{[t-1,t]}\times$ homeownership rate$_{z,t-1}$			0.556**
			(0.282)
$\Delta r_{[t-1,t]}\times$ rental vacancy rate$_{z,t-1}$			-2.416***
			(0.768)
$\Delta r_{[t-1,t]}\times$ income-to-price ratio$_{z,t-1}$			-0.209
			(0.140)
Adjusted R^2	0.831	0.850	0.850
Observations	47,297	47,297	47,297
County × Year FE	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes
Zip Economic Chars		Yes	Yes

Table IA.E3 illustrates the heterogeneous price responses to federal funds rate (FFR) changes across zip codes with varying housing duration levels. The dependent variable is the cumulative change in house prices, $\Delta HPI_{z,[t-1,t+1]}$, from the end of year $t-1$ to $t+1$. The variable, $\Delta r_{[t-1,t]} \times Duration_{z,t-1}$, captures the heterogeneous house price sensitivity to FFR changes based on the zip-code housing duration. $\Delta r_{[t-1,t]}$ measures the annual change in the FFR from the end of year $t-1$ to t. Section II.B provides details on the estimation of housing duration. We include different combinations of fixed effects indicated at the bottom of the table. Standard errors are clustered at the individual asset level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table IA.E4. 5- and 10-Year Housing Duration and Monetary Policy Transmission to House Prices in 1, 2, and 3-year Horizons

Panel A: Duration (5-year)

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta r_{[t-1,t]}\times$ Duration$_{z,t-1}$	1.026***	0.730***	2.662***	1.937***	1.812***	1.391***
	(0.100)	(0.132)	(0.184)	(0.253)	(0.228)	(0.357)
Duration$_{z,t-1}$	-0.055***	-0.057***	-0.144***	-0.137***	-0.254***	-0.247***
	(0.004)	(0.003)	(0.008)	(0.007)	(0.014)	(0.013)
Δ HPI$_{z,[t-2,t-1]}$		0.147***		0.163***		0.129***
		(0.010)		(0.017)		(0.021)
Adjusted R^2	0.800	0.824	0.823	0.850	0.824	0.852
Observations	47,316	47,316	47,297	47,297	42,758	42,758
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
$\Delta r_{[t-1,t]}\times$ Zip Economic Chars		Yes		Yes		Yes

Panel B: Duration (10-year)

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta r_{[t-1,t]}\times$ Duration$_{z,t-1}$	0.327***	0.233***	0.830***	0.623***	0.604***	0.504***
	(0.029)	(0.038)	(0.054)	(0.073)	(0.063)	(0.097)
Duration$_{z,t-1}$	-0.020***	-0.020***	-0.052***	-0.047***	-0.090***	-0.084***
	(0.001)	(0.001)	(0.003)	(0.002)	(0.005)	(0.004)
Δ HPI$_{z,[t-2,t-1]}$		0.144***		0.156***		0.115***
		(0.010)		(0.017)		(0.021)
Adjusted R^2	0.801	0.825	0.825	0.851	0.825	0.853
Observations	47,316	47,316	47,297	47,297	42,758	42,758
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
$\Delta r_{[t-1,t]}\times$ Zip Economic Chars		Yes		Yes		Yes

Table IA.E4 presents the heterogeneous effects of interest rate changes on house price growth over 1-, 2-, and 3-year horizons across zip codes with varying housing duration levels. Panel A uses the duration measure with a 5-year property holding horizon assumed, while Panel B employs the 10-year horizon version of housing duration. The dependent variable in each column is the cumulative change in house prices, $\Delta HPI_{z,[t-1,t+h]}$, from the end of year $t-1$ to $t+h$, where $h \in \{0,1,2\}$ denotes the ex-post horizon in years. The key explanatory variable, $\Delta r_{[t-1,t]} \times Duration_{z,t-1}$, captures the heterogeneous house price sensitivity to FFR changes based on the zip-code housing duration. $\Delta r_{[t-1,t]}$ measures the annual change in the FFR from the end of year $t-1$ to t. Section II.B provides details on the estimation of housing duration. All specifications include county-year and zip-code fixed effects. Columns 2, 4, and 6 additionally control for time-varying zip-code economic characteristics and their interactions with the interest rate change, consistent with Column 3 of Table 3. Standard errors are clustered at the zip code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table IA.E5. 5- and 10-Year Housing Duration (LASSO) and Monetary Policy Transmission to House Prices in 1, 2, and 3-year Horizons

Panel A: Duration (5-year)

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta r_{[t-1,t]}\times$ Duration$_{z,t-1}$	0.942***	0.495***	2.343***	1.482***	1.885***	1.437***
	(0.079)	(0.099)	(0.142)	(0.178)	(0.168)	(0.233)
Duration$_{z,t-1}$	-0.040***	-0.038***	-0.105***	-0.093***	-0.181***	-0.168***
	(0.003)	(0.003)	(0.006)	(0.006)	(0.010)	(0.010)
Δ HPI$_{z,[t-2,t-1]}$		0.133***		0.137***		0.096***
		(0.009)		(0.014)		(0.018)
Adjusted R^2	0.812	0.830	0.837	0.857	0.839	0.860
Observations	75,601	75,601	75,544	75,544	68,329	68,329
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
$\Delta r_{[t-1,t]}\times$ Zip Economic Chars		Yes		Yes		Yes

Panel B: Duration (10-year)

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta r_{[t-1,t]}\times$ Duration$_{z,t-1}$	0.297***	0.148***	0.725***	0.455***	0.592***	0.457***
	(0.023)	(0.029)	(0.042)	(0.052)	(0.048)	(0.066)
Duration$_{z,t-1}$	-0.014***	-0.012***	-0.035***	-0.030***	-0.061***	-0.054***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)	(0.003)
Δ HPI$_{z,[t-2,t-1]}$		0.131***		0.132***		0.084***
		(0.009)		(0.014)		(0.018)
Adjusted R^2	0.812	0.830	0.838	0.857	0.840	0.860
Observations	75,601	75,601	75,544	75,544	68,329	68,329
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
$\Delta r_{[t-1,t]}\times$ Zip Economic Chars		Yes		Yes		Yes

Table IA.E5 presents the heterogeneous effects of interest rate changes on house price growth over 1-, 2-, and 3-year horizons across zip codes with varying housing duration levels, which are estimated with LASSO selected predictors. Panel A uses the duration measure with a 5-year property holding horizon assumed, while Panel B employs the 10-year horizon version of housing duration. The dependent variable in each column is the cumulative change in house prices, $\Delta HPI_{z,[t-1,t+h]}$, from the end of year $t-1$ to $t+h$, where $h \in \{0,1,2\}$ denotes the ex-post horizon in years. The key explanatory variable, $\Delta r_{[t-1,t]} \times Duration_{z,t-1}$, captures the heterogeneous house price sensitivity to FFR changes based on the zip-code housing duration. $\Delta r_{[t-1,t]}$ measures the annual change in the FFR from the end of year $t-1$ to t and it is estimated with LASSO selected predictors. The LASSO prediction regression results are presented in Table IA.C2. Section II.B provides details on the estimation of housing duration. All specifications include county-year and zip-code fixed effects. Columns 2, 4, and 6 additionally control for time-varying zip-code economic characteristics and their interactions with the interest rate change, consistent with Column 3 of Table 3. Standard errors are clustered at the zip code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table IA.E6. Housing Duration, 30-Year Mortgage Rate Changes, and House Prices in 1, 2, and 3-year Horizons

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta r^{30Y}_{[t-1,t]}\times$ Duration$_{z,t-1}$	1.764***	0.909***	4.513***	2.159***	5.360***	3.079***
	(0.123)	(0.176)	(0.227)	(0.321)	(0.290)	(0.450)
Duration$_{z,t-1}$	-0.055***	-0.058***	-0.145***	-0.135***	-0.256***	-0.242***
	(0.004)	(0.003)	(0.008)	(0.007)	(0.014)	(0.013)
Δ HPI$_{z,[t-2,t-1]}$		0.138***		0.139***		0.102***
		(0.010)		(0.017)		(0.021)
Adjusted R^2	0.801	0.825	0.825	0.851	0.827	0.854
Observations	47,316	47,316	47,297	47,297	42,758	42,758
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
$\Delta r^{30Y}_{[t-1,t]}\times$ Zip Economic Chars		Yes		Yes		Yes

Table IA.E6 examines the house price responses to monetary policy shocks (MPS) over one-, two-, and three-year horizons. Panel A presents the results using duration values, while Panel B presents duration percentiles. Each year, a zip code is assigned a percentile based on its estimated housing duration value relative to all other zip codes for that year. The dependent variable, $\Delta HPI_{i,[t-1,t+1]}$, is the house price growth of zip code i from the end of year t-1 to t in Columns 1 and 2, from year t-1 to t+1 in Columns 3 and 4, and from year t-1 to t+2, where t is the year when MPS occurs. The variable MPS_t captures the annual monetary policy shocks that occur in year t, as estimated by Bauer and Swanson (2023b). The variable $Duration_{i,t}$ indicates the duration level or percentiles of zip code i in year t. Section II.B provides details on the estimation of housing duration. Each observation in the sample represents a zip code in a year. In Columns 2, 4, and 6, we control for the same time-varying economic characteristics at the zip-code level as Table 3. We also include county-year and zip-code fixed effects, as indicated at the bottom of the table. Standard errors are clustered at the zip code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table IA.E7. Housing Duration, Bauer and Swanson (2023a) Orthogonalized Monetary Policy Shocks, and House Prices in 1, 2, and 3-year Horizons

Panel A: BS MPS

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
MPS$_t$ × Duration$_{z,t-1}$	11.312***	4.482***	26.723***	17.727***	29.021***	23.249***
	(0.750)	(1.009)	(1.359)	(1.905)	(1.601)	(2.474)
Duration$_{z,t-1}$	-0.056***	-0.057***	-0.146***	-0.140***	-0.259***	-0.253***
	(0.004)	(0.003)	(0.008)	(0.007)	(0.014)	(0.013)
Δ HPI$_{z,[t-2,t-1]}$		0.143***		0.163***		0.135***
		(0.010)		(0.017)		(0.021)
Adjusted R^2	0.802	0.826	0.826	0.852	0.827	0.855
Observations	47,316	47,316	47,297	47,297	42,758	42,758
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
MPS$_t$ × Zip Economic Chars		Yes		Yes		Yes

Panel B: BS MPS_ORTH

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
MPS$_t$ × Duration$_{z,t-1}$	4.840***	3.022**	6.094***	9.033***	-15.535***	-5.572*
	(1.069)	(1.518)	(1.751)	(2.429)	(1.908)	(2.929)
Duration$_{z,t-1}$	-0.055***	-0.057***	-0.145***	-0.143***	-0.255***	-0.253***
	(0.004)	(0.003)	(0.008)	(0.008)	(0.014)	(0.013)
Δ HPI$_{z,[t-2,t-1]}$		0.156***		0.180***		0.124***
		(0.010)		(0.017)		(0.021)
Adjusted R^2	0.799	0.825	0.821	0.848	0.823	0.851
Observations	47,316	47,316	47,297	47,297	42,758	42,758
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
MPS$_t$ × Zip Economic Chars		Yes		Yes		Yes

Table IA.E7 presents the heterogeneous effects of monetary policy shocks (MPS) on house price growth over 1-, 2-, and 3-year horizons across zip codes with varying housing duration levels. Panel A uses the standard MPS constructed by Bauer and Swanson (2023a), while Panel B employs their orthogonalized MPS. The dependent variable in each column is the cumulative change in house prices, $\Delta HPI_{z,[t-1,t+h]}$, from the end of year $t-1$ to $t+h$, where $h \in \{0,1,2\}$ denotes the ex-post horizon in years. The key explanatory variable, $MPS_t \times Duration_{z,t-1}$, captures the heterogeneous house price sensitivity to FFR changes based on the zip-code housing duration. MPS_t measures the aggregated annual MPS from the end of year $t-1$ to t. Section II.B provides details on the estimation of housing duration. All specifications include county-year and zip-code fixed effects. Columns 2, 4, and 6 additionally control for time-varying zip-code economic characteristics and their interactions with the interest rate change, consistent with Column 3 of Table 3. Standard errors are clustered at the zip code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table IA.E8. Monetary Policy Shocks, Housing Duration, and House Price Growth

	1-Year Yield Surprise$_t$		BS MPS$_t$		BS MPS_ORTH $_t$		JK PM MPS$_t$		JK Median MPS$_t$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MPS$_t$ × Duration$_{z,t-1}$	3.179***	1.986***	26.723***	17.727***	6.094***	9.033***	0.275***	0.157***	0.229***	0.133***
	(0.199)	(0.271)	(1.359)	(1.905)	(1.751)	(2.429)	(0.015)	(0.021)	(0.016)	(0.022)
Duration$_{z,t-1}$	-0.128***	-0.123***	-0.146***	-0.140***	-0.145***	-0.143***	-0.126***	-0.124***	-0.120***	-0.119***
	(0.008)	(0.007)	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)	(0.007)	(0.008)	(0.007)
Δ HPI$_{z,[t-2,t-1]}$		0.158***		0.163***		0.180***		0.153***		0.158***
		(0.017)		(0.017)		(0.017)		(0.017)		(0.017)
Adjusted R^2	0.824	0.851	0.826	0.852	0.821	0.848	0.824	0.851	0.823	0.850
Observations	47,297	47,297	47,297	47,297	47,297	47,297	47,297	47,297	47,297	47,297
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes		Yes		Yes
MPS$_t$ × Zip Economic Chars		Yes		Yes		Yes		Yes		Yes

Table IA.E8 examines how alternative measurements of monetary policy shocks (MPS) affect house price growth differently across zip codes with varying housing durations. The specific MPS measure used in each column is indicated at the top. The dependent variable, $\Delta HPI_{z,[t-1,t+1]}$, is the cumulative house price growth from the end of year $t-1$ to $t+1$. The primary explanatory variable, $MPS_t \times Duration_{z,t-1}$, captures the heterogeneous house price sensitivity to MPS based on the zip-code housing duration. Section II.B provides details on the estimation of housing duration. The MPS variable, MPS_t, aggregates monetary policy shocks occurring between the end of year $t-1$ and t. Columns 1 and 2 employ the 1-year treasury yield surprise as the MPS measure. Columns 3 and 4 utilize the standard MPS measure developed by Bauer and Swanson (2023a), while columns 5 and 6 apply the orthogonalized version from Bauer and Swanson (2023a). Columns 7 and 8 incorporate the PM MPS measure from Jarociński and Karadi (2020), and columns 9 and 10 use their median MPS measure. All specifications include county-year and zip-code fixed effects. Columns 2, 4, 6, 8, and 10 additionally control for time-varying zip-code economic characteristics and their interactions with MPS, consistent with Column 3 of Table 3. Standard errors are clustered at the zip code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

E.3. Rental Yield, Δr, Δ30-Year Mortgage Rate, and Monetary Policy Shocks

Figure IA.E6. County-level Geographic Heterogeneity in Rental Yield

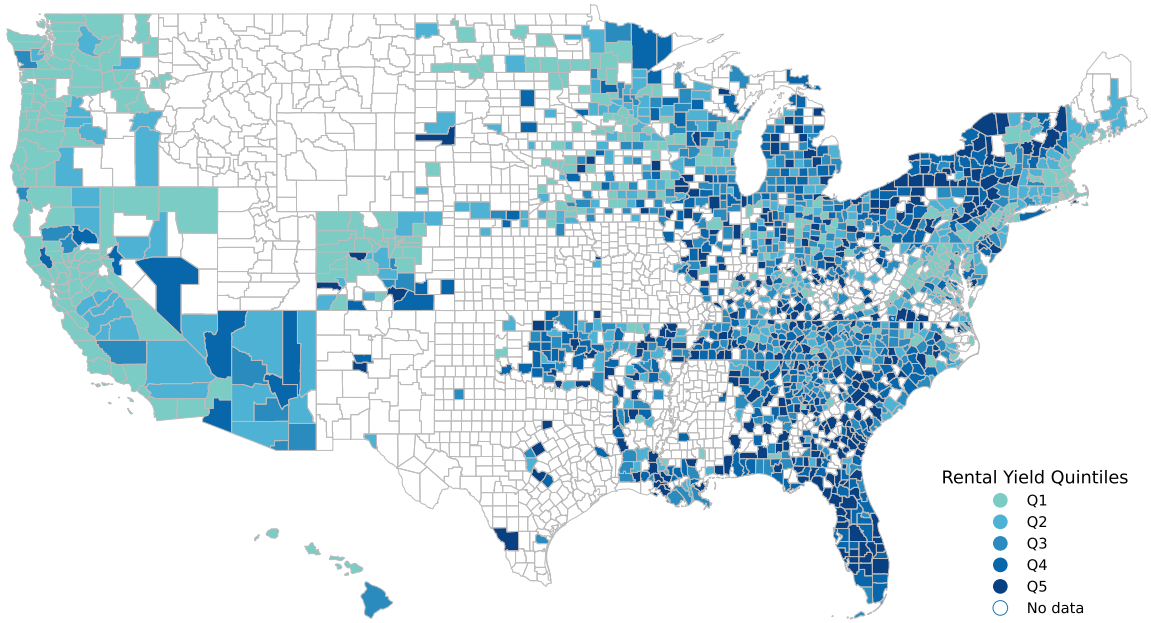


Figure IA.E6 presents county-level geographic heterogeneity in rental yield. The figure categorizes counties into quintiles (Q1 to Q5) based on rental yield, with darker shading indicating higher rental yield values. County-level rental yield measure is computed by averaging across all available zip codes and years within each county. Counties without sufficient data are shown in white.

Figure IA.E7. Heterogeneity in House Price Responses by Rental Yield Following a 100 bps Decrease in the Federal Funds Rate and 30-Year Mortgage Rate



Figure IA.E7 illustrates the differences in house price responses across zip-code rental yield quintiles following a 100 basis-point (bps) decrease in the interest rate, compared to quintile 5 (baseline group). Each year, zip codes are categorized into five rental yield quintiles. Quintile 1 represents zip codes with the lowest rental yield, while quintile 5 includes those with the highest rental yield. Panel A uses the federal funds rate changes as the interest rate change measure, while Panel B uses the 30-year mortgage rate changes. The interest rate shock is introduced at horizon 0, representing the period from year $t-1$ to t. The x-axis represents the response horizon h in years following the interest rate change, while the y-axis shows the difference in the cumulative percentage change in house prices over 1-, 2-, and 3-year horizons relative to the quintile 5 (long duration) group. The analysis employs the same regression specification as Column 5 of Table 2 Panel A for each horizon, as presented in the following:

$$\Delta HPI_{z,c,[t-1,t+h]} = \alpha_h + \beta_{1,h}\,\Delta r_{[t-1,t]} \times \mathrm{RY}_{z,t-1} + \beta_{2,h}\,\mathrm{RY}_{z,t-1} + \zeta_c \times \theta_t + \lambda_z + \epsilon_{z,c,t},$$

where $\Delta HPI_{z,c,[t-1,t+h]}$ is the cumulative house price change of zip code z in county c from year $t-1$ to $t+h$. $\Delta r_{[t-1,t]}$ indicates the annual change in the federal funds rate from year $t-1$ to t. $\mathrm{RY}_{z,t-1}$ is a categorical variable ranging from 1 to 5, indicating the quintile ranking of rental yield for zip code z in year $t-1$. The term $\zeta_c \times \theta_t$ represents the county-year fixed effects, and λ_z denotes the zip code fixed effects. The gray-shaded error bars indicate 95% confidence intervals. Standard errors are clustered at the zip code level.

Figure IA.E8. Heterogeneity in House Price Responses by Rental Yield Following a 25 bps of Negative Monetary Policy Shock (MPS)

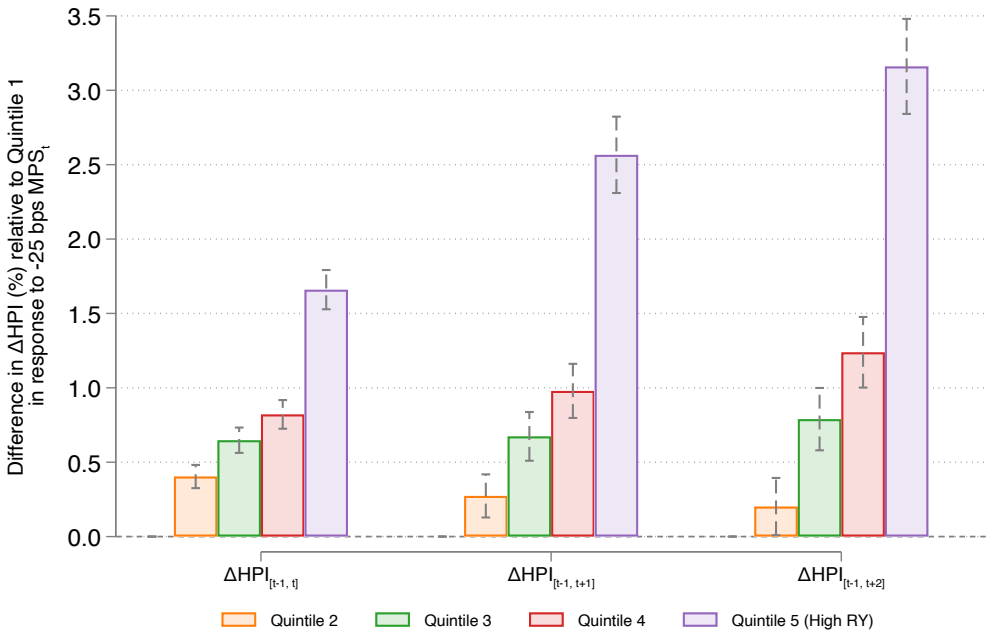


Figure IA.E8 illustrates the differences in house price responses across zip-code rental yield quintiles following a negative 25 basis-point (bps) of monetary policy shocks (MPS), compared to quintile 5 (baseline group). Each year, zip codes are categorized into five rental yield quintiles. Quintile 1 represents zip codes with the lowest rental yield, while quintile 5 includes those with the highest rental yield. The figure uses the standard MPS constructed by Bauer and Swanson (2023a) as the shock measure. The shock is introduced at horizon 0, representing the period from year $t-1$ to t. The x-axis represents the response horizon h in years following the MPS, while the y-axis shows the difference in the cumulative percentage change in house prices over 1-, 2-, and 3-year horizons relative to the quintile 5 (long duration) group. The analysis employs the same regression specification as Column 5 of Table 2 Panel A for each horizon, as presented in the following:

$$\Delta HPI_{z,c,[t-1,t+h]} = \alpha_h + \beta_{1,h}\, MPS_t \times \text{Duration Quintile}_{z,t-1} + \beta_{2,h}\, \text{Duration Quintile}_{z,t-1} + \zeta_c \times \theta_t + \lambda_z + \epsilon_{z,c,t},$$

where $\Delta HPI_{z,c,[t-1,t+h]}$ is the cumulative house price change of zip code z in county c from year $t-1$ to $t+h$. MPS_t indicates the aggregated annual MPS from the end of year $t-1$ to t. Duration Quintile$_{z,t-1}$ is a categorical variable ranging from 1 to 5, indicating the quintile ranking of housing cash flow duration for zip code z in year $t-1$. The term $\zeta_c \times \theta_t$ represents the county-year fixed effects, and λ_z denotes the zip code fixed effects. The gray-capped error bars indicate 95% confidence intervals. Standard errors are clustered at the zip code level.

Figure IA.E9. Heterogeneity in House Price Response to the Federal Funds Rate and 30-Year Mortgage Rate across Rental Yield and Local Economic Characteristics

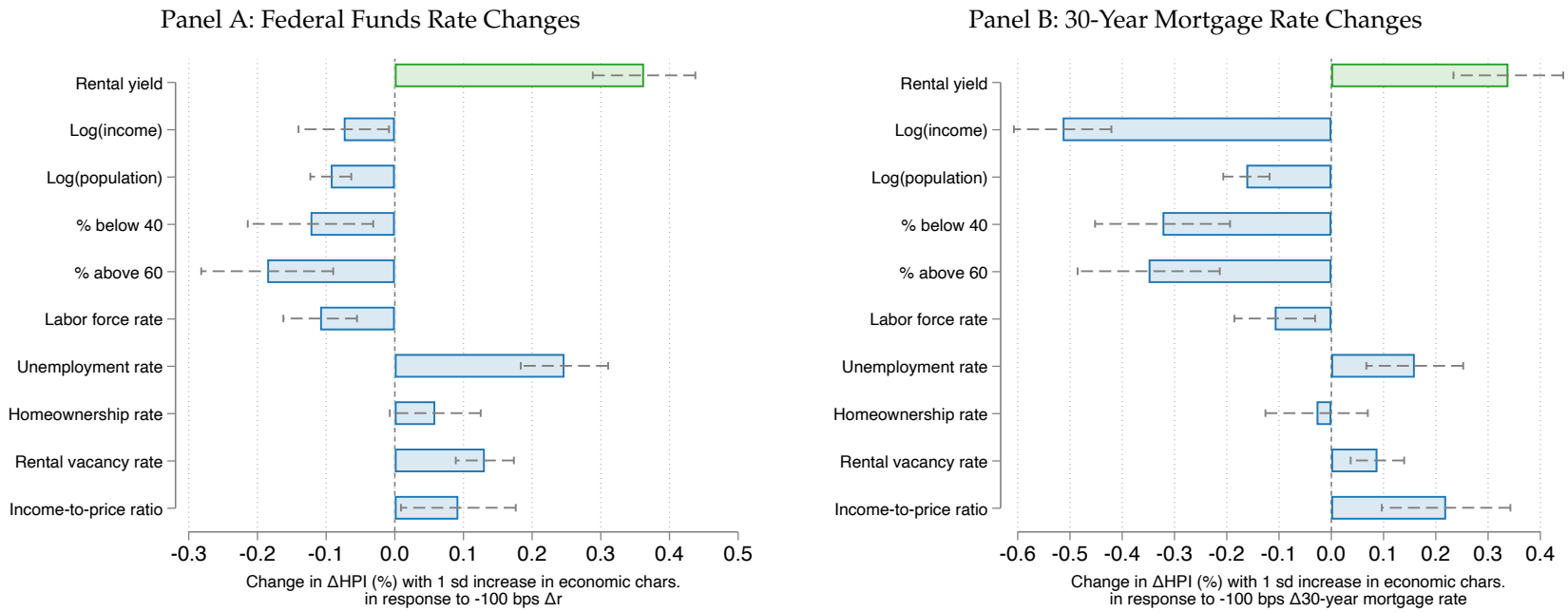


Figure IA.E9 presents the heterogeneous effects of a 100 basis-point (bps) decrease in the federal funds rate (FFR) (Panel A) and the 30-year mortgage rate (Panel B) on two-year house price growth across zip codes with varying rental yield and economic characteristics. The interest rate shock is introduced at horizon 0, representing the period from year $t-1$ to t. The x-axis represents the differential impact on cumulative two-year house price growth, $\Delta HPI_{z,c,[t-1,t+1]}$, associated with a one standard deviation (sd) increase in each specified economic characteristic at the zip-code level. The y-axis lists the economic characteristics analyzed. The heterogeneity is estimated using the regression specification applied in Column 3 of Table 3, as indicated in the following:

$$\begin{aligned}\Delta HPI_{z,c,[t-1,t+1]} = \alpha + \beta_1 \Delta r_{[t-1,t]} \times \mathrm{RY}_{z,t} + \beta_2 \Delta r_{[t-1,t]} \times \text{Economic Chars}_{z,t} \\ + \delta\, \mathrm{RY}_{z,t} + \gamma\, \text{Economic Chars}_{z,t} + \zeta_c \times \theta_t + \lambda_z + \epsilon_{z,c,t},\end{aligned}$$

where $\Delta HPI_{z,c,[t-1,t+1]}$ denotes cumulative house price changes in zip code z, county c, from year $t-1$ to $t+1$, and $\Delta r_{[t-1,t]}$ represents the annual change in the FFR (Panel A) or the 30-year mortgage rate (Panel B) from year $t-1$ to t. The variable $\mathrm{RY}_{z,t}$ captures rental yield at the zip-code-year level. The term $\zeta_c \times \theta_t$ represents the county-year fixed effects, and λ_z denotes the zip code fixed effects. The gray-capped error bars indicate 95% confidence intervals. Standard errors are clustered at the zip code level.

Figure IA.E10. Heterogeneity in House Price Response to Monetary Policy Shocks across Rental Yield and Local Economic Characteristics

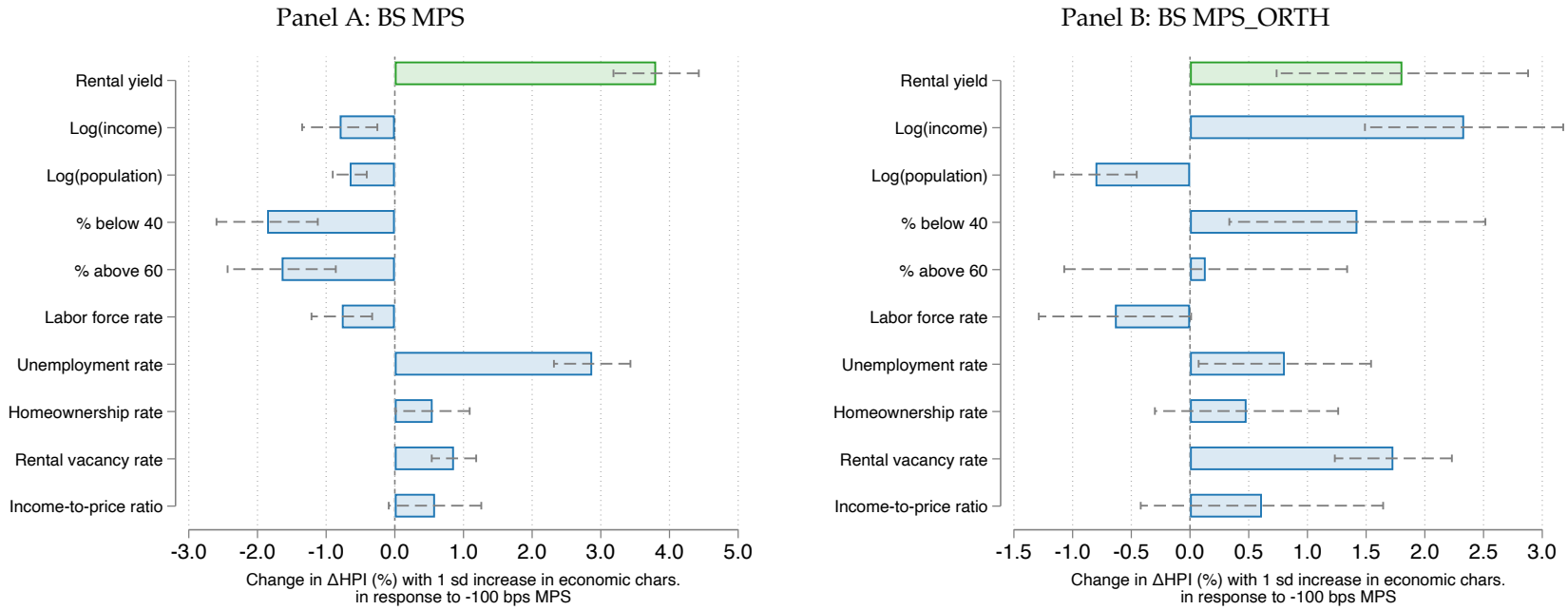


Figure IA.E10 presents the heterogeneous effects of a 100 basis-point (bps) decrease in the standard monetary policy shocks (MPS) (Panel A) and the orthogonalized MPS (Panel B) constructed by Bauer and Swanson (2023a) on two-year house price growth across zip codes with varying rental yield and economic characteristics. The shock is introduced at horizon 0, representing the period from year $t-1$ to t. The x-axis represents the differential impact on cumulative two-year house price growth, $\Delta HPI_{z,c,[t-1,t+1]}$, associated with a one standard deviation (sd) increase in each specified economic characteristic at the zip-code level. The y-axis lists the economic characteristics analyzed. The heterogeneity is estimated using the regression specification applied in Column 3 of Table 3, as indicated in the following:

$$\begin{aligned}\Delta HPI_{z,c,[t-1,t+1]} = \alpha + \beta_1 MPS_t \times \mathrm{RY}_{z,t} + \beta_2 MPS_t \times \text{Economic Chars}_{z,t} \\ + \delta\, \mathrm{RY}_{z,t} + \gamma\, \text{Economic Chars}_{z,t} + \zeta_c \times \theta_t + \lambda_z + \epsilon_{z,c,t},\end{aligned}$$

where $\Delta HPI_{z,c,[t-1,t+1]}$ denotes cumulative house price changes in zip code z, county c, from year $t-1$ to $t+1$, and MPS_t represents the aggregated annual MPS from year $t-1$ to t. The variable $\mathrm{RY}_{z,t}$ captures housing duration at the zip-code-year level. The term $\zeta_c \times \theta_t$ represents the county-year fixed effects, and λ_z denotes the zip code fixed effects. The gray-capped error bars indicate 95% confidence intervals. Standard errors are clustered at the zip code level.

Table IA.E9. Rental Yield and Monetary Policy Transmission to House Prices

Panel A: Baseline results

	Δ HPI$_{z,[t-1,t+1]}$				
	(1)	(2)	(3)	(4)	(5)
$\Delta r_{[t-1,t]} \times$ RY$_{z,t-1}$		-9.250***	-8.536***	-12.173***	-10.170***
		(0.683)	(0.682)	(0.661)	(0.674)
$\Delta r_{[t-1,t]}$	-1.777***	-1.088***			
	(0.022)	(0.053)			
RY$_{z,t-1}$	0.334***	0.371***	0.423***	0.478***	0.312***
	(0.017)	(0.017)	(0.018)	(0.017)	(0.025)
Adjusted R^2	0.074	0.076	0.260	0.787	0.830
Observations	95,555	95,555	95,555	95,555	95,555
Year FE			Yes		
County × Year FE				Yes	Yes
Zip FE					Yes

Panel B: Robustness results

	Δ HPI$_{z,[t-1,t+1]}$		
	(1)	(2)	(3)
$\Delta r_{[t-1,t]} \times$ RY$_{z,t-1}$	-10.600***	-10.452***	-7.145***
	(0.693)	(0.703)	(0.750)
RY$_{z,t-1}$	0.330***	0.303***	0.276***
	(0.025)	(0.025)	(0.026)
Δ HPI$_{z,[t-2,t-1]}$	0.262***	0.140***	0.142***
	(0.013)	(0.013)	(0.013)
$\Delta r_{[t-1,t]} \times$ log(income)$_{z,t-1}$			0.185**
			(0.084)
$\Delta r_{[t-1,t]} \times$ log(population)$_{z,t-1}$			0.141***
			(0.023)
$\Delta r_{[t-1,t]} \times$ % below 40$_{z,t-1}$			1.386***
			(0.526)
$\Delta r_{[t-1,t]} \times$ % above 60$_{z,t-1}$			2.282***
			(0.603)
$\Delta r_{[t-1,t]} \times$ labor force rate$_{z,t-1}$			1.385***
			(0.349)
$\Delta r_{[t-1,t]} \times$ unemployment rate$_{z,t-1}$			-6.554***
			(0.861)
$\Delta r_{[t-1,t]} \times$ homeownership rate$_{z,t-1}$			-0.353*
			(0.202)
$\Delta r_{[t-1,t]} \times$ rental vacancy rate$_{z,t-1}$			-2.203***
			(0.363)
$\Delta r_{[t-1,t]} \times$ income-to-price ratio$_{z,t-1}$			-0.223**
			(0.103)
Adjusted R^2	0.835	0.848	0.849
Observations	95,555	95,555	95,555
County × Year FE	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes
Zip Economic Chars		Yes	Yes

Table IA.E9 illustrates the heterogeneous price responses to federal funds rate (FFR) changes across zip codes with varying rental yield. The dependent variable is the cumulative change in house prices, $\Delta HPI_{z,[t-1,t+1]}$, from the end of year $t-1$ to $t+1$. The variable, $\Delta r_{[t-1,t]} \times RY_{z,t-1}$, captures the heterogeneous house price sensitivity to FFR changes based on the zip-code rental yield. $\Delta r_{[t-1,t]}$ measures the annual change in the FFR from the end of year $t-1$ to t. Section XXXXXRY provides details on the estimation of rental yield. We include different combinations of fixed effects indicated at the bottom of the table. Standard errors are clustered at the individual asset level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table IA.E10. Rental Yield and Heterogeneous House Price Responses to Interest Rate Changes over 1-, 2-, and 3-Year Horizons

Panel A: Federal Funds Rate Changes

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta r_{[t-1,t]}\times$ RY$_{z,t-1}$	-3.492***	-2.155***	-10.170***	-7.145***	-8.611***	-6.969***
	(0.351)	(0.396)	(0.674)	(0.750)	(0.846)	(1.050)
RY$_{z,t-1}$	0.117***	0.109***	0.312***	0.276***	0.585***	0.544***
	(0.012)	(0.012)	(0.025)	(0.026)	(0.044)	(0.046)
Δ HPI$_{z,[t-2,t-1]}$		0.154***		0.142***		0.092***
		(0.008)		(0.013)		(0.017)
Adjusted R^2	0.802	0.821	0.830	0.849	0.833	0.852
Observations	95,637	95,637	95,555	95,555	86,442	86,442
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
$\Delta r_{[t-1,t]}\times$ Zip Economic Chars		Yes		Yes		Yes

Panel B: 30-Year Mortgage Rate Changes

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
Δ 30-year Mortgage Rate$_{[t-1,t]}\times$ RY$_{z,t-1}$	-3.997***	-1.502**	-13.965***	-6.668***	-16.436***	-9.308***
	(0.475)	(0.597)	(0.885)	(1.055)	(1.183)	(1.537)
RY$_{z,t-1}$	0.109***	0.101***	0.295***	0.247***	0.576***	0.514***
	(0.011)	(0.011)	(0.025)	(0.025)	(0.044)	(0.045)
Δ HPI$_{z,[t-2,t-1]}$		0.149***		0.129***		0.080***
		(0.008)		(0.013)		(0.017)
Adjusted R^2	0.801	0.822	0.830	0.849	0.834	0.853
Observations	95,637	95,637	95,555	95,555	86,442	86,442
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
Δ 30-year Mortgage Rate$_{[t-1,t]}\times$ Zip Economic Chars		Yes		Yes		Yes

Table IA.E10 presents the heterogeneous effects of interest rate changes on house price growth over 1-, 2-, and 3-year horizons across zip codes with varying rental yield. Panel A uses the federal funds rate (FFR) as the interest rate measure, while Panel B employs the 30-year mortgage rate. The dependent variable in each column is the cumulative change in house prices, $\Delta HPI_{z,[t-1,t+h]}$, from the end of year $t-1$ to $t+h$, where $h \in \{0,1,2\}$ denotes the ex-post horizon in years. The key explanatory variable, $\Delta r_{[t-1,t]} \times Duration_{z,t-1}$, captures the heterogeneous house price sensitivity to FFR changes based on the zip-code rental yield. $\Delta r_{[t-1,t]}$ measures the annual change in the FFR (Panel A) or 30-year mortgage rate (Panel B) from the end of year $t-1$ to t. Section XXXXXRY provides details on the estimation of rental yield. All specifications include county-year and zip-code fixed effects. Columns 2, 4, and 6 additionally control for time-varying zip-code economic characteristics and their interactions with the interest rate change, consistent with Column 3 of Table 3. Standard errors are clustered at the zip code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table IA.E11. Rental Yield and Heterogeneous House Price Responses to Bauer and Swanson (2023a) Monetary Policy Shocks over 1-, 2-, and 3-Year Horizons

Panel A: BS MPS

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
MPS$_t$ × RY$_{z,t-1}$	-58.088***	-50.619***	-123.263***	-122.323***	-139.317***	-159.048***
	(3.030)	(3.123)	(5.971)	(6.343)	(7.672)	(8.738)
RY$_{z,t-1}$	0.132***	0.133***	0.334***	0.330***	0.624***	0.621***
	(0.011)	(0.011)	(0.024)	(0.024)	(0.044)	(0.043)
Δ HPI$_{z,[t-2,t-1]}$		0.154***		0.131***		0.056***
		(0.007)		(0.013)		(0.016)
Adjusted R^2	0.804	0.823	0.833	0.851	0.836	0.855
Observations	95,637	95,637	95,555	95,555	86,442	86,442
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
MPS$_t$ × Zip Economic Chars		Yes		Yes		Yes

Panel B: BS MPS_ORTH

	Δ HPI$_{z,[t-1,t]}$		Δ HPI$_{z,[t-1,t+1]}$		Δ HPI$_{z,[t-1,t+2]}$	
	(1)	(2)	(3)	(4)	(5)	(6)
MPS$_t$ × RY$_{z,t-1}$	0.710	-9.456*	-6.076	-35.598***	80.756***	19.240
	(4.544)	(5.391)	(8.408)	(10.756)	(11.076)	(14.520)
RY$_{z,t-1}$	0.102***	0.108***	0.272***	0.275***	0.537***	0.524***
	(0.012)	(0.013)	(0.026)	(0.028)	(0.045)	(0.046)
Δ HPI$_{z,[t-2,t-1]}$		0.161***		0.151***		0.073***
		(0.008)		(0.013)		(0.016)
Adjusted R^2	0.801	0.821	0.828	0.847	0.833	0.851
Observations	95,637	95,637	95,555	95,555	86,442	86,442
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes
MPS$_t$ × Zip Economic Chars		Yes		Yes		Yes

Table IA.E11 presents the heterogeneous effects of monetary policy shocks (MPS) on house price growth over 1-, 2-, and 3-year horizons across zip codes with varying rental yield. Panel A uses the standard MPS constructed by Bauer and Swanson (2023a), while Panel B employs their orthogonalized MPS. The dependent variable in each column is the cumulative change in house prices, $\Delta HPI_{z,[t-1,t+h]}$, from the end of year $t-1$ to $t+h$, where $h \in \{0,1,2\}$ denotes the ex-post horizon in years. The key explanatory variable, $MPS_t \times RY_{z,t-1}$, captures the heterogeneous house price sensitivity to FFR changes based on the zip-code rental yield. MPS_t measures the aggregated annual MPS from the end of year $t-1$ to t. Section XXXXXRY provides details on the estimation of rental yield. All specifications include county-year and zip-code fixed effects. Columns 2, 4, and 6 additionally control for time-varying zip-code economic characteristics and their interactions with the interest rate change, consistent with Column 3 of Table 3. Standard errors are clustered at the zip code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table IA.E12. Monetary Policy Shocks, Rental Yield, and House Price Growth

	1-Year Yield Surprise$_t$		BS MPS$_t$		BS MPS_ORTH $_t$		JK PM MPS$_t$		JK Median MPS$_t$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MPS$_t$ × RY$_{z,t-1}$	-12.417***	-7.546***	-123.263***	-74.912***	-6.076	-35.598***	-1.165***	-0.631***	-0.972***	-0.559***
	(0.744)	(0.786)	(5.971)	(6.243)	(8.408)	(10.756)	(0.063)	(0.059)	(0.057)	(0.060)
RY$_{z,t-1}$	0.272***	0.235***	0.334***	0.290***	0.272***	0.275***	0.256***	0.230***	0.225***	0.210***
	(0.025)	(0.024)	(0.024)	(0.024)	(0.026)	(0.028)	(0.025)	(0.024)	(0.025)	(0.024)
Δ HPI$_{z,[t-2,t-1]}$		0.136***		0.125***		0.151***		0.124***		0.134***
		(0.013)		(0.013)		(0.013)		(0.013)		(0.013)
Adjusted R^2	0.831	0.850	0.833	0.851	0.828	0.847	0.832	0.850	0.830	0.849
Observations	95,555	95,555	95,555	95,555	95,555	95,555	95,555	95,555	95,555	95,555
County × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip Economic Chars		Yes		Yes		Yes		Yes		Yes
MPS$_t$ × Zip Economic Chars		Yes		Yes		Yes		Yes		Yes

Table IA.E12 examines how alternative measurements of monetary policy shocks (MPS) affect house price growth differently across zip codes with varying rental yield. The specific MPS measure used in each column is indicated at the top. The dependent variable, $\Delta HPI_{z,[t-1,t+1]}$, is the cumulative house price growth from the end of year $t-1$ to $t+1$. The primary explanatory variable, $MPS_t \times RY_{z,t-1}$, captures the heterogeneous house price sensitivity to MPS based on the zip-code rental yield. Section XXXXXRY provides details on the estimation of rental yield. The MPS variable, MPS_t, aggregates monetary policy shocks occurring between the end of year $t-1$ and t. Columns 1 and 2 employ the 1-year treasury yield surprise as the MPS measure. Columns 3 and 4 utilize the standard MPS measure developed by Bauer and Swanson (2023a), while columns 5 and 6 apply the orthogonalized version from Bauer and Swanson (2023a). Columns 7 and 8 incorporate the PM MPS measure from Jarociński and Karadi (2020), and columns 9 and 10 use their median MPS measure. All specifications include county-year and zip-code fixed effects. Columns 2, 4, 6, 8, and 10 additionally control for time-varying zip-code economic characteristics and their interactions with MPS, consistent with Column 3 of Table 3. Standard errors are clustered at the zip code level. *,**, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

F Baseline Analysis with Zillow Sample

F.1. Data Source

To construct the zip-code level housing duration, we implement the Zillow Home Value Index (ZHVI) and the Zillow Observed Rent Index (ZORI). ZHVI provides a measure of the house price levels and changes of the typical home in the 35th to 65th percentile range across zip codes. Similarly, ZORI provides a measure of the typical observed market rent rate across zip codes. It is a repeat-rent index that is weighted to the rental housing stock, not just those homes currently listed for rental, to ensure representativeness for the entire market. We use the same smoothed and seasonally adjusted version of the ZHVI and ZORI measured for all homes to reduce any discrepancies in the index construction or errors related to property type measurement. Since zip code-level ZHVI and ZORI data are available from as early as 2000 and 2015, respectively, our analysis of housing cash flow duration at the zip code level will start from 2016. However, for our property-level analysis, we can extend the measurement period back to 2011 due to the availability of detailed property-level rental listing data.

G Property-level Transaction Price Sensitivity to Interest Rate Changes

G.1. Rental Yields Estimated from By-county-year Hedonic Regressions

H Literature Review

H.1. Monetary Policy Transmission and Housing Markets

Credit Channel A foundational strand of literature examines how credit supply influences house prices through mortgage markets Mian and Sufi (2009); Favara and Imbs (2015). Early work by Mian and Sufi (2009) and Favara and Imbs (2015) establish that expansions in credit availability, driven by securitization or deregulation, significantly amplify housing booms.

A strand of literature examines how Fed tightening impacted mortgage lending through the deposits channel. Monetary tightening causes deposit outflows from banks due to higher spreads between deposit rates and federal funds rates (Drechsler et al., 2017). This shift significantly reduces bank portfolio lending, pushing borrowers toward private-label securitization (PLS) and nonbank originators (Drechsler et al., 2022). Fed tightening thus induced a shift in mortgage lending away from stable, insured deposit funding toward run-prone and fragile capital markets funding with little impact on overall lending. Additionally, quantitative easing (QE) and quantitative tightening (QT) actions by the Fed and banks directly affect mortgage spreads and credit availability, as these institutions buy or sell mortgage-backed securities (MBS). Banks specifically adjust their holdings of MBS in response to deposit flows to match the interest-rate sensitivity of their income and expenses (Drechsler et al., 2024).

Greenwald (2018) underscores the role of mortgage market structure in macroeconomic transmission, particularly emphasizing the significance of payment-to-income (PTI) constraints alongside loan-to-value (LTV) ratios. His model highlights how PTI constraints amplify monetary policy shocks by influencing housing prices and mortgage borrowing, a mechanism he terms the mortgage credit channel. Greenwald emphasizes that PTI constraints have a more pronounced effect on boom-bust cycles than LTV constraints, offering important insights for macroprudential policies aimed at stabilizing housing markets.

Further examining credit supply dynamics, Bosshardt et al. (2024) focus on the distributional impacts of monetary tightening, specifically through debt-to-income (DTI) constraints. They show that during monetary tightening, borrowers near regulatory DTI limits (e.g., 45–50%) face sharper reductions in mortgage originations, with areas of high DTI exposure experiencing amplified declines in house prices, loan volume, and consumption. Adelino et al. (2025) estimate the causal impact of credit availability on house prices using exogenous variation from conforming loan limit (CLL) adjustments. Their difference-in-differences approach, leveraging the 80% LTV threshold, reveals that houses just eligible for conforming loans command higher values per square foot, implying a local house price elasticity to interest rates below 6.

Landvoigt et al. (2015) develop a segmented housing-market assignment model using detailed San Diego data. They find that during the early-2000s housing boom, cheaper and entry-level housing

markets experienced stronger price responses to easier credit conditions. Their results highlight that lower-tier segments, typically associated with financially constrained buyers, are particularly sensitive to changes in borrowing conditions. Given that low-tier markets are correlated with high rental yield, their findings complement our findings that housing markets characterized by short-duration (high-rent-yield) markets exhibit greater sensitivity to interest rate changes.

The credit supply largely influences house prices and aggregate economic outcomes. Loutskina and Strahan (2015) explore financial integration's role in amplifying economic volatility by facilitating capital flows toward areas experiencing housing price booms. Di Maggio and Kermani (2017) similarly underscore the role of credit supply in fueling economic volatility through regulatory changes. Their study examines the impact of national bank preemption of local antipredatory lending laws, finding significant expansions in mortgage credit to riskier borrowers, which boosted local house prices and employment but also heightened economic volatility during the subsequent downturn. Mian and Sufi (2022) analyze how credit supply expansion specifically fueled housing speculation during the mid-2000s.

Refinancing Channel The refinancing channel, which involves households' ability to refinance mortgages to benefit from lower interest rates, plays a crucial role in monetary policy transmission. Hanson (2014) finds that mortgage refinancing reduces aggregate MBS duration, which acts as a supply shock to long-term interest rate risk that must be borne by bond investors and leads to volatility in the term premium.

Beraja, Fuster, Hurst, and Vavra (2019) find that regions with higher housing equity experience greater refinancing activity and larger consumption responses during monetary easing periods. Di Maggio, Kermani, and Palmer (2020) find that quantitative easing through MBS purchase increased refinancing activity, reduced interest payments for refinancing households, led to a boom in equity extraction, and increased aggregate consumption.

Di Maggio, Kermani, Keys, Piskorski, Ramcharan, Seru, and Yao (2017) exploit automatic resets in adjustable-rate mortgages (ARMs) to clearly identify the effect of reduced mortgage rates on household financial decisions. They document significant increases in durable consumption and voluntary deleveraging following interest rate reductions, emphasizing the importance of mortgage contract rigidity and household balance sheet conditions. Their regional analysis further underscores substantial spatial heterogeneity, with areas featuring higher ARM shares experiencing stronger rebounds in consumption, house prices, and employment. Berger, Milbradt, Tourre, and Vavra (2021) and Eichenbaum, Rebelo, and Wong (2022)) extend these insights by emphasizing path-dependent and state-dependent effects of monetary policy. They reveal that the past interest rate level could influence household responsiveness to subsequent interest rate changes and affect future interest rate cuts on economy stimulation.

Behavioral Channel Hanson, Lucca, and Wright (2021) find that after 2000, long-term rates become more sensitive to short-term rates at higher frequencies than at lower frequencies. Empirical tests confirm that mortgage refinancing and investor extrapolation significantly contribute to the observed

dynamics. First, Lower short-term rates trigger mortgage-refinancing waves, decreasing the duration (interest rate sensitivity) of mortgage-backed securities (MBS), which creates transient supply shocks to long-term bonds. Second, investors incorrectly extrapolate recent changes in short rates, causing transient shifts in demand for long-term bonds. Such behavior increases when interest rates rise, temporarily increasing bond risk premia.

Shue, Townsend, and Wang (2024) find that individuals exhibit "categorical thinking," in which they group short- and long-term interest rates into a single category. This bias causes homebuyers to mistakenly think that an expected increase in short-term interest rates will also lead to future increases in long-term rates, making them rush to lock in long-term mortgage rates. The authors highlight that this systematic forecasting error influences real economic behaviors, including household borrowing decisions, and ultimately reduces the effectiveness of monetary policy's forward guidance.

H.2. Monetary Policy Surprise Measurement

Kroen, Liu, Mian, and Sufi (2021) examines how interest rate cuts in a low-interest-rate environment disproportionately benefit industry leaders through a stronger decline in the borrowing rate for industry leaders, who also borrow more, invest more aggressively, and acquire assets at a faster pace. To obtain the long-term rate shock measurement, Kroen et al. (2021) regress the monetary policy shocks (MPS) on a short-rate surprise measured within 30 minutes around FOMC announcements and obtain the residuals as the long-term rate surprise. Specifically, based on Gurkaynak, Sack, and Swanson (2005), high-frequency movements around FOMC announcements represent two separate factors, a short-run "current Federal Funds rate target" and a longer-run "future path of policy". Nakamura and Steinsson (2018) and Bauer and Swanson (2023a) calculate the first principal component of changes in the Federal Funds rate and Eurodollar futures contracts around FOMC announcements. The first principal component, therefore, reflects the unanticipated shift in the yield curve around the 30-minute FOMC announcement window starting at 10 minutes prior to the FOMC press release. Nakamura and Steinsson (2018) find that an unexpected increase in real interest rate increases output growth expectation, challenging conventional theories. To rationalize their findings, they introduce a model incorporating "Fed information effects," where Fed announcements convey information about economic fundamentals and lead the private sector to update its beliefs about other economic fundamentals. They estimate that about two-thirds of the real interest rate response reflects updated beliefs about the natural rate of interest.

Kroen et al. (2021) take the first principal component from Nakamura and Steinsson (2018) to more recent data as the default measure of ω. Then, they split ω into news about the short versus the long end of the yield curve. The variable ω^{ff} captures the response of Federal Funds rate Futures within a 30-minute time window (-10 minutes until +20 minutes) around FOMC meeting announcements. Kroen et al. (2021) obtain the shocks from Gorodnichenko and Weber (2016), which captures the response of the short end of the yield curve. Then, the long end of the yield curve is captured by $\tilde{\omega}$ which is obtained as the residual from regressing ω on ω^{ff} with the following regression

$$\omega_t = \alpha + \beta\, \omega_t^{ff} + \tilde{\omega}_t$$

H.3. Duration and Monetary Policy Transmission

Kilic and Zhang (2025)

Kroen et al. (2021) examines how interest rate cuts in a low-interest-rate environment disproportionately benefit industry leaders through a stronger decline in the borrowing rate for industry leaders, who also borrow more, invest more aggressively, and acquire assets at a faster pace. To measure long-term interest rate surprises, Kroen et al. (2021) leverages monetary policy shocks (MPS) constructed from high-frequency changes within a 30-minute window around FOMC announcements. Specifically, following the methodology of Gurkaynak et al. (2005), these high-frequency interest rate movements around FOMC announcements are decomposed into two distinct components: the short-term "current Federal Funds rate target" and the longer-term "future path of policy."

H.4. Duration, Term Structure of Equity Returns, and Monetary Policy Transmission

Recent literature highlights the importance of duration in asset pricing, particularly emphasizing how asset sensitivity to interest rate fluctuations varies with the maturity of expected cash flows. The foundational work by Dechow et al. (2004) introduces the concept of equity duration derived from financial statements to assess equity risk analogously to fixed-income securities. Their research demonstrates that equity duration is positively correlated with stock price volatility and beta, which provide an improved measure of risk relative to equity factors such as the book-to-market ratio.

Lettau and Wachter (2011) further develop a dynamic risk-based model that jointly explains the term structures of interest rates and equity returns. The paper highlights a critical tension that equities exhibit a downward-sloping term structure of returns, while interest rates are typically upward-sloping. They resolve this through the interplay of shocks to dividend growth, real interest rates, and inflation expectations within a stochastic discount factor framework. Their model can account for the variation in aggregate market returns, bond yields, and the value premium.

Building on these theoretical foundations, empirical studies by Binsbergen et al. (2012) and Van Binsbergen and Koijen (2017) investigate dividend strip markets. They find that short-term equity claims, or dividend strips, have higher average returns and Sharpe ratios than the aggregate stock market, which is hard to reconcile with traditional macro-finance models. However, Schulz (2016) argues that tax considerations substantially influence dividend returns, providing adjustments that bring empirical findings closer to theoretical expectations.

Weber (2018) and Gonçalves (2021) expand on the implications of cash flow duration, documenting a robust "short-duration premium" where short-duration stocks outperform long-duration stocks. This premium is attributed primarily to reinvestment risk and investor sentiment, with Gonçalves notably demonstrating its dominance over traditional anomalies like value and profitability premiums. These results reinforce the critical role of duration in explaining cross-sectional equity returns.

Gormsen and Lazarus (2023) provide additional empirical support by utilizing single-stock dividend futures to show that expected returns generally decline with increasing cash flow duration, which strengthens the theoretical link between duration and asset pricing.

Gormsen and Lazarus (2025) argue that equity returns do not proportionally respond to interest

rate changes because they should only react to variations in the pure discounting component of rates. They propose a decomposition of interest rate movements into three distinct components: a pure discounting shock, changes in expected economic growth, and shifts in uncertainty. After isolating the pure discounting shock from the other two factors, they find a strong, direct relationship between equity valuations and pure discounting rate changes. Additionally, they demonstrate a significant sensitivity of long-duration assets specifically to these pure discounting shocks. Their findings clarify why equity valuation adjustments to overall interest rate changes often appear muted, as the underlying components other than pure discounting (i.e., growth expectations and uncertainty) have ambiguous or offsetting impacts on equity prices.

Andrews and Gonçalves (2020) develop a no-arbitrage term structure model that jointly prices nominal bonds, real bonds, and dividend strips over the period 1972 to 2022. Using this comprehensive model, they decompose the equity risk premia into three distinct components: term risk premia, inflation risk premia, and pure cash flow risk premia, defined as dividend strip returns exceeding those of maturity-matched nominal bond strips. Their analysis reveals that while term and inflation risk premia consistently rise with maturity, cash flow risk premia exhibit a hump-shaped pattern, peaking at intermediate maturities and declining for longer maturities. Moreover, the study finds that short-maturity equity risk premia are primarily driven by cash flow risk premia, whereas variations in long-maturity equity premia are predominantly influenced by bond-based term and inflation risk premia.

Bansal, Miller, Song, and Yaron (2021) introduce regime-switching dynamics into equity term structures, finding downward-sloping equity returns during recessions and upward-sloping returns in expansions. Their approach reconciles conflicting evidence from dividend strip markets and macro-finance models by showing that unconditional equity risk premia are positively sloped once regime shifts are accounted for.

Giglio, Kelly, and Kozak (2024) enhance methodology by using equity returns data within an affine model framework to estimate equity term structures without relying on dividend strip data. Their approach accurately matches dividend strip prices and extends empirical evidence back to the 1970s, significantly enriching the analysis of equity term structures across economic cycles.

In the housing markets, Giglio et al. (2015) and Giglio et al. (2021) investigate very long-run discount rates and the term structure of housing returns using extremely long-term leasehold versus freehold property right contracts in the U.K. and Singapore. They document low discount rates applied by households for extremely long-run cash flows and a negative term structure of housing returns. These findings suggest households discount very long-run benefits at rates significantly lower than typically assumed, highlighting important policy implications for long-term investments.

Finally, Boguth et al. (2023) address measurement errors and leverage-induced biases present in earlier studies, demonstrating a generally flat equity term structure after accounting for these issues, which contrasts earlier findings of a downward-sloping structure.

H.5. Estimating Property-level Rental Yields and Total Housing Returns

Both Kermani and Wong (2024) and Diamond and Diamond (2024) measure the total housing returns of minorities. Diamond and Diamond (2024) develop a new method of estimating rental yield by using the joint distribution of rental value and resale price of the same home from American Housing Survey data. They use a house's resale price as the proxy for unobserved house characteristics to more accurately impute rental value. With the method, they measure the total return homeowners get from a housing investment and find that Black and Hispanic homeowners earn higher rental yields and, hence, higher total returns than White homeowners.

One existing method of measuring rent yields is directly observing the property price and rental income of the same individual housing units. Eichholtz, Korevaar, Lindenthal, and Tallec (2021) use the historical observations of prices and rents of the same individual houses in Paris and Amsterdam to construct the property-level rental yields. Chambers, Spaenjers, and Steiner (2021) collect the transaction prices, rental income, and costs for the same sample of individual properties in four large Oxford colleges in the early twentieth century. They construct the rental income growth and yield indices by property types.

Halket et al. (2023) use CoreLogic MLS data and identify a set of properties for which there is both a rental and sale transaction within one year of each other. They run year-by-year hedonic regressions of prices and rents onto various property characteristics and zip-code- and CBSA-relevant fixed effects. By holding the property characteristics constant, they obtained the predicted property values and rents across zip codes.

Gilbukh, Haughwout, Landau, and Tracy (2023) apply a hedonic model to the American Housing Survey (AHS) and estimate property rents based on their characteristics. Colonnello, Marfè, and Xiong (2021) use German rental and sale listing data to construct 1.5 million property-level rent-to-price ratios. They find a significant yield heterogeneity unexplained by property characteristics or zip-code-time level fixed effects. Because the rental and sale prices are originally listed for different properties, they match the two prices based on property characteristics.

Fama and French (2025) argue that the shared variation in house prices and price-rent ratios unrelated to expected rents is correlated across areas, which could be due to variation in discount rates for expected rents or irrational rent forecasts that do not forecast rent growth. This variation clouds the predictability of price-rent ratios for rent growth. The cross-section demeaning or adding the time fixed effects could mitigate the problem and restore the prediction.

Damen, Korevaar, and Van Nieuwerburgh (2025) find that the low-rent level areas provide high investment returns to institutional investors of residential properties. They derive the net rental income from mortgage loans on multifamily rental properties by using the loan-to-value (LTV) ratio and the debt service coverage (DSCR) ratio at loan origination. The net operating income (NOI), calculated as DSCR times debt service, will be the rent revenues minus operating expenses.

There may be concerns that errors in rental yield measurements can occur if rental data is primarily sourced from lower-quality segments of the housing market, while price data mainly comes from higher-quality segments. Begley, Loewenstein, and Willen (????) use microdata to estimate property-level rental yield and reveal that price variations in both owner-occupied and renter-occupied housing

markets are closely correlated.

H.6. "Reaching-for-income" Investment Behavior

The "reaching-for-income" investment behavior is defined as the behavior where investors show increased demand for income-generating assets in response to low interest rates. It has gained popular attention in recent financial economics literature. This review summarizes recent findings in this area and emphasizes its implications for asset pricing and allocation within housing and broader financial markets.

Daniel et al. (2021) provide foundational evidence of "reaching-for-income" behavior, documenting that investors following a "living off income" rule-of-thumb substantially increase allocations to high-dividend stocks and high-yield bonds when interest rates decrease. This behavior significantly impacts asset prices by increasing demand from income-seeking investors. This creates a critical transmission channel of monetary policy, influencing firms' capital allocation decisions and aggregate consumption dynamics.

Gargano and Giacoletti (2022) find the "reaching-for-income" beahvior in housing markets. Using Australian tax filing data, the paper reveals that interest rate decreases make older individuals substitute interest income with rental income. This substitution effect markedly elevates individual participation in the rental market, increasing household exposure to local shocks and driving local house prices higher, consequently compressing rental yields.

Using evidence from 18th-century Amsterdam, Korevaar (2023) historically contextualizes "reaching-for-yield" behaviors in the housing market. The paper demonstrates that the"reach-for-yield" behavior of wealthy investors resulted in a large boom and bust in house prices and major changes in rental yields. investors living off capital income shifted their portfolios towards real estate and other higher-yielding assets when bond yields were low and decreasing, exacerbating price volatility and intensifying wealth inequality in housing markets.

Jiang and Sun (2020) highlight similar dynamics within equity income funds, where investors' increased preference for dividends in low-interest-rate environments results in systematic overweighting of high-dividend stocks by fund managers. Such "reaching for dividends" behavior notably inflates the prices of high-dividend stocks when rates drop, leading to lower subsequent excess returns as rates normalize.

Gomes et al. (2022) provide further evidence from household-level brokerage data, confirming retail investors' reaching-for-yield behaviors across asset classes. Notably, younger and less wealthy investors, who possess relatively larger human capital to financial wealth ratios, display stronger tendencies to reallocate towards riskier assets when interest rates decline. Prospect theory further explains that investors trading at a loss show heightened risk-taking behaviors in response to reduced rates.

Becker and Ivashina (2015) analyze corporate bond markets and show that insurance firms have a propensity to buy riskier bonds with higher yields conditional on their regulatory capital constraints. The paper suggests that "reaching-for-yield" behaviors can significantly distort market pricing mechanisms and enhance systemic risk, particularly during economic expansions.

Hanson and Stein (2015) document that monetary policy significantly influences long-term real rates through term-premium adjustments, largely driven by "yield-oriented" investors seeking to maintain portfolio yields. Such investor behavior generates substantial fluctuations in asset prices and yield structures, demonstrating how the "reaching-for-yield" can profoundly influence macroeconomic dynamics beyond traditional channels.

Choi and Kronlund (2018) further illustrate reaching-for-yield within corporate bond mutual funds, observing that funds strategically tilt portfolios towards higher-yielding, riskier bonds to boost returns and attract inflows, particularly during periods of low interest rates. However, this behavior ultimately leads to negative risk-adjusted returns, exacerbating liquidity risks and redemption pressures.

Using randomized investment experiments, Lian et al. (2019) find that individuals exhibit "reaching-for-yield" when interest rates are low. They suggest that reference dependence and salience significantly drive individuals' increased allocations to risky assets when facing low interest rates. The paper proposes psychological mechanisms beyond purely financial rationalizations.

Campbell and Sigalov (2022) propose a theoretical model linking "reaching-for-yield" behavior to sustainable spending constraints. Their model shows that investors increase risk-taking to maintain stable spending levels in low-rate environments, highlighting an important theoretical underpinning of the reaching-for-yield phenomenon observed empirically.

I Merge Altos Lab Rental Listing and ATTOM Housing Data

I.1. Clean Addresses in Altos Lab Rental Listing Data

Altos Lab rental data provides historical rental listing information from 2011 until today. The data provider claims that the data has a 98% national coverage on the active rental market for single-family residences and multi-unit apartment buildings. It tracks data points such as rental rate, property type, square footage, beds and baths, and amenities. The rental data sources (independent from MLS) do not include sources such as Craigslist but are private proprietary sources the data provider contracts with and covers most major metro areas and states, essentially every zip code in the US where there are houses/units. The company refreshes data weekly to provide a most updated picture of the rental market.

The rental property addresses in the data include the unit name, street address, city, state, and zip code. While the city, state, and zip code fields are relatively standard and clean, the unit name and street address fields are messy and cannot be directly used to merge with the ATTOM property addresses. Specifically, in ATTOM data, the property address is broken down into the following granular fields: `unit prefix`, `unit value`, `house number`, `street direction`, `street name`, `street suffix`, `city`, `state`, and `zip code`. In the Altos rental listing data, the unit prefix and number are included in the `"unit name"` field, while the house number, street direction, street name, and street suffix are mixed together in the `"street address"` field.

To effectively merge the rental property addresses with the ATTOM property addresses, we need to parse and standardize the rental property addresses to match the structured format provided by the ATTOM data. We aim to ensure that the rental property addresses have the same address components as those in the ATTOM data. To achieve that, we perform the following steps.

1. We use ArcGIS Pro to parse and standardize the rental addresses from the Altos data.[20]. After this step, we obtain most parsed address components, including unit prefix and number, street direction, name, and suffix, for each rental property address, aligning them with the ATTOM address fields.
2. We further standardize the parsed address direction component by ensuring consistency in the standard format of direction abbreviations in the following forms: N, S, E, W, NE, NW, SE, and SW. As ATTOM street directions are standardized in those formats, this step will ensure that there are no discrepancies in the street direction components of the addresses.
3. There are situations in which unit information may fail to be extracted from ArcGIS Pro. To enhance the accuracy of matching rental property addresses, we implement an additional text processing step that employs regular expressions to identify and extract potential unit identifiers from the address information. First, we start with using the property unit information that is contained in rental property addresses and extracted by ArcGIS Pro. For example, a rental property with the address "701 HOLLYWOOD BLVD UNIT 701" will be parsed by ArcGIS Pro, which will give "701" as the unit number. Second, if the unit information fails to be extracted, we

[20] We followed the procedure outlined on the ArcGIS Pro website (https://pro.arcgis.com/en/pro-app/latest/tool-reference/geocoding/split-address-into-components.htm)

extract unit numbers that directly follow the terms "UNIT," "APT," "SUITE," "PLAN," "STUDIO," and "#" from the "`unit name`" and "`street address`" fields. Second, if the unit number is still missing and the value contained in "`unit name`" field has only one word that contains at least one numerical character (e.g., C1 and B5), we will use the value in the "`unit name`" field as the unit number. Finally, if the unit number remains missing and the "`unit name`" field contains just one letter, we will adopt that single letter as the unit number.

4. We standardize street names that use numbers written as words (e.g., First Street and Second Avenue). ATTOM converts these written forms into their numerical equivalents (e.g., 1st and 2nd). We then apply a consistent formatting rule to ensure that all street names have a uniform structure across two datasets.

I.2. Merge Altos Lab Rental Properties and ATTOM Properties

We merge the rental property addresses with the ATTOM property addresses by using parsed and standardized addresses. The merging process is conducted on a *zip code-by-zip code* basis, meaning we merge properties *within the same zip code*. We require exact matches for each merging criterion rather than allowing for fuzzy matching. Given the same zip code, we match the rental property addresses to the Attom addresses in the following order.

1. Based on the parcel number (referred to as `APNFormatted` in ATTOM and `parcel_number` in Altos), we merge properties from the two datasets. We believe that using the parcel number for matching provides the most accurate way to combine the two datasets, as each parcel number serves as a unique identifier for individual properties. Any rental addresses that do not match with ATTOM addresses will proceed to the next step in our merging process.
2. We merge two addresses based on the unit number, house number (i.e., street number), street direction, and street name. For apartments (i.e., Condo/Townhome), we consider two properties to be the same if they have the same unit number, street number, direction, and name. Specifically, we require a non-missing unit number match. If the unit number is missing in Altos or ATTOM, we are not confident in identifying which property unit is listed for rent and will lose those Condo/Townhome properties with incomplete unit information in our sample. Our restrictive matching criterion may create a downward estimation bias as some rented apartments will fail to be identified in the transaction record and falsely identified as owner-occupied. For other property types (e.g., SFR), we lose the requirement by allowing the unit number to be missing because, usually, the matching at the house number level would be enough to identify those types of properties uniquely. Any rental addresses that remain unmatched will proceed to the next step of the merging process.
3. We merge two addresses based on the unit number, house number (i.e., street number), and street name. In this phase, we remove the requirement for street direction. We observed that some addresses failed to match due to variations in how the street direction was included. For example, "Unit 2, 1234 N Main Street" may fail to match "Unit 2, 1234 Main Street" because the street direction is omitted in either ATTOM or Altos data, even though both refer to the same

location within the same zip code. To address the failed matches caused by these inconsistencies, we assume that two properties are considered the same if the unit number, street number, and street name all match within the same zip code. Any rental addresses that remain unmatched will proceed to the next step of the merging process.

4. We merge two addresses based on the house number (street number), street direction, and street name. Single-family residential (SFR) properties typically do not include a unit number in their addresses; therefore, this step focuses primarily on merging SFR houses. We believe that an address without a unit number can be accurate enough to identify an SFR property but may not be sufficient for identifying other types, such as condos. Any rental addresses that remain unmatched will proceed to the next step of the merging process.
5. We merge two addresses based on the house number (i.e., street number) and street name without requiring the street direction. Similarly, single-family residences (SFR) addresses do not include unit numbers. Some matching failures occurred due to the absence of street directions, even though the addresses referred to the same property. This merging step applies only to SFR matching and not to other property types. The entire matching process concludes at this stage.

When the property type is a condo or townhouse, it is essential that the unit number matches in both datasets. In other words, steps 4 and 5 do not apply to condos or townhouses. If two apartments share the same street number and name within the same zip code, we cannot confidently match the two properties. This is because different apartments with distinct characteristics and transaction prices may exist in the same building at that address.

If an apartment is listed for rent without a specific unit number, we cannot accurately determine which apartment within the building it corresponds to, nor can we identify its characteristics and transaction details. To ensure a more unbiased estimation of rental yields in the next step, we implement a very strict matching process of requiring unit number matching for condos or townhouses. This helps ensure that the rental listing information is accurately matched to housing transactions and property characteristics.

We believe that, at this point, we have identified the most comprehensive set of matching property addresses between the rental and ATTOM datasets. The rental properties that did not match an address in the ATTOM data may not match due to typos in the addresses or because those rental properties have never been publicly transacted.