Missing Home-Buyers and Rent Inflation: The Role of Interest Rates and Mortgage Underwriting Standards

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Abstract

Using property-level data from the American Housing Survey (AHS), I document a novel channel through which rising mortgage rates fuel rent inflation. A regression-discontinuity design around the Federal Housing Finance (FHA) mortgage payment-to-income (MTI) threshold, combined with counterfactual MTI simulations show that the surge in mortgage rates between 2022 and 2023 pushed a substantial mass of prospective first-time buyers above common mortgage underwriting limits, reducing renter-to-owner transitions. Exploiting city-level variation in the shares of constrained first-time buyers combined with unit-level data on (hedonic) rent price changes, I show that this shift resulted in a reallocation of shelter demand into the rental sector, materially contributing to 2023 rent inflation. These effects were more pronounced in smaller units and among lower-income renters—highlighting an important distributional dimension of monetary tightening.

JEL Classification: G21; G51; R21

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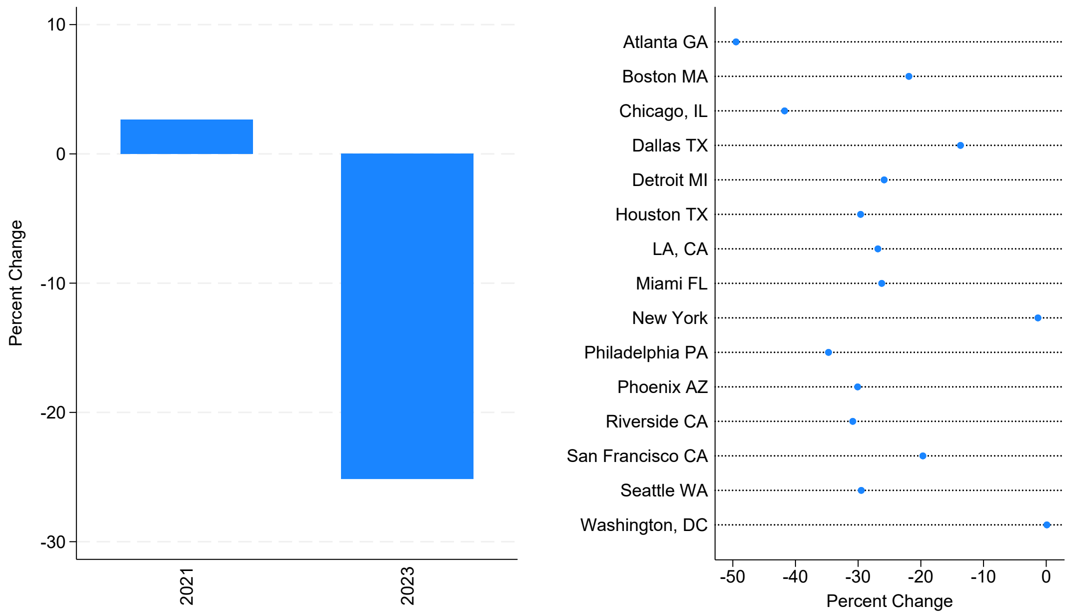
1. Introduction

The post-pandemic tightening cycle has rekindled concerns that monetary policy could exacerbate inequality in home-buying (Bosshardt et al., 2024; Ringo, 2024). Caught between historically high mortgage rates and soaring property prices (Figure A1), US renters transitioned into home-ownership at a rate that was 25 percent lower on average in 2023, compared to 2021 (Figure 1). Meanwhile, rental prices surged—especially in cities experiencing a sharper decline in the volumes of first-time buyers (Figure A2), further intensifying affordability pressures. Yet, research on how monetary policy affects the rental market remains limited, leaving its distributional consequences largely unexplored.

Using property-level data from the American Housing Survey (AHS), this paper documents and quantifies a previously under-emphasized channel through which monetary tightening raises shelter costs: the interaction between rising mortgage rates and pre-existing mortgage underwriting limits. Leveraging the AHS's longitudinal component and property-level data, I combine a regression-discontinuity at the Federal Housing Finance (FHA) front-end ratio underwriting threshold with a counterfactual analysis based on the methodology proposed in Bosshardt et al. (2024) and show that the 2021–2023 increase in mortgage rates pushed a sizable group of potential first-time buyers above FHA underwriting limits—reducing transitions into home-ownership.[1] Combining city-level variation in the shares of potential first-time buyers excluded from the owner-occupied market with property-level data on (hedonic) rent price changes from the AHS, I show that borrowing constraints reallocated shelter demand to the rental sector, while rental supply remained broadly stable in the short run. This mechanism generated substantial rent price inflation in 2023, particularly among lower-income renters, underscoring the potential for second-round distributional effects of monetary policy.

[1]In any given year, FHA loans constitute a substantial portion of the US mortgage market, particularly among first-time buyers. Bhutta and Ringo (2021) estimate that in 2014 the FHA insured nearly one-fifth of all home purchase loans issued in the US.

Figure 1: *Change in the share of first-time buyers in 2023*



Sources: American Housing Survey, 2021-2023. The left-hand side of the chart displays the average percentage change in the share of renters who became home-buyers in 2021 (relative to 2019) and 2023 (relative to 2021). The right-hand side displays the percent decline in the share of first-time buyers by CBSA between 2021 and 2023. Observations are weighted by frequency weights.

Methodologically, the analysis proceeds in three steps. First, I use information on both renter and owner-occupied properties in the 2019-2023 waves of the American Housing Survey (AHS), a representative sample of US housing units. Exploiting the panel component of the survey, I identify first-time home-buyers (FTHB), or households transitioning from renting to owning between survey waves. The dataset also contains detailed information on property characteristics (e.g., location, size, age), as well as household demographics, tenure status, income, house value, mortgage financing, and family composition. Based on this information, I construct household-specific mortgage payment-to-income (MTI) ratios at the time of purchase, generating time-varying MTI distributions across waves. I also impute MTI ratios for renters, simulating their affordability constraints should they attempt to purchase the units they currently occupy.[2]

Combining observed MTI ratios for first-time buyers and imputed (potential) MTIs for renters, I show that there is a significant discontinuity in the probability of switching from renting to owning around an MTI ratio of 31-a key FHA underwriting threshold known as *front-end* ratio.[3] Using a regression discontinuity design, I find that households

[2]Details on the imputation of MTIs for renters are provided in Appendix B.

[3]Conventional mortgages apply similar underwriting limits. Freddie Mac mortgages for example cap

just above the 31 percent threshold are about 5 percent less likely to switch from renting to owning compared to otherwise similar households just below the limit.

In the second step, I examine how rising mortgage rates made the MTI threshold binding for a large share of renters, thereby explaining much of the decline in first-time buyers between 2021 and 2023. I follow Defusco et al. (2020) and Bosshardt et al. (2024) and employ a non-parametric approach to examine how the change in mortgage rates between 2021 and 2023 altered the distribution of MTI ratios for first-time home-buyers. I construct a counterfactual distribution of MTIs for 2021 first-time buyers, simulating their affordability under 2023 mortgage rates while holding loan demand and housing choices constant.

The observed 2023 distribution diverges from this counterfactual mostly above the 31 percent MTI threshold, consistent with the interpretation that higher mortgage rates interacted with underwriting limits to restrict access to credit. This corroborates the evidence in Bosshardt et al. (2024), who find a similar result using overall DTI limits and studying the general population of home-buyers. Using 2019 as a baseline year yields qualitatively similar results, as does adjusting mortgage volumes for the intensive margin of mortgage demand driven by changes in rates, incomes and house prices, based on the methodology proposed by Bosshardt et al., 2024. Placebo tests using the 1978–1980 tightening cycle, when the increase in mortgage rates was similar but underwriting payment-to-income limits were less binding, also support this interpretation.

Third, I link the relative prevalence of constrained first-time buyers across metropolitan (CBSA) areas to local rental market outcomes. To do so, I exploit the longitudinal component of the AHS, which allows me to develop a property-level measure of (hedonic) rent price changes between the two waves. Linking this information to city-level variation in the shares of constrained first-time buyers, I find that areas where a larger proportion of potential first-time buyers were constrained by rising mortatge rates experienced tighter rental markets in 2023–characterized by lower vacancy rates and significantly higher rent price growth. This result is robust across specifications and holds to controlling for unit and occupant characteristics, as well as city-level macroeconomic developments including population growth and housing supply response. The shares of constrained home-buyers are not related to rent price developments prior to 2023, supporting the validity of the parallel trend assumption. These findings are robust to the use of an alternative measure of borrowing constraints based on overall DTI (back-end)

the front-end ratio at 28 percent. Hence the FHA limit reflects the maximum allowable front-end ratio to be eligible for any mortgage sponsored by the government or by one of the agencies.

limits, computed using loan level-data from HMDA and Freddie Mac's Single-Family Loan-Level Dataset (SFLLD). Finally, these results also hold to controlling for lock-in effects determined by rising mortgage rates (Fonseca et al., 2024), which by reducing the availability of starter homes for sale can determine an increase in rental prices in the short run (De La Roca et al., 2024).

An analysis of heterogeneity by segment indicates that rent prices increased most for smaller rental units occupied by households in the lower deciles of the city-level income distribution, largely because of lower pre-existing slack in the rental segment occupied by relatively poorer tenants. This evidence suggests that a surge in mortgage rates may have additional distributional consequences via the rental market, beyond its role in determining home-ownership rates and tenure decisions.

A simple back of the envelope calculation based on these estimates suggests that borrowing constraints affecting first-time buyers could be responsible for a weighted-average rent increase at the national level of about 3.9 percent between 2021 and 2023, or about one-third of the average rent increase recorded in the AHS during this period.[4] Considering that shelter costs (combining rents and owner-equivalent imputed rents) account for more than one-third of the US CPI basket in any given year, these effects may have significantly contributed to persistent headline inflation during the post-pandemic monetary tightening cycle (Bolhuis et al., 2022).

Related literature

This paper draws from earlier work on how debt servicing to-income limits determine housing tenure decisions. Home-ownership rates among younger and more constrained buyers decline as rising rates make payment-to-income constraints more binding (Acolin et al., 2016; Bosshardt et al., 2024; Mabille, 2023; Ringo, 2024), while the loosening of these constraints has the opposite effects, increasing transitions into home-ownership (Bhutta and Ringo, 2021).[5]

I contribute to this evidence by (i) focusing explicitly on tracing the transitions from renting into first-time home-ownership and (ii) studying how fluctuations in tenure decisions affects rental markets, an area where evidence is still scarce. Gete and Reher (2018)

[4]The AHS records price growth in both existing and new leases, hence it tends to estimate lower average rent price growth relative to indices focusing on new leases only (Adams et al., 2024).

[5]A related literature studies the effects of the introduction of DTI or LTV limits on credit allocation, house prices and real economic activity (Greenwald, 2018, Defusco et al., 2020, Acharya et al., 2022).

find that tighter lending standards lowered home-ownership rates after the Great Recession and increased demand for rental housing, leading to higher aggregate rental prices. Similarly, Dias and Duarte (2019) show that, in contrast with house prices, the aggregate US rent price index increases in response to contractionary monetary policy shocks while home-ownership rates and rental vacancies decline. Dias and Duarte (2022) and Castellanos et al. (2024) tease out the theoretical mechanisms by which monetary policy can reduce home-ownership rates and drive up average rent prices, generating a temporary increase in headline inflation. The empirical evidence on these channels is mixed, with Dias and Duarte (2019), Castellanos et al. (2024) and Abramson et al. (2025) finding that aggregate and regional rental price indices increase after a tightening shock, while Cloyne et al. (2019), Albuquerque et al. (2025) and Groiss and Syrichas (2025) find the opposite effects. De La Roca et al. (2024) stress how mortgage lock-in effects can determine a reduction in starter homes for sale which can increase rental prices by pricing many potential buyers out of the market, a mechanism which is plausibly complementary to the one described here.

While most of this literature focuses on the increase in mortgage rates, my results emphasize how the interaction between pre-existing mortgage underwriting standards and mortgage rates is key to understanding the effects of monetary policy on rental markets. Moreover, by using property-level data, as opposed to aggregate or regional rent indices, I am able to examine the cross-sectional distribution of rent price changes, holding unit and occupant characteristics constant. Lower-income tenants occupying smaller units are much more likely to be pushed out of home-ownership and at the same time to experience the steepest rent price increases, when monetary tightening interacts with pre-existing mortgage underwriting standards. This is consistent with the results in De La Roca et al. (2024), who show that rental prices of smaller units in lower-income neighborhoods in Los Angeles tend increase more the larger the decline in starter homes for sale due to mortgage lock-in effects (Fonseca and Liu, 2024; Fonseca et al., 2024). These effects are likely to exacerbate the distributional consequences of monetary policy, especially since shelter makes up a larger share of the consumption basket among poorer consumers (Molloy, 2024, Jaravel, 2024).

By highlighting how rising interest rates can affect shelter costs differentially across the renters' population, this paper uncovers a novel mechanisms by which monetary policy can affect consumption inequality, contributing to a growing literature on this topic (Coibion et al., 2017, Ampudia et al., 2018, Andersen et al., 2023, Bartscher et al., 2022). While this literature stresses the role of housing returns in determining the distributional effects of monetary policy, it largely abstracts from its effects on shelter costs, particularly those paid by renters.

More broadly, this paper also relates to the ongoing debate on the drivers of sticky inflation in the post-pandemic phase, particularly to the literature highlighting the key role of rising housing rents as drivers of the overall persistence in inflation despite sharp and persistent monetary tightening (Bolhuis et al., 2022).

The paper proceeds as follows. Section 2 describes the data and defines tenure transitions and other relevant variables. Section 3 presents the results on monetary policy, MTI constraints and tenure decisions. Section 4 examines the effects on rental markets and Section 5 briefly concludes.

2. Data

The American Housing Survey (AHS) is one of the most comprehensive sources of U.S. housing data (Adams et al., 2024). Conducted by the U.S. Census Bureau since 1973, it was originally annual and is now fielded biennially in odd-numbered years.

The AHS uses a stratified sampling design. Its target population comprises all residential housing units in the United States—both occupied and vacant, excluding commercial structures. The sample is divided into two parts: a core national sample that is revisited over successive survey rounds (thus providing a longitudinal component) and independent metropolitan area samples that allow for localized analysis in major urban centers. Periodically, the sampling frame is refreshed by adding newly constructed housing units, ensuring that the survey remains representative of the evolving housing stock.

This paper uses the longitudinal component of the survey, thus focusing on the core national sample. To ensure consistency between the waves, I also exclude units with missing information on geographic location (i.e. CBSA codes), hence focusing on the urban sample only. I use five waves of the survey: those conducted around the most recent monetary tightening cycle (2019 through 2023) and the two conducted in 1978 and 1980 respectively.

The urban sample contains 23,000–28,000 observations per wave, with about 62–64 percent owner-occupied, and covers 15 CBSAs.[6] The survey provides detailed data on

[6] Atlanta, GA; Boston, MA; Chicago, IL; Dallas, TX; Detroit, MI; Houston, TX; Los Angeles, CA; Miami, FL; New York, NY; Philadelphia, PA; Phoenix, AZ; Riverside, CA; San Francisco, CA; Seattle, WA;

unit characteristics (age, size, type, structural condition), housing costs (rent, mortgage, utilities, maintenance), financing details (loan size, interest rate), demographics of occupants (income, household composition, education, age, tenure status), and neighborhood attributes (safety, amenities, perceived quality).

The longitudinal component of the survey is designed to track housing units rather than occupants, but asks recent movers information on their previous tenure status. This allows me to identify first-time buyers, defined as home-owners who report having moved into the housing unit in the survey year or previous year and having switched from renting to buying in the process.

Using reported purchase prices, mortgage size, interest payments, and household income, I compute mortgage payment-to-income (MTI) ratios for first-time buyers, defined as annual mortgage payments divided by annual income.[7] Because of the panel design, the AHS can also be used to calculate unit-specific (hedonic) rent changes between waves. Following Molloy (2024), I exclude units in the bottom/top 5 percent of the rent change distribution in any given wave.

Descriptive statistics for 2019–2023 are shown in Table A1. The share of first-time buyers was stable between 2019 and 2021 but fell by about one percentage point in 2023 (a 25% decline relative to 2021). Other sample characteristics remained broadly stable, aside from a modest rise in average MTI for first-time buyers and a sharp increase in rent inflation in 2023.

Using survey information, I estimate the cost renters would face if they were to purchase the same property they live in. I do so in three steps. First, I estimate the property's value using reported prices of comparable units in the same city and year, via a hedonic pricing model.[8] Second, I predict mortgage amounts needed to finance the property acquisition, using mortgage sizes of first-time buyers with similar demographics and property values in the same city-year. Third, I predict the interest rates for renters, based on the mortgage rates paid by first-time home-buyer purchasing similar properties with similar mortgage amounts in the same city and year.[9] Further details on the

Washington, DC.

7The survey only includes information on mortgage payments, not other debt payments. Hence, I can calculate the household-specific mortgage-to-income ratio (or front-end ratio) but not its overall debt-to income ratio, or back-end ratio.

8The survey contains a wide set of unit-specific characteristics, which allows me to impute the renter-equivalent sale price of the property using an hedonic pricing model. This is conceptually very similar to the way owner-equivalent rents are imputed by the Bureau of Labor Statistics for owner-occupied properties, and used in the development of shelter inflation series.

9The AHS does not contain information on the mortgage maturity structure, but I assume that loan amortization will follow the schedule of a 30 year FRM. While FRM originations have declined slightly imputation procedure are provided in Appendix B.[10]

Using these assumptions, I impute potential annual mortgage payments for renters, which rescaled by their annual income yields imputed MTIs if they were to purchase a similar property to the one they currently live in.[11] This measure is used to estimate the discontinuity in the propensity from rent to own around key mortgage underwriting thresholds.

3. Interest rates and first-time home buyers

This section examines how changes in mortgage rates interact with mortgage underwriting standards to determine the share of renters who transition into home-ownership. First, I show that the mortgage payment-to-income ratio, or front-end ratio, is a key determinant of the likelihood of becoming a first-time buyer, as it governs mortgage eligibility under FHA rules. Second, I apply a non-parametric approach to assess how rising interest rates interacted with mortgage underwriting limits to exclude a significant share of potential buyers from the owner-occupied housing market between 2021 and 2023.

3.1. First-time buyers and mortgage underwriting standards: regression discontinuity

Loans insured by the Federal Housing Administration (FHA) must satisfy specific underwriting standards designed to ensure borrower solvency. These include limits on the overall debt-to-income (DTI) ratio —typically capped at 43–50 percent of monthly income (Bhutta and Ringo, 2021)- but also limits on mortgage payment-to-income ratios (or front-end ratio), defined as the share of housing expenses (mortgage payments, taxes, insurance, and fees) in total income. For FHA loans, the front-end ratio generally should not exceed 31 percent of annual income.[12] Although this is a soft limit and many

during the recent tightening cycle (De Stefani and Mano, 2025), this remains by far the most common mortgage typology in the US.

[10]The results are fully robust to an alternative imputation procedure, which assumes all renters will finance the property acquisition using a 30 year fixed-rate mortgage at the prevailing mortgage rates at the time of the survey.

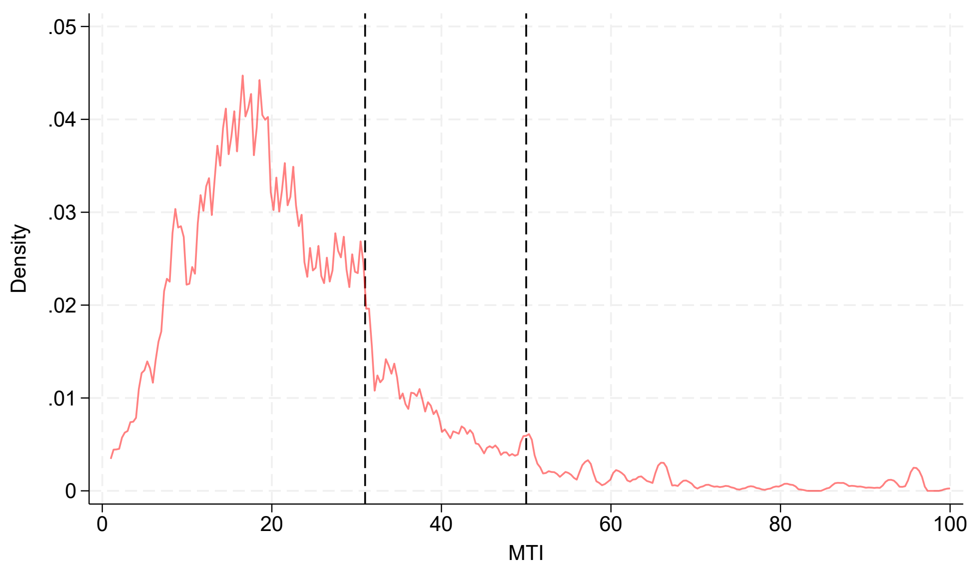
[11]The implicit assumption is that renters will always want trade up, buying a housing unit of equivalent or higher cost than the one they live in. This is likely a reasonable assumption, as the units occupied by first-time buyers are on average larger than those occupied by renters (Figure A3).

[12]See HUD's Mortgage Credit Analysis for Mortgage Insurance, Chapter 4, Section F.

borrowers obtain FHA loans above it, exceeding the threshold often triggers manual underwriting and requires additional guarantees, such as higher collateral, savings, or stronger credit history.

Consistently with these guidelines, the distribution of MTI ratios among first-time buyers in the AHS exhibits a clear discontinuity at this 31 percent threshold, with noticeable bunching just below (Figure 2).

Figure 2: *Distribution of MTI ratios for first-time home buyers*



Sources: American Housing Survey, 2019-2023. The chart displays the frequencies of observed MTI ratio for all first-time home buyers. MTIs are rounded up to the closest integer. Observations are weighted by frequency weights.

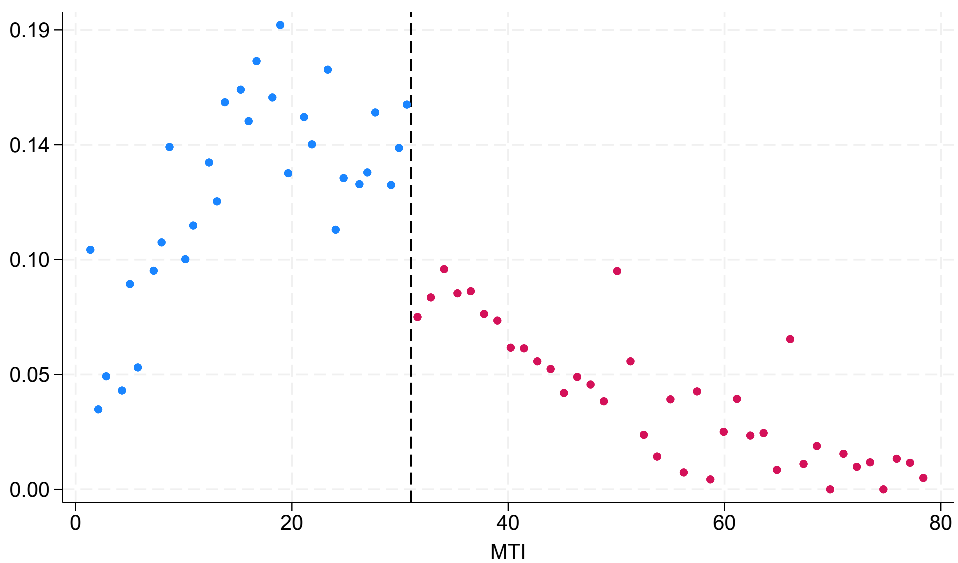
I exploit this discontinuity to estimate how binding payment-to-income constraints affect the likelihood of transitioning from renting to owning. To do so, I impute MTI ratios which renters would face if they were to purchase the same home they currently live in.[13] Combining these imputed MTIs for renters with observed MTIs for first-time buyers allows to measure how the probability of switching from renting to buying changes within a narrow bandwidth around the 31 percent MTI threshold, controlling for observable household characteristics.

Figure 3 plots the distribution of first-time buyer status relative to MTIs (observed or imputed). The unconditional probability of observing a buyer in this sample drops sharply just above the 31 percent MTI threshold, albeit other household characteristics plausibly related to home-ownership decisions, such as income, age and property

[13]See Section 2 and Appendix B.

value (observed or imputed) remain constant around this threshold (Appendix Figure A4). Placebo tests conducted at alternative thresholds confirm that the discontinuity is unique to the 31 percent cutoff (Figure A5). Finally, other indicators correlated with borrowing constraints, such as LTV ratios and interest rates, vary smoothly around the limit (Appendix figure A6).

Figure 3: *Share of first-time buyers vs renters by MTI ratio*



Sources: American Housing Survey, 2019-2023. The chart displays the relative percentage of first-time home-buyers as a proportion of the sample of first-time buyers and renters. For each MTI value, the vertical axis plots the average value of a dummy, taking value 1 if the unit is occupied by first-time buyers, 0 if occupied by renters. MTIs are observed for first-time buyers, imputed for renters; they are rounded up to the closest integer. Observations are weighted by frequency weights.

To measure the effects of MTI limits on the probability of becoming a first-time buyers, I estimate the following regression-discontinuity model:

$$Pr(FTHB_{imt} = 1) = \alpha + \beta_1 Threshold_{imt} + \beta_2 MTI_{imt} + \beta_3 MTI_{imt} * Threshold_{imt} + \gamma_n^N X_{imt} + \theta_{mt} + \varepsilon_{imt} \quad (1)$$

Where $FTHB$ is a dummy taking value 1 if a given unit i in CBSA m in year t is occupied by a first-time buyer, 0 if occupied by a renter; MTI is the unit/household-specific mortgage-to-income ratio (observed for first-time buyers, imputed for renters). X_{imt} is a vector of household and unit-specific controls (income decile, family composition, educational attainment of the household head, their age and square of age, unit size, bedrooms, bathrooms and property value). θ_{mt} are CBSA-by-year fixed-effects, meant to capture all aggregate variation affecting equally all family units living in the same municipality during the same year. The coefficient β_3 captures the shift in slope above and below the threshold and β_1 is the parameter of interest, capturing the change in the probability of being a first-time buyer just above versus just below the threshold.

Table 1 reports the results of this specification. Column (1) uses the full sample (MTIs up to 100 percent), while columns (2) and (3) progressively narrow the bandwidth of the estimation. Across all specifications, coefficients are negative, significant, and broadly stable. Column 3 reports the results of local linear regression, limited to MTIs between 25 and 37, the optimal bandwidth according to the selection process described in Calonico et al. (2014). According to this rather restrictive specification, the probability of being a first-time buyer is roughly 5 percentage points lower just above the threshold than just below, for similar households living in the same city and year. These results are robust to different specifications.[14] This corroborates the unconditional evidence presented in Figures 2 and 3 and indicates that front-end ratios appear to meaningfully determine transitions from renting into first-time home-ownership.

Table 1: *Probability of becoming a first-time buyer as a function of MTI limits*

	(1)	(2)	(3)
VARIABLES	FTHB	FTHB	FTHB
	0-100	0-50	25-37
Threshold	-0.052***	-0.045***	-0.052***
	(0.007)	(0.010)	(0.017)
MTI	0.006***	0.005***	0.011***
	(0.000)	(0.001)	(0.003)
Threshold*MTI	-0.005***	-0.006***	-0.000
	(0.000)	(0.001)	(0.005)
Observations	23,181	18,268	4,768
R-squared	0.107	0.102	0.136
CBSA by Year FE	Yes	Yes	Yes
HH and Unit controls	Yes	Yes	Yes

Notes: AHS 2019-2023. FTHB is a dummy taking value 1 if a household switches from renting to buying, 0 if it remains a renter. The sample includes first-time buyers and renters. MTIs are measured as mortgage service to income ratios: these are reported for home buyers and imputed for renters. Controls include age, race and educational attainment of household head, annual household income, family composition, and unit characteristics (size, n.bedrooms, n.bathrooms, unit type). CBSA by year FE included. Heteroskedasticity-robust SEs in parentheses.

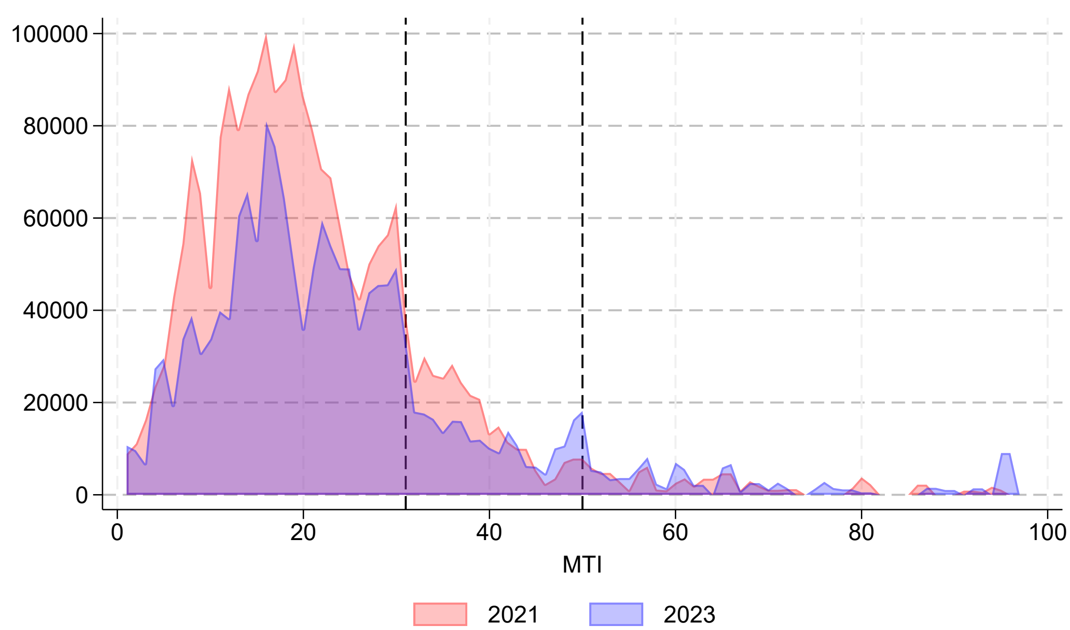
[14] Table A2 presents the results of a specification which introduces a quadratic polynomial, showing that the estimates using a linear model are conservative. Results are also robust to the use of robust bias-corrected confidence intervals, as in Calonico et al. (2014).

3.2. Measuring the effect of interest rates on purchasing behavior: counterfactual distributions

To assess how mortgage rates interacted with underwriting thresholds in driving the decline in first-time home-ownership, this section restricts the sample to first-time home-buyers observed between 2019 and 2023. Figure 4 shows a marked drop in the volumes of first-time buyers between 2021 and 2023, corresponding to roughly 300,000 fewer purchases nationwide, or about 25% from 2021 levels. The reduction is broadly uniform across the MTI distribution.

To determine the role of credit supply constraints in driving this decline, I follow the the methodology outlined in Bosshardt et al. (2024). Specifically, I use older AHS waves (2019-2021) to build counterfactual distributions for the 2023 wave and simulate what would have happened to volume of home-buyers in absence of credit supply constraints induced by the increase in interest rates between the different iterations of the survey.[15]

Figure 4: *Volume of first-time buyers by MTI and year*



Sources: American Housing Survey , 2021-2023. The chart displays the number of first-time home-buyers by MTI value and year. MTIs are rounded up to the closest integer. Observations are weighted by frequency weights.

To do so, I recalculate MTIs for borrowers observed in 2021 assuming they faced

[15] Defusco et al. (2020) and Bhutta and Ringo (2021) also use counterfactual distributions to estimate the extensive margin of mortgage demand, albeit focusing on different policies and time frames.

2023 mortgage rates. The average rate on newly originated 30-year fixed-rate mortgages rose by 4.2 percentage points between early 2021 and early 2023.[16] Applying this average increase to each borrower-specific mortgage rate yields a counterfactual 2021 distribution of MTIs that isolates the effect of interest rates while holding loan size, property value, and income constant.[17] On average, monthly mortgage payments rise by about 1,200 USD per household, and MTIs increase by 11 percentage points.[18]

Figure 5 presents the results of this counterfactual exercise, comparing the observed 2023 MTI distribution with the simulated 2021 counterfactual. The observed decline in buyer volumes occurs almost entirely above the 31 percent threshold—about a 29 percent drop relative to 2021—while volumes below the threshold rise modestly (4 percent). By construction, the integral of these difference across the entire MTI distribution corresponds to the overall decline in first-time buyers between the two waves (25 percent), as presented in Table A1.[19] Intuitively, this asymmetry suggest that payment-to-income limits, rather than demand shifts, explain most of the contraction in first-time buying between the waves, consistently with findings in Bosshardt et al. (2024) on overall DTI limits.

A series of robustness checks confirm these findings. Using 2019 as the base year produces similar results (Figure A8), with a 24 percent decline above the threshold and a 6 percent increase below, for an aggregate decline of 18 percent. This is consistent with a more modest increase in mortgage rates between the two waves, as the change in average 30 year FRM rates corresponds to 3.5 percentage points between 2019 and 2023, compared to 4.2 between 2021 and 2023.

Adjusting the counterfactual to account for the intensive margin of mortgage demand— thus taking into account that both housing and mortgage demand may decline as a result of rising rates, based on the demand-adjusted counterfactual methodology proposed by Bosshardt et al. (2024) - also yields nearly identical results. This alternative definition of counterfactual MTIs entails reducing loan amounts by 2 percent per

[16]The AHS does not provide mortgage origination dates, but all interviews are conducted in the first semester of any given year. Based on FRED data (Figure A1), the average rate on newly originated 30 year fixed-rate mortgages (FRMs) in the first semester of 2021 was 2.9 percent, while average rates had increased to 7.1 percent by the end of the first semester of 2023.

[17]Despite applying a homogeneous mortgage rate increase, individual mortgage interest rates retain significant cross-sectional heterogeneity in the counterfactual distribution, because of ex-ante differences in the rates paid by 2021 buyers. A small fraction of observations lack information on interest rates charged on the mortgage. For these buyers, the counterfactual distribution is built by applying the average percent increase in MTI ratios between observed and counterfactual across first-time buyers in a given wave.

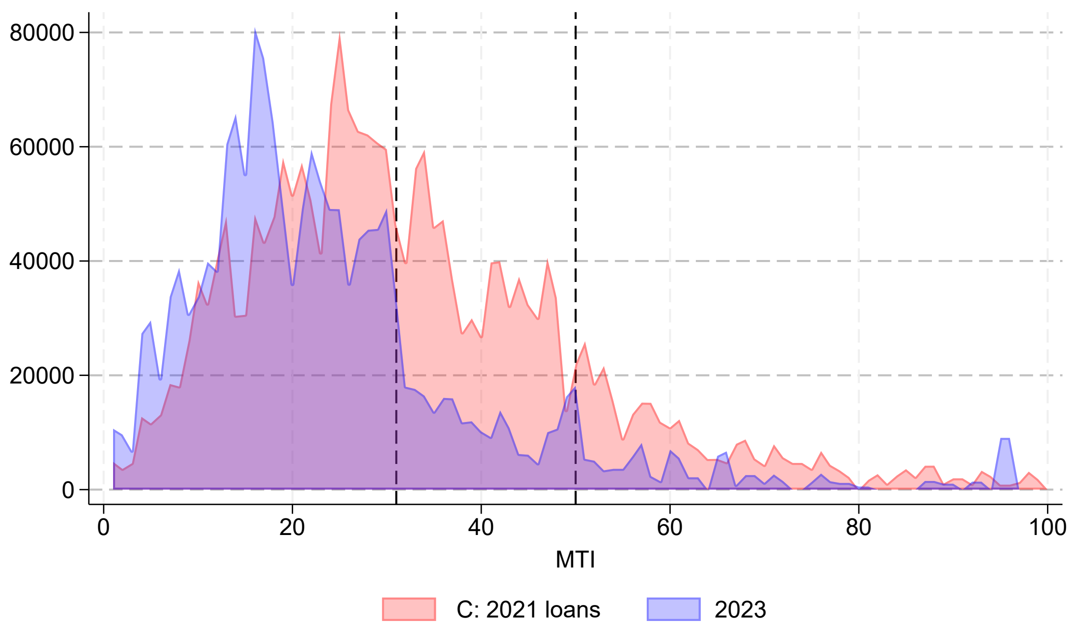
[18]This corresponds to about 50% of the average observed 2021 mortgage payment in this sample.

[19]This is because the counterfactual does not alter the overall volume of 2021 buyers, but just their placement in the distribution of MTIs.

percentage point rate increase, following the elasticities identified by DeFusco and Paciorek (2017) and adjusting mortgage amounts to changes in CBSA-average incomes and house prices recorded between the two waves.[20] Below the limit, 2023 volumes increase by 5 percent relative to the 2021 counterfactual, while they decline by 29 percent above (Figure A9).

These patterns–a similar distribution of observed and counterfactual below the 31 percent threshold, but a significant decline in buyers' volumes above– can be interpreted along the lines described in Bosshardt et al. (2024), or as result of credit supply constraints rather than a drop in buyers' demand. Rising rates made MTI thresholds a binding constraint for many potential first-time buyers, reducing their access to home-ownership.

Figure 5: *Volume of first-time buyers: 2023 and counterfactual distributions*



Sources: American Housing Survey , 2021-2023. The chart displays the number of first-time home-buyers by MTI value. The area shaded in blue represents observed 2023 volumes; the red area represents counterfactual distributions, based on 2021 data. MTIs are rounded up the closest integer. Frequency weights are assumed.

[20]This is adjustment is obtained by regressing individual (log)loan amounts on (log)income and log(house value), conditional on CBSA and year fixed-effects. The average elasticities are then multiplied by the average change in incomes and house prices in a given CBSA between 2021 and 2023. Finally, individual loan amounts in the 2021 counterfactual are rescaled by this coefficient and divided by household income.

3.3. Robustness: the 1970s as a placebo test

To verify that these results are not mechanical artifacts of the simulation but rather reflect the role of binding payment-to-income constraints, I replicate the exercise using the 1978 and 1980 AHS waves.

This is a useful laboratory to test how mortgage rates in isolation affect tenure decisions, in absence of binding payment-to-income limits. Similarly to recent years, the steep monetary tightening cycle of the late 1970s resulted in a dramatic increase in mortgage borrowing costs. However, unlike during the 2021-2023 episode, borrowers were not facing the same systematic payment-to-income constraints, both because manual underwriting was predominant at the time and because payment-to-income limits did not apply as strictly to mortgages sponsored by the FHA, or by the Agencies.[21]

Between 1978 and 1980, average mortgage rates increased by 4.7 percentage points (from 9.3 to 14 percent), a change similar to the one experienced between 2021 and 2023. The share of first-time buyers fell from 3.2 to 2.4 percent— also a decline comparable to the one observed during the most recent tightening cycle. However, the MTI distribution in 1980 shifts rightward rather than truncating near 31 percent, consistent with payment-to-income underwriting limits being not binding at the time (left-hand panel of Figure A10).

When applying the same counterfactual methodology—applying 1980 mortgage rates to 1978 first-time buyers—the simulated distribution closely mirrors the observed 1980 distribution (right-hand panel of Figure A10).[22]

As in Defusco et al. (2020), I interpret this as evidence validating the parallel trend assumption implied in this counterfactual analysis: in absence of the policy change (i.e. an interaction between rising mortgage rates and MTI limits) the counterfactual is able to closely resemble the observed distribution. Moreover, the relative decline in loan volumes between the two waves occurs mostly *below* the MTI threshold of 31, and relatively less above, as it would be expected given that underwriting MTI limits were not strictly

[21] The first FHA underwriting manual, published in 1936, did not set explicit payment to-income limits, leaving this parameter to the discretion of the underwriter. As of the early 1980s, some income limits had been introduced, and front-end ratios were generally capped around 33-36 percent of income for both FHA and conventional loans (Dennis, 1981). However, individual loan officers retained a large margin of discretion in the application of these standards, as manual underwriting remained predominant until credit (FICO) scores were introduced in the 1990s.

[22] As these early waves of the AHS do not contain interest rate information for individual borrowers, I build the counterfactual distribution by assuming that all first-time buyers payed the average mortgage rate on 30 year FRMs in 1978, and the same in 1980.

enforced at the time. The more uniform nature of the drop is potentially consistent with a simple reduction in loan demand due to rising interest rates–or it could indicate that credit supply constraints were binding on margins other than mortgage payment-to-income limits. Either way, the sharp contrast with the counterfactual distribution presented in Figure 5 indicates that the results presented in the latter are not a mechanic result of the simulation, but likely reflect the dominant role of payment-to-income constraints in driving the decline in home-purchasing activity in 2023.

4. Regional heterogeneity and effects on rent price inflation

In this section, I test whether missing mass of first-time buyers in 2023 placed additional demand pressure on rental markets, determining short-run rent inflation. The underlying hypothesis is that as higher mortgage rates excluded potential buyers from homeownership, these households remained renters for longer, raising rental demand. As the supply of rental units adjusts gradually to demand pressures, the resulting imbalance should push rents upwards—even for tenants who never intended to buy.

4.1. Constrained first-time buyers and rent prices

Across cities, the change in first-time buyers between 2021 and 2023 is negatively correlated with rent price growth (Figure A2). To examine whether rising mortgage rates caused this relationship, I follow the identification strategies of Acharya et al., 2022 and Bosshardt et al., 2024, exploiting geographic variation in the ex-ante share of potential buyers constrained by underwriting limits.

Building on the counterfactual analysis developed in Section 3.2, I construct a measure of constrained home buyers for each CBSA: the share of 2019–2021 first-time buyers whose observed MTI fell below the 31 percent limit at the time of purchase but whose counterfactual MTI under 2023 mortgage rates would have exceeded it. This share varies substantially across cities (Figure A11), allowing me to exploit regional differences in exposure to binding constraints to estimate their effects on rental markets.

I estimate the following regression:

$$\Delta Rent_{im,23} = \alpha + \beta_1 ShareC_{m,19-21} + \gamma_n^N X_{i,23}^N + \theta_n^N \Delta\lambda_{m,23}^N + \varepsilon_{im,23} \tag{2}$$

Where $\Delta Rent_{im,23}$ is the log change in rent price for unit i, in city m between 2021 and 2023.[23] β_1 is the coefficient of interest, measuring how pre-existing exposure to constrained buyers (first-time buyers who would have been pushed above underwriting limits by the rise in interest rates) predicts rent growth across cities.[24] $X^N_{i,23}$ includes property and tenant characteristics (unit size, bedrooms, bathrooms, type, age, occupant income decile, household size, and tenant age). $\Delta\lambda^N_{m,23}$ captures city-level changes in house prices, average income, and population between 2021 and 2023. This vector also includes static controls for housing policy, such as as the share of rent-controlled units and housing voucher recipients, as well as income and population levels measured in 2023.

The inclusion of unit-level and city-level controls assimilates this to a difference-in-differences setup, comparing changes in rental prices between 2021 and 2023 for similar units occupied by similar tenants across different cities, holding other city-level macroeconomic developments constant.

The inclusion of unit and city-level controls is key to assuage concerns about omitted variables potentially affecting the coefficient β_1. This is because, even if measured ex-ante, the city-level share of constrained home-buyers $ShareC_{m,19-21}$ may be correlated with characteristics of the population or macroeconomic circumstances which may independently drive rental price growth ex-post. For example, Table A3 suggests that, on average, constrained home-buyers tend to be poorer, less likely to have a graduate degree and slightly more likely to belong to racial and ethnic minority groups compared to other first-time buyers. However, these differences seem to reflect within-city variation across buyers rather than cross-sectional variation across CBSAs, as the correlations with city-level averages generally have the opposite sign (Figure A12).

It is also reassuring to observe that, an aggregate level, the share of constrained buyers $ShareC_{m,19-21}$ is negatively correlated with the growth in variables which would generally be expected to induce an increase in rental prices ex-post, such as growth in income, population or house prices, and positively correlated with the proportion of rent-controlled units (Figure A13). This suggests that the pure cross-sectional relationship would most likely be biased towards underestimating the role of constrained home-buyers on rent price growth. Nevertheless, the wide set of city-level and property-

[23] Tracking unit-level price changes allows me to hold unit characteristics constant between waves, effectively measuring the effects on the stock of all leases, rather than just the flow of new ones. Indices based on new leases only tend to over-report average rent-price growth experienced by the broad cross-section of consumers Adams et al. (2024).

[24] Following the approach used in Bosshardt et al. (2024), I take an average of the 2019 and 2021 shares, to reduce noise and increase the number of observations on which this average is calculated.

level controls included in equation 2 aims at partialling out for these and other factors which can potentially drive rent price growth above and beyond the role of home-buying constraints induced by the interaction between the change in mortgage rates and MTI limits.

Table 2 presents the main results of this section. Columns (1)–(3) confirm that cities with larger declines in first-time buyers experienced stronger rent inflation. While this change in the share of first-time buyers is likely endogenous to this specification, Columns (4)–(6) present the results of equation 2, where the main variable of interest is the share of constrained first-time buyers ex-ante, based on the counterfactual analysis developed in the previous section. The relative prevalence of constrained home-buyers in a city is a strong predictor of hedonic rent price growth, even after controlling for changes local economic conditions (house prices, population and income growth) as well as housing policy characteristics (share of rent-controlled units and of voucher recipients). Quantitatively, one–standard-deviation increase in the share of constrained buyers (about 6 percentage points) raises average unit rents by roughly 1 percentage point, or 4 percent of a standard deviation in the dependent variable. A simple back of the envelope calculation based on these coefficients suggests that this channel could be responsible for a weighted- average rent increase at the national level of about 3.9 percent, or about one-third of the average rent increase observed between 2021 and 2023 in this sample (Table A1).[25]

The results are robust to across specifications, including to controlling for lagged rent changes at the unit-level (Table A4), of for housing supply response at the city-level (Table A7) measured either as the change in the share of multifamily building permits issued between 2021 and 2023 or as housing supply elasticity ex-ante measured by Saiz (2010).

To test for pre-trends, I re-estimate Equation 2 using rent changes between 2019 and 2021, before the inception of the tightening cycle. The coefficients on the share of constrained buyers are small and statistically insignificant A5, confirming that prior to the beginning of the tightening cycle, cities with a larger proportion of constrained homebuyers were not on differential rent price trajectories. Table A6 presents results of a placebo test, where the shares of constrained home-buyers are defined according to dif-

[25]This estimate is based on (i) applying a coefficient of 0.22 to the CBSA-level share of constrained homebuyers, $ShareC_{m,19-21}$; (ii) multiplying these weights for the number of rental units in a given CBSA and rescaling this city-level aggregate for the total number of national rental units (based on AHS data) (iii) dividing the estimates obtained in (ii) by the weighted average rent increase observed nationally between 2021 and 2023.

ferent MTI thresholds, which do not correspond to any particular underwriting limit. Specifically, in Columns 1-3 the share of constrained buyers is defined as the proportion of first-time buyers with an observed MTI below 25 percent and a counterfactual MTI above 25 percent. Columns 3-6 repeat the same test with the shares based on observed MTIs below 50 percent, counterfactual above. The coefficients are statistically insignificant across all these specifications.

Table A8 dives into the mechanism underlying rent price growth, showing that the price effects are likely determined by increased demand for rentals, which could not be matched by an equivalent increase in supply in the short run. Cities with more constrained buyers show no significant increase in conversions from owner-occupied to rental units (column 1), which is consistent with the notion that these are segmented markets (Dias and Duarte, 2022; Greenwald and Guren, 2025). Although construction of new rental units rises modestly in cities with a larger proportion of constrained homebuyers (column 2) overall rental vacancies decline (column 3), indicating that demand pressures in these cities outpaced supply responses. This supports the interpretation of rent inflation as a symptom of short-run market tightness driven by an increase in rental demand by renters who have been priced out of the owner-occupied market.

Table 2: *Rent increase and constrained home-buyers*

VARIABLES	(1) $\Delta Rent_{i,23}$	(2) $\Delta Rent_{i,23}$	(3) $\Delta Rent_{i,23}$	(4) $\Delta Rent_{i,23}$	(5) $\Delta Rent_{i,23}$	(6) $\Delta Rent_{i,23}$
$\Delta FTHB_{m,23}$	-0.078***	-0.079***	-0.075***			
	(0.026)	(0.023)	(0.023)			
$\text{ShareC}_{m,19-21}$				0.231***	0.218***	0.226***
				(0.061)	(0.060)	(0.058)
$\Delta HP_{m,23}$	0.229***	0.195***	0.196***	0.275***	0.239***	0.242***
	(0.066)	(0.062)	(0.062)	(0.067)	(0.064)	(0.062)
$\Delta Income_{m,23}$	0.431**	0.423**	0.363**	0.679***	0.653***	0.605***
	(0.190)	(0.179)	(0.180)	(0.213)	(0.210)	(0.202)
$\text{Population}_{m,23}$	0.051**	0.052***	0.051**	0.095***	0.094***	0.094***
	(0.021)	(0.020)	(0.021)	(0.023)	(0.023)	(0.023)
CBSA controls	Yes	Yes	Yes	Yes	Yes	Yes
Unit controls	No	Yes	Yes	No	Yes	Yes
Tenant controls	No	No	Yes	No	No	Yes
Observations	5,911	5,911	5,911	5,911	5,911	5,911
R-squared	0.008	0.013	0.019	0.008	0.013	0.020

Notes: AHS 2021-2023. $\Delta Rent_{i,23}$ measures the unit-specific change in (log) rent between 2021 and 2023; FTHB measures the change in the share of FTHB between 2021 and 2023 at the CBSA level; $ShareC_{m,19-21}$ measures the share of constrained home buyers in a given CBSA (average between 2021 and 2019). CBSA level controls average house price growth (2021-2023); population growth (2021-2023); change in average annual income (2021-2023) as well the share of voucher recipients, the share of rent-controlled units and (log) average income and (log)population size in 2023. Unit-level controls include dummies for unit size, n.bedrooms, n.bathrooms, building age in years a dummy for whether the unit is an apartment or a house. Tenant controls include age of the household head, household income decile (relative to the city/year income distribution) and number of people living in the unit. Heteroskedasticity-robust standard errors are clustered at the city-size level.

As a robustness check, A9 constructs an alternative AHS-based measure of constrained *renters*, those who would fall below the (imputed) MTI threshold under 2021 rates but exceed it under 2023 rates. This measure is contemporaneous to rent price developments and is useful to relax some assumptions in earlier specifications, including that of unchanged distributions of house prices and income growth across cities between 2019/2021 and 2023. Reassuringly, a larger share of constrained renters still predicts higher rental price growth (column 1). While it also predicts a moderate increase in rental supply, measured by conversions and new developments (columns 2-3), this is however insufficient to limit rental market tightness, given that rental vacancies decline as the share of constrained renters increases (column 4).

4.2. Robustness: back-end ratios, mortgage lock-in effects

Because the AHS lacks data on back-end ratios (overall DTI), the baseline specification captures only constraints arising from FHA front-end MTI limits. However, a larger proportion of potential borrowers are likely constrained by overall DTI caps, such as those determining borrowing limits on conventional mortgages, which typically limit mortgage payments to 50 percent of annual income (Bhutta and Ringo, 2021; Ringo, 2024). Bosshardt et al. (2024) find that interaction between back-end ratio limits and rising interest rates between 2021 and 2023 explain a large proportion of the decline in home-purchasing behavior during this phase, particularly among poorer borrowers.

To test whether the results in Table 2 are robust to using a more comprehensive measure of borrowing constraints induced by the increase in mortgage rates, I modify the specification in Equation 2 so that coefficient β_1 measures the share of home-buyers constrained by back-end DTI limits, as opposed to front-end MTI limits. To do so, I use data from Freddie Mac's Single Family Loan Level Dataset, which unlike the AHS includes information on borrowers' overall DTI ratios.[26] Crucially, and unlike HMDA and other publicly accessible mortgage-level datasets, Freddie Mac's data includes also information on first-time home-buyer status, which is key to the analysis of rental market equilibria.[27]

This distinction matters, because borrowing constraints affecting first-time buyers

[26]Using loan-level data based on the universe of mortgages securitized by Freddie Mac in any given year helps also assuaging concerns about potential measurement error in income and mortgage payments stemming from the use of survey data. I am grateful to Daniel Ringo for suggesting this test.

[27]One important limitation of Freddie Mac's data is that it does not include information on applicants income levels, which means that counterfactual DTI need to be approximated. I do so using HMDA data: Appendix C provides details on the development of counterfactual DTIs using Freddie Mac data.

have a direct effects on rental demand, while the same constraint affecting repeat-home buyers should matter less for rent prices, due to segmentation between the leased and owner-occupied market (Greenwald and Guren, 2025).

Table A10 confirms that the share of constrained first-time buyers is a strong predictor of rent increases, even under the DTI-based measure (columns 1-3). By contrast, the share of constrained repeat buyers has no significant effect on rent prices (columns 4-6). Similarly, A11 shows that a larger proportion of first-time buyers constrained by back-end DTI limits predict declining rental vacancies (column 3), while constrained repeat buyers do not (column 6). This evidence is overall consistent with the rent price effect operating through an increase in rental demand unmatched by an equivalent increase in supply, in cities where the proportion of first-time buyers close to their borrowing limits was higher.

The fact that the coefficients associated with the proportion of constrained repeat-buyers is broadly insignificant across these specifications is helpful in assuaging concerns that the ex-ante share of constrained buyers could be capturing unobserved city-level characteristics or shocks which are correlated with rent price growth between 2021 and 2023. This includes the relative importance of mortgage lock-in effects (De La Roca et al., 2024; Fonseca and Liu, 2024; Fonseca et al., 2024), which by reducing the supply of starter homes for sale in the market and thus pricing out a number of potential first-time buyers, could increase rental prices in the short run (De La Roca et al., 2024). While this mechanism is plausibly complementary to the one identified here, lock-in effects on rental prices should work through the choices of repeat-buyers. If results in this section were spuriously capturing lock-in dynamics, the coefficients associated with the shares of constrained repeat home-buyers in Table A10 should be positive and significant.

To further assuage concerns that the baseline specification may be capturing lock-in effects, Table A12 controls directly for the share of existing homeowners with outstanding mortgage at rates below those prevalent in 2023 (based on weighted AHS data). The results are robust to this specification.

These findings reinforce the notion that the rent inflation in cities with a larger proportion of constrained first-time buyers reflects increased rental demand driven by households excluded from home-ownership, rather than unobserved aggregate shocks.

4.3. Heterogeneity: Tenants and market segments

The effects of borrowing constraints on rent inflation are not uniform across rental market segments or even renters. Table A13 shows that households in the bottom four deciles of the income distribution experience significantly larger rent increases as the share of constrained buyers rises, while renters in higher income deciles are progressively less affected (column 1). These differences persist after excluding tenants renting through voucher programs (column 2) and units subject to rent control (column 3). They also remain robust to the exclusion of new leases (column 4) or recent tenancies (columns 5), indicating that greater lease turnover among poorer households is not driving the differences in rent price developments across income deciles.[28]

Instead, this result is likely reflecting differences in slack across rental segments. Lower-income tenants occupy the majority of smaller units—those under 750 square feet—which exhibited significantly lower vacancy rates before the tightening cycle (Figure A14). Table A15 confirms that rent growth is strongest in these smaller units (column 1) while other unit characteristics potentially correlated with rent price developments, such as whether the unit is a single-family home (column 2) or whether it was built recently (column 3) do not seem to matter. Rent growth is instead inversely related to pre-existing vacancy rates in a given segment (column 4): segments with a higher vacancy rate ex-ante exhibited significantly lower rent-price increase ex-post. Once controlling for initial vacancy conditions, income-based heterogeneity in rent price growth disappears (column 5).

These results imply that poorer renters faced disproportionate exposure to rent price inflation in the post-pandemic tightening cycle, predominantly because they were concentrated in market segments with little pre-existing slack. The findings suggest a second-round distributional channel of monetary policy: rising interest rates not only price out lower-income buyers, but they also increase their rental costs more relative to other renters. This effect is likely compounded by the fact that shelter typically accounts for a larger share of the consumption basket among poorer tenants (Jaravel, 2024; Molloy, 2024).

This evidence aligns with De La Roca et al. (2024), who find that lock-in effects raise rents more for smaller rentals in low-income neighborhoods of Los Angeles. On the other hand, Abramson et al. (2025) document larger rent increases for single-family

[28] Table A14 tests for pre-trends in this specification, showing that prior to 2023, the share of constrained buyers was not systematically correlated with differential rent price growth across income deciles.

homes, in response to monetary tightening. This difference likely stems from the mechanisms underpinning our respective results. Borrowing constraints induced by the interaction between rising rates and mortgage underwriting standards disproportionately affect lower-income households Bosshardt et al. (2024). In contrast, Abramson et al. (2025) examine the aggregate effects of mortgage rate increases, which capture borrowing constraints as well as purchase postponement (i.e. demand-side effects) among higher-income, unconstrained renters. This latter group is more likely to voluntarily delay purchases in response to rising rates and move into properties which are more closely substitutable to the owner-occupied segment (i.e. single-family homes). Poorer households, who tend to rent smaller properties on average (Figure A14), may not have the opportunity to move into larger and more expensive single-family homes if priced out of the owner-occupied market. Thus, when focusing the supply-side effects of monetary policy only, as in this section, the effects tend to be more pronounced among rental units which are typically in higher demand by relatively poorer renters, and subject to lower market slack.[29]

5. Conclusions

This paper examines how monetary policy interacts with mortgage underwriting standards to shape tenure choices and rental market dynamics. I derive two key takeaways.

First, the sharp decline in first-time home buyers between 2021 and 2023 can be largely attributed to rising mortgage rates, which pushed many potential first-time buyers above pre-existing mortgage-to-income underwriting thresholds. This interaction constrained their access to credit, forcing many to remain renters.

Second, the resulting increase in rental demand placed additional pressure on the rental market, driving a pronounced rise in average rent prices. These effects were especially acute for smaller housing units occupied by renters in the bottom deciles of the income distribution, underscoring the potential for monetary tightening to amplify existing inequalities in housing affordability.

Beyond these specific mechanisms, the findings contribute to the broader debate on the persistence of post-pandemic inflation (Adams et al., 2024; Bolhuis et al., 2022). Rents

[29]In addition, Abramson et al. (2025) measure price changes on new leases, while AHS data reflect mostly price developments on the stock of *existing* leases. Substitution effect into the leased single-family market is likely to drive the price effects in the cross section of new leases, as richer households are more likely to move and start a new lease during a period of rent increases.

and owner-equivalent imputed rents together account for more than one-third of the U.S. Consumer Price Index; hence, the interaction between interest rates and mortgage underwriting standards likely played a non-trivial role in sustaining overall inflation despite sharp monetary tightening.

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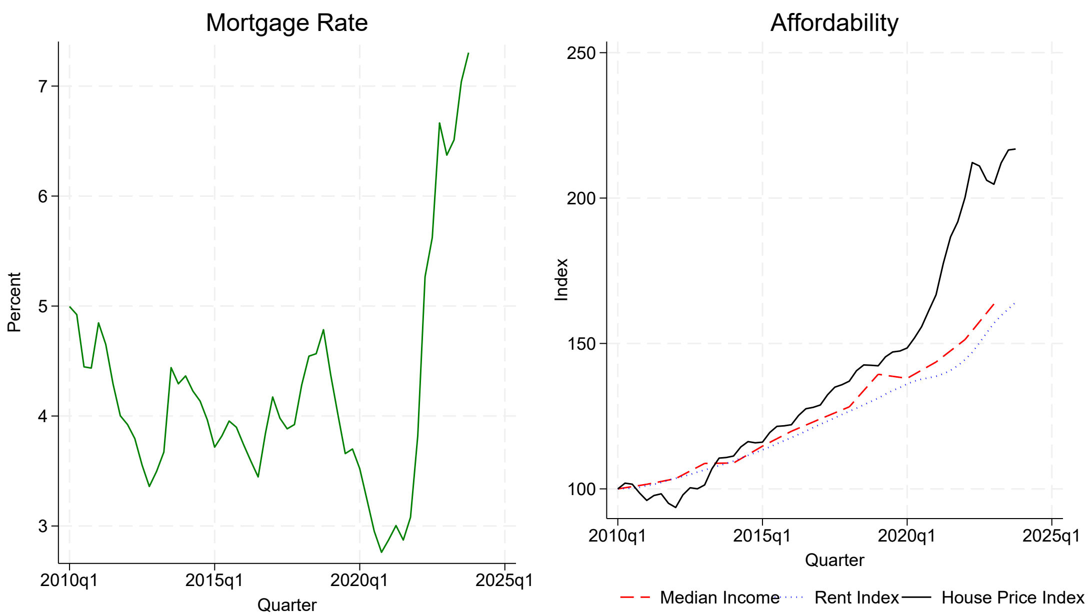
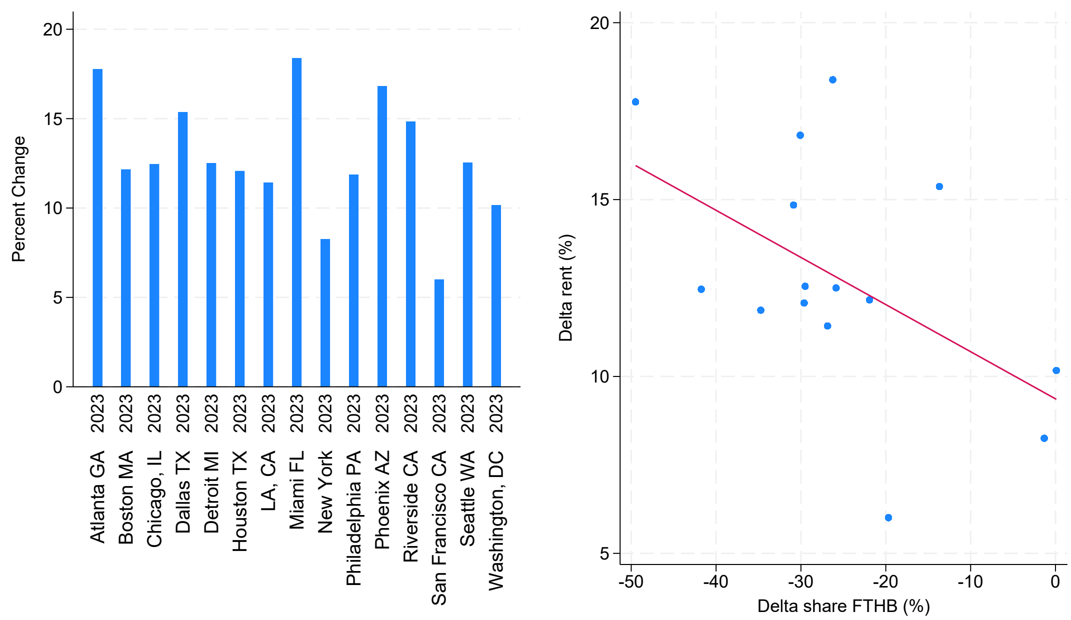
A. Appendix: Figures and tables

Figure A1: *Housing affordability over time*



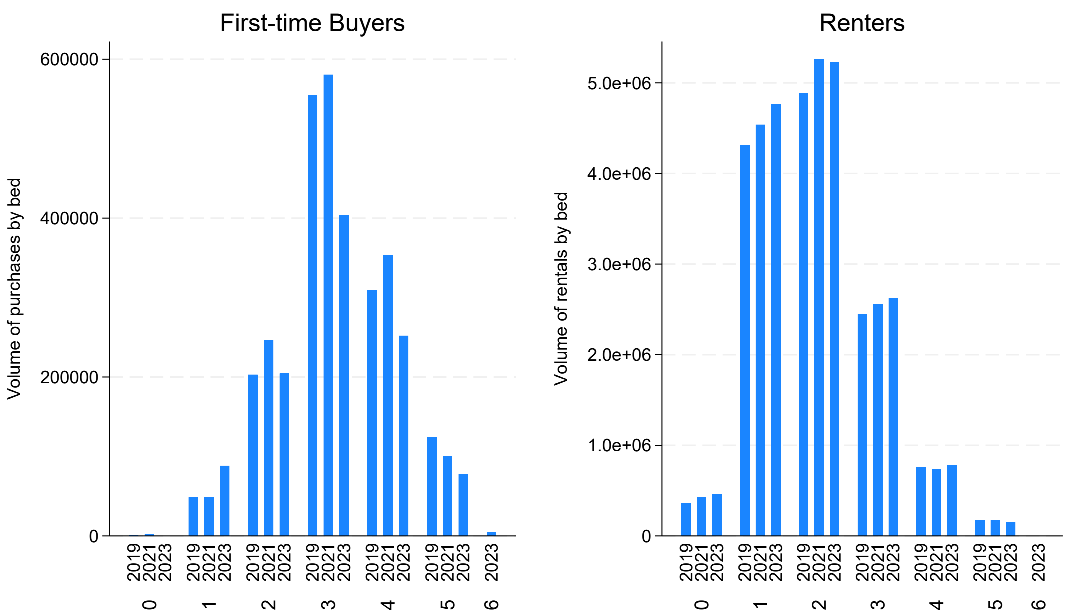
Sources: FRED. Mortgage rates are the average rates on newly originated 30-year FRMs. House Prices Index measures changes in value of the owner-occupied housing stock; Rental Index the change in rents of primary residences. Median household income (nominal) is interpolated to obtain quarterly frequencies. All three series are rescaled to be expressed as percentages of 2010 values (2010 q1=100).

Figure A2: *Change in average rents by city, 2021-2023*



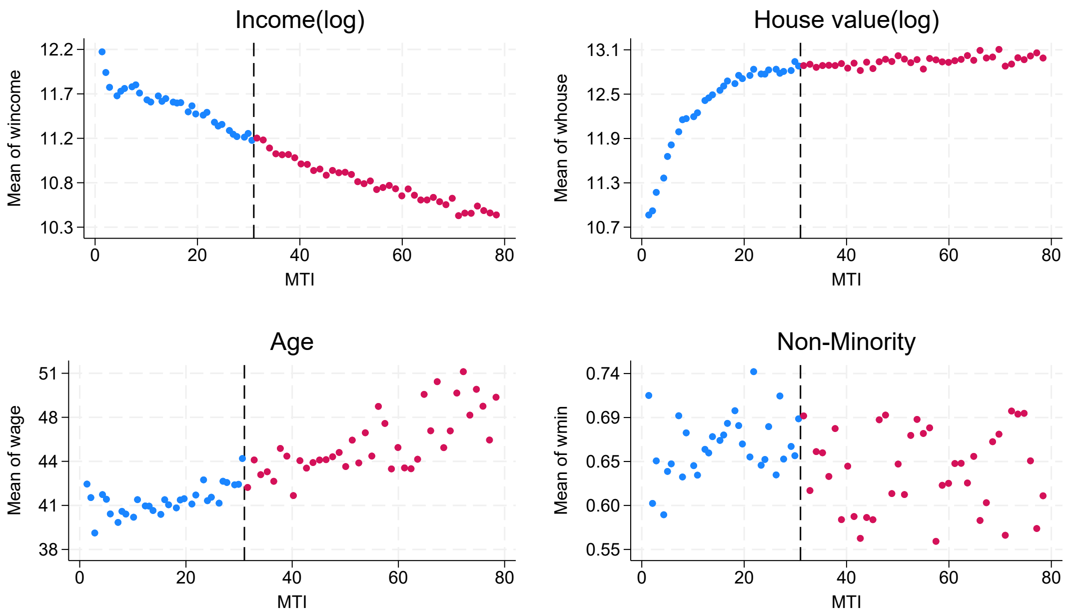
Sources: American Housing Survey, 2021-2023. LHS: Change in average rent by city: existing and new tenancies. The change in rent is computed as the frequency weighted log difference in rents charged on any given housing unit between the 2021 and the 2023 survey. RHS: Correlation between city-level change in rent prices and change in the share of first-time home-buyers between 2021 and 2023

Figure A3: *Volume of units by size: renters VS first-time buyers*



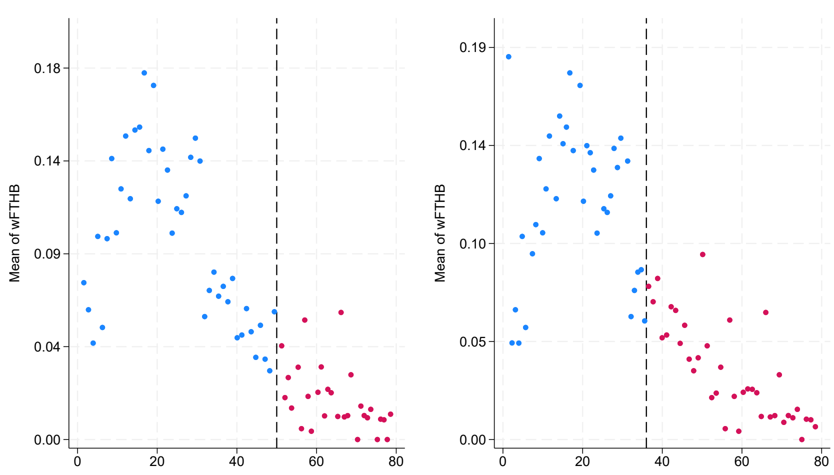
Sources: American Housing Survey , 2019-2023. The chart displays the volume of housing units by number of bedrooms and occupation status (renter VS first-time buyers). Observations are weighted by frequency weights.

Figure A4: *Share of first-time home-buyers by MTI: placebo tests*



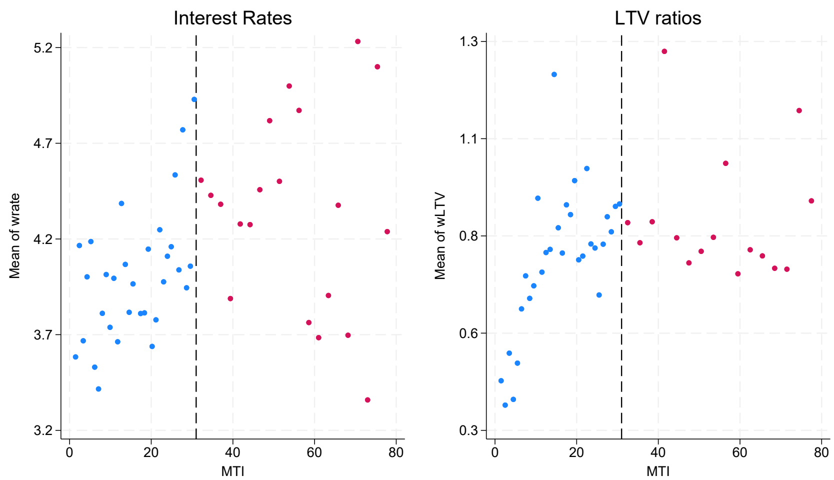
Sources: American Housing Survey, 2021-2023. The sample include first-time homebuyers and renters. The figure plots, clockwise: average income by MTI; average house value; 1- share of racial and ethnic minority groups; age of household head. MTIs are rounded up to the closest integer. Observations are weighted by frequency weights.

Figure A5: *Share of first-time home-buyers by MTI: placebo tests*



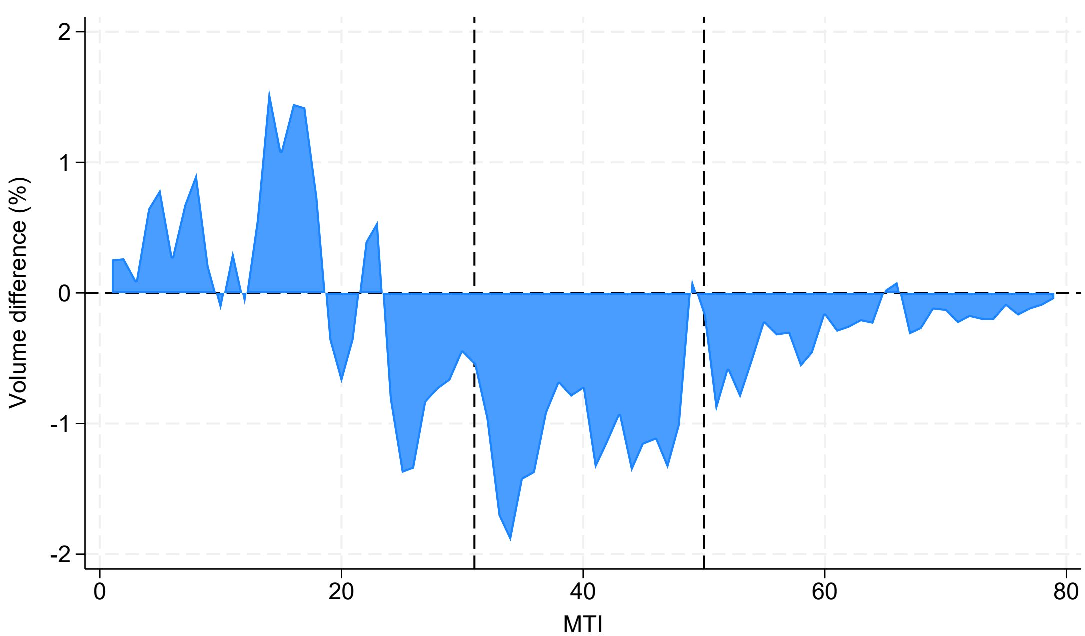
Sources: American Housing Survey, 2021-2023. The figure plots the share of FTHB by MTI; it splits the sample at MTI=36 and MTI=50, corresponding to FHA back-end ratio and overall DTI ratios. MTIs are rounded up to the closest integer. Observations are weighted by frequency weights.

Figure A6: *Interest rates and LTVs for first-time buyers at different levels of MTI limits*



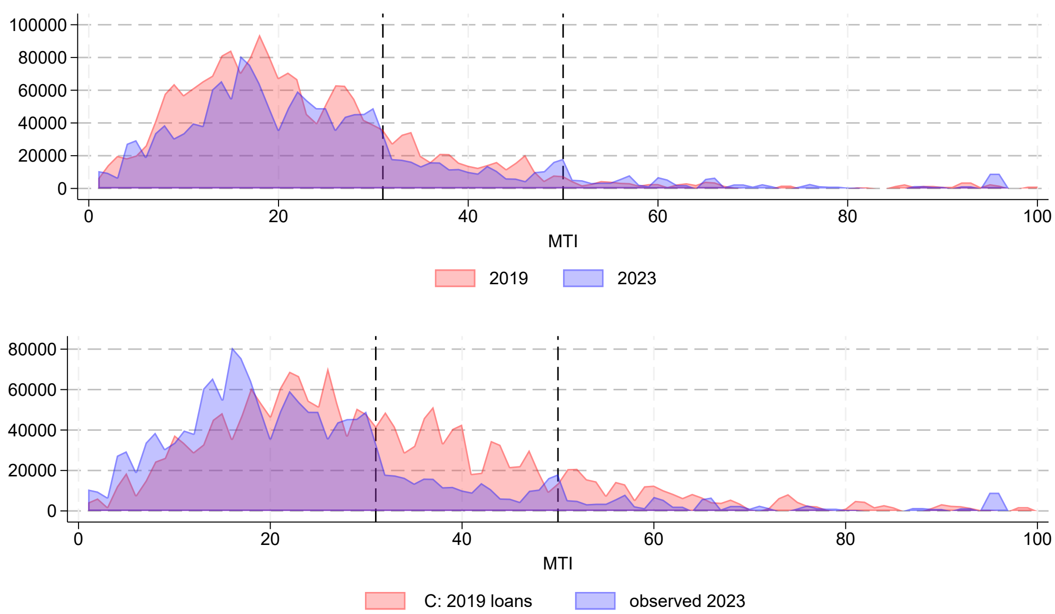
Sources: American Housing Survey, 2021-2023. The figure plots the average interest rate and average LTV ratio for first-time homebuyers at different points in the MTI distribution. MTIs are rounded up to the closest integer. Observations are weighted by frequency weights.

Figure A7: *Difference between 2023 and counterfactual distribution: percent of 2021 originations*



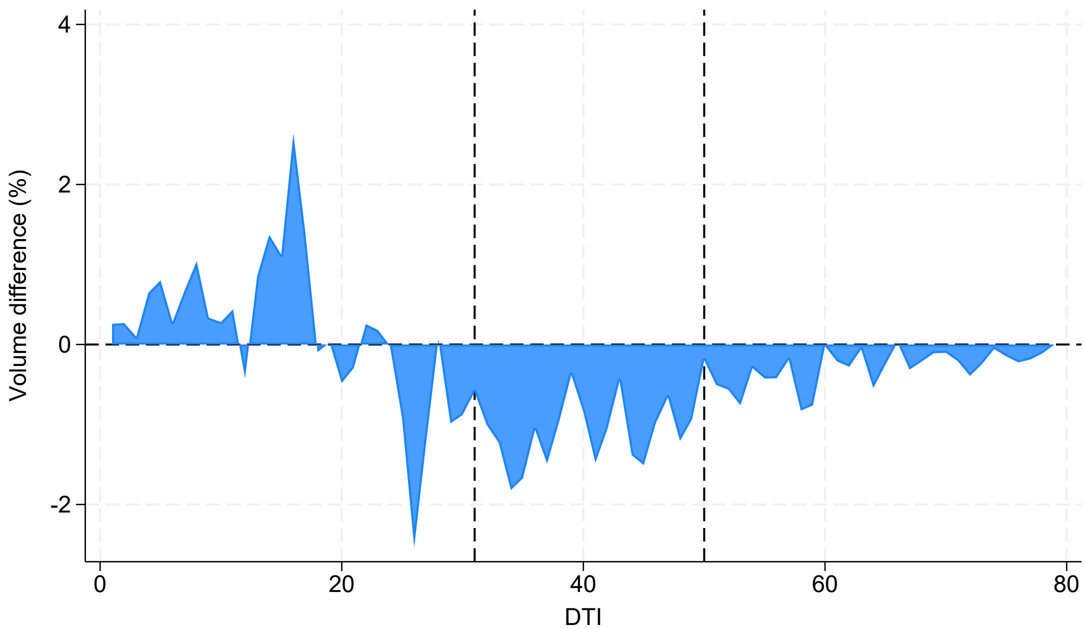
Sources: American Housing Survey , 2021-2023. The chart displays the difference between the observed 2023 distribution and the counterfactual distribution, built using 2021 data. Volumes are expressed in percentage points of 2021 volumes, by MTI value. MTIs are rounded up to the closest integer. Observations are weighted by frequency weights.

Figure A8: *2023 and 2019 distributions: Observed and counterfactual*



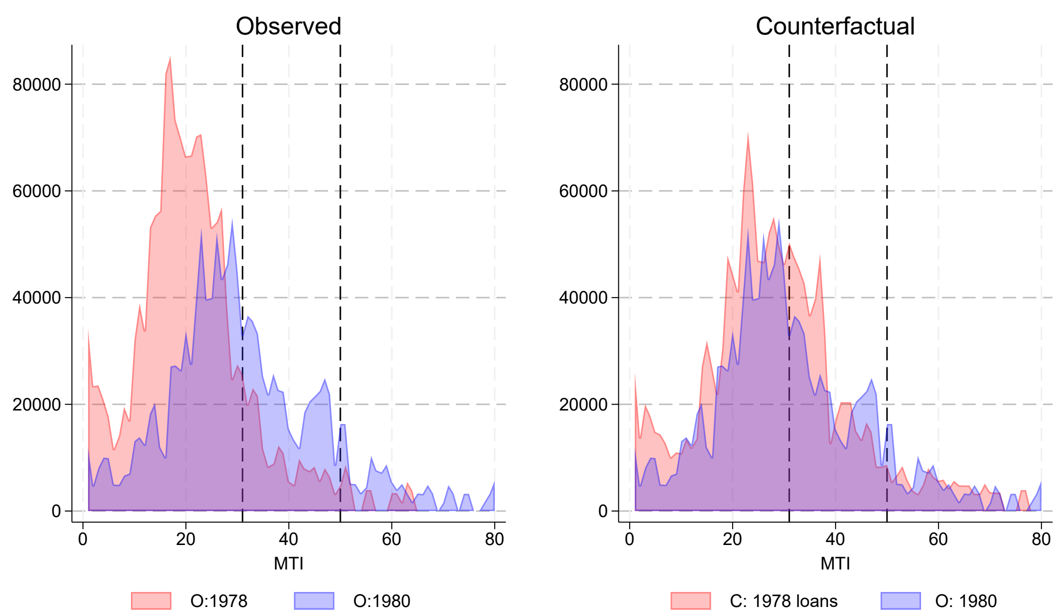
Sources: American Housing Survey , 2019-2023. The chart displays the observed MTI distributions for first-time buyers in 2019 and 2023 (top chart); and the counterfactual distribution for 2019 buyers relative to the observed 2023 distribution (bottom chart). Counterfactual distributions for 2019 buyers assume a 3.5 percentage points increase in mortgage rates, corresponding to the average increase between the first semester of 2019 and the first semester of 2023. MTIs are rounded up to the closest integer. Observations are weighted by frequency weights.

Figure A9: *Demand-adjusted counterfactual, percent of 2021 distributions*



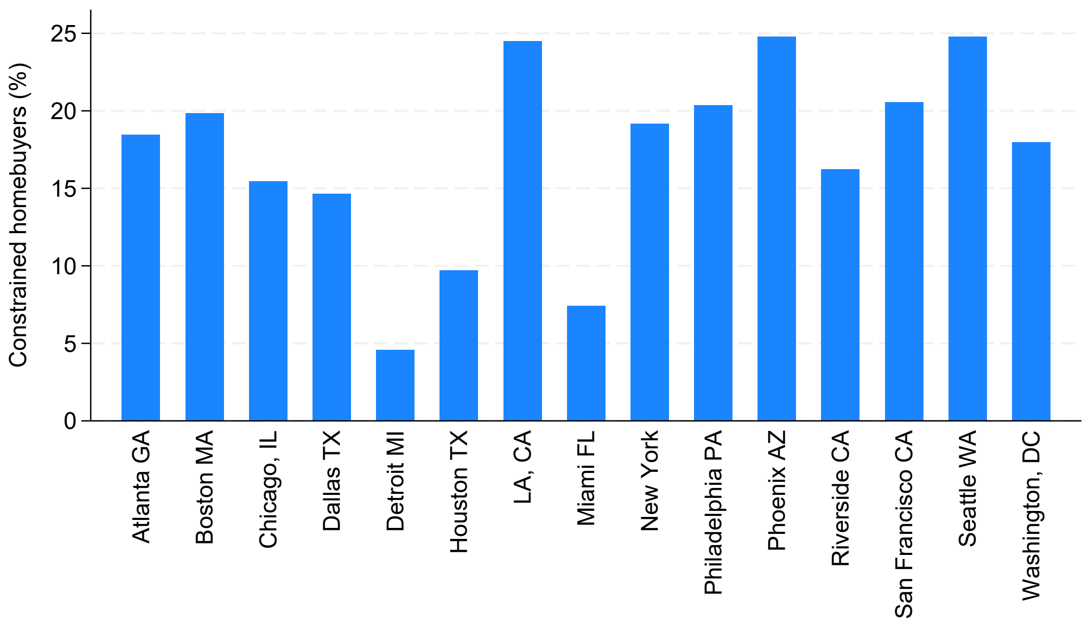
Sources: American Housing Survey , 2021-2023. The chart displays the difference in MTI distributions for first-time buyers in 2023 vs the demand-adjusted counterfactual relative to 2021 volumes. Following the methodology in Bosshardt et al. (2024), I adjust the extensive margin of loan demand in the counterfactual distribution by assuming (i) 2 percent reduction inloan size for each percentage point increase in interest rates; (ii) adjusting loan demand to average changes in income and house prices between 2021 and 2023, by multiplying average city-level growth in income and house prices by the average elasticity between loan size and income/house values conditional on city and year fixed-effects obtained across the 2019-2023 waves of the survey. MTIs are rounded up to the closest integer. Frequency weights are assumed.

Figure A10: *Placebo tests: 1978-1980 first-time buyers*



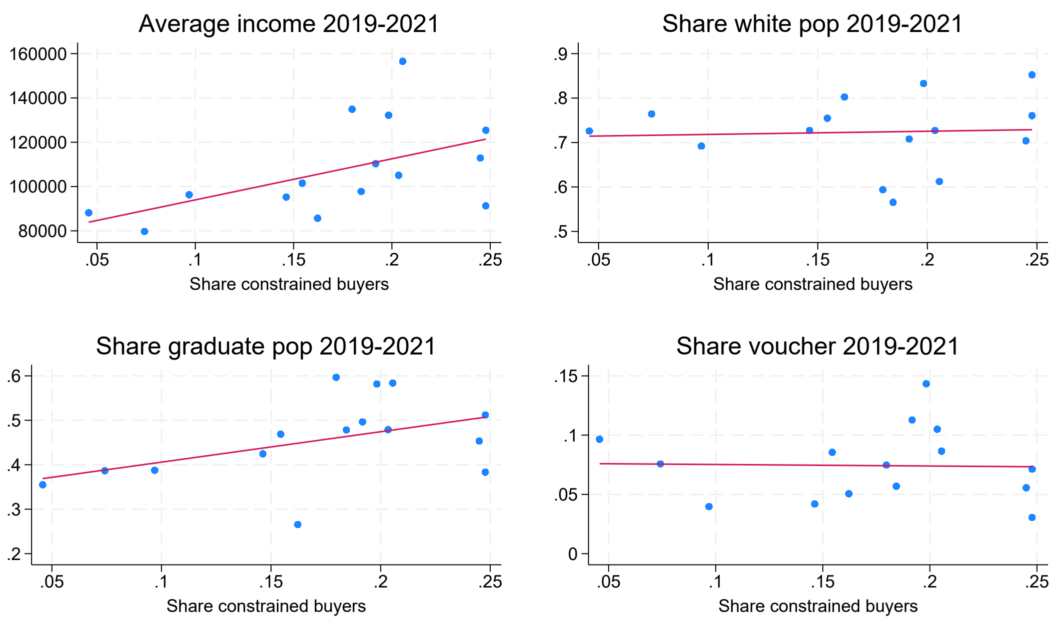
Sources: American Housing Survey , 1978-1980. The chart displays the number of first-time home-buyers by MTI value. The area shaded in blue represents observed 1980 volumes; the red area represents 1978 volumes, observed (LHS) and counterfactual (RHS). MTIs are rounded up to the closest integer. Frequency weights are assumed.

Figure A11: *Share of constrained home-buyers by city: percent of 2021 buyers*



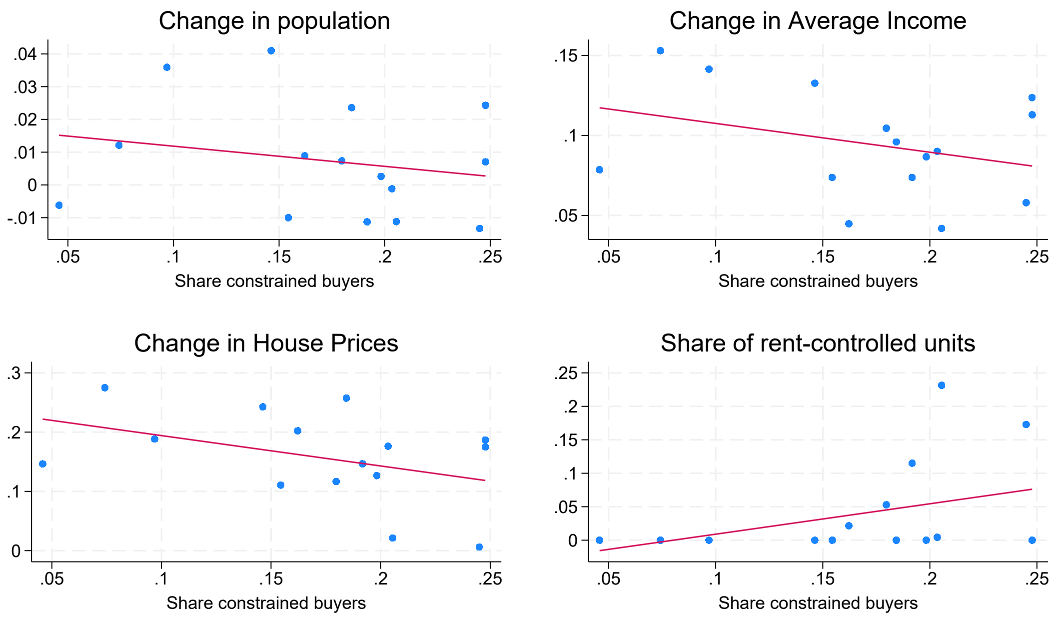
Sources: American Housing Survey , 2021. The chart displays the relative prevalence of constrained home-buyers in 2021 across US CBSAs. Constrained home-buyers are defined as first-time buyers with an observed MTI below 31 and a counterfactual MTI above 31, in 2021. MTIs are rounded up to the closest integer. Observations are weighted by frequency weights.

Figure A12: *Share of constrained home-buyers ex-ante and city-level demographic characteristics*



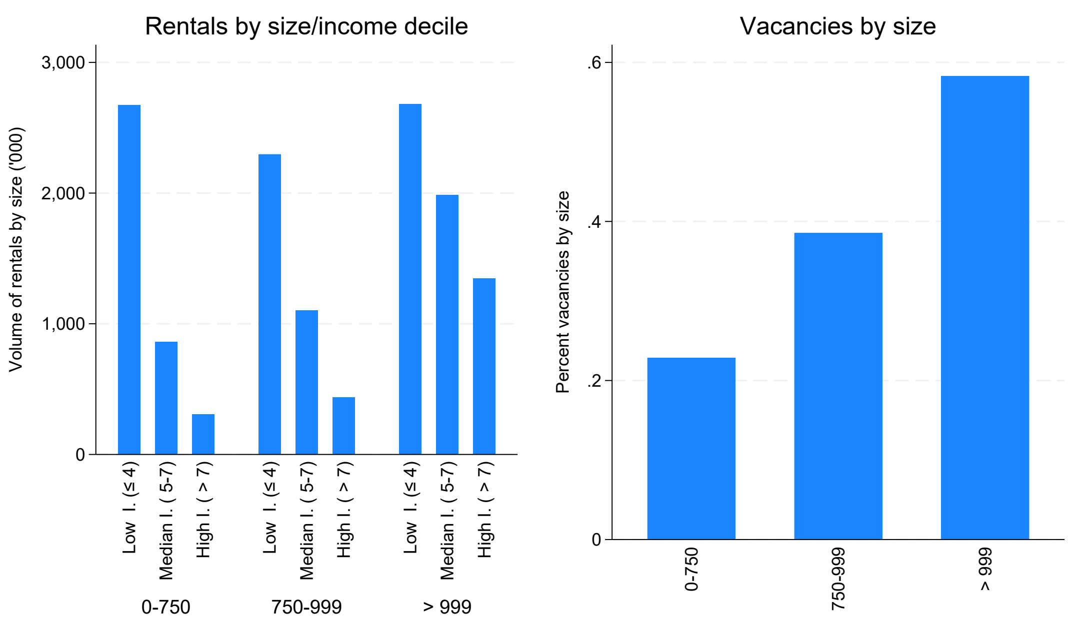
Sources: American Housing Survey, 2019-2021. The chart displays the correlation between the share of constrained home-buyers in 2019-2021 and CBSA level average income, share of graduates, share of housing voucher recipients and share of White population measured contemporaneously. Constrained home-buyers are defined as first-time buyers with an observed MTI below 31 and a counterfactual MTI above 31. MTIs are rounded up to the closest integer. Observations are weighted by frequency weights.

Figure A13: *Share of constrained home-buyers ex-ante and city-level outcomes in 2023*



Sources: American Housing Survey, 2019-2023. The chart displays the correlation between the share of constrained home-buyers in 2019-2021 across CBSAs and growth in income, population, house prices in 2023, as well as the 2023 share of rent-controlled units. Constrained home-buyers are defined as first-time buyers with an observed MTI below 31 and a counterfactual MTI above 31. MTIs are rounded up to the closest integer. Observations are weighted by frequency weights.

Figure A14: *Income decile of occupants and vacancy rates by unit size*



Sources: American Housing Survey, 2019-2021. The chart displays the average size of renter-occupied housing units (LHS) by income decile of its occupants; and the proportion of units which are vacant for rent as a share of total available units in the same market segment (RHS). Observations are weighted by frequency weights.

Table A1: *Descriptive statistics by survey year*

	(1)	(2)	(3)
	2019	2021	2023
First-time buyers (percent)	3.6	3.7	2.7
Share renters (percent)	37	37	37
Annual Income (2019 USD)	107,043	107,942	109,507
Age head	51.6	51.8	52.4
MTI (FTHB, percent)	23	22	25
Change in rent (percent)	7.6	6.4	11.4
Observations	28,147	27,157	23,942

Notes: American Housing Survey, 2019-2023. Change in rent is expressed as an average percent change relative to the previous wave (2 years before). Observations are weighted by frequency weights. Household income is expressed in 2019 USD.

Table A2: *Regression discontinuity: quadratic polynomial*

VARIABLES	(1) FTHB 0-100	(2) FTHB 0-50	(3) FTHB 25-37
Threshold	-0.017*	-0.034**	-0.069**
	(0.010)	(0.015)	(0.030)
MTI	-0.000	0.000	0.010
	(0.001)	(0.001)	(0.010)
Threshold* MTI	-0.000	0.005	0.014
	(0.001)	(0.004)	(0.021)
MTI2	-0.000***	-0.000***	-0.000
	(0.000)	(0.000)	(0.002)
Threshold*MTI2	0.000***	-0.000	-0.002
	(0.000)	(0.000)	(0.003)
Observations	23,181	18,268	4,768
R-squared	0.108	0.104	0.136
CBSA by Year FE	Yes	Yes	Yes
HH and Unit controls	Yes	Yes	Yes

Notes: AHS 2019-2023. FTHB is a dummy taking value 1 if a household switches from renting to buying, 0 otherwise. The sample includes first-time home-buyers and renters. MTIs are measured as mortgage service to income ratios: these are reported for homebuyers and imputed for renters. Controls include age, race and educational attainment of household head, annual household income, family composition, and unit characteristics (size, n.bedrooms, n.bathrooms, unit type). CBSA by year FE included. Heteroskedasticity-robust SEs in parentheses.

Table A3: *Demographic characteristics of constrained home-buyers (2019-2021)*

Variable	Constrained	Not constrained
White population (Percent)	67	73
HH Gross Income (2019 USD)	108,130	163,001
Head graduate (Percent)	55	65
LTV (Percent)	88	78
Percent of total	25	75

Notes: American Housing Survey, 2021. Constrained buyers are defined as 2021 first-time home-buyers with MTI below 31 and counterfactual MTI above 31. Observations are weighted by frequency weights. Household income is expressed in 2019 USD.

Table A4: *Rent increase and constrained home-buyers: including lag rents*

VARIABLES	(1) $\Delta Rent_{i,23}$	(2) $\Delta Rent_{i,23}$	(3) $\Delta Rent_{i,23}$
$\text{ShareC}_{m,19-21}$	0.217***	0.212***	0.217***
	(0.070)	(0.069)	(0.069)
$\Delta Rent_{i,21}$	-0.327***	-0.327***	-0.326***
	(0.019)	(0.020)	(0.019)
CBSA controls	Yes	Yes	Yes
Unit controls	No	Yes	Yes
Tenant controls	No	No	Yes
Observations	3,975	3,975	3,975
R-squared	0.119	0.124	0.132

Notes: AHS 2021-2023. $\Delta Rent_{i,23}$ measures the unit-specific change in (log) rent between 2021 and 2023, and $\Delta Rent_{i,21}$ measures the change in the same unit's rent between 2019 and 2021. $ShareC_{m,19-21}$ measures the share of constrained home buyers in a given CBSA (average between 2021 and 2019). CBSA level controls average house price growth (2021-2023); population growth (2021-2023); change in average annual income (2021-2023) as well the share of voucher recepients, the share of rent-controlled units and (log) average income and (log)population size in 2023. Unit-level controls include dummies for unit size, n.bedrooms, n.bathrooms, building age in years a dummy for whether the unit is an apartment or a house. Tenant controls include age of the household head, household income decile (relative to the city/year income distribution) and number of people living in the unit. Heteroskedasticity-robust standard errors are clustered at the city-size level.

Table A5: *Pre-trends: Rent increase and constrained home-buyers in 2021*

VARIABLES	(1) $\Delta Rent_{i,21}$	(2) $\Delta Rent_{i,21}$	(3) $\Delta Rent_{i,21}$	(4) $\Delta Rent_{i,21}$	(5) $\Delta Rent_{i,21}$	(6) $\Delta Rent_{i,21}$
$\Delta FTHB_{m,21}$	-0.037	-0.034	-0.034			
	(0.023)	(0.023)	(0.023)			
$\text{ShareC}_{m,19-21}$				-0.068	-0.064	-0.061
				(0.089)	(0.083)	(0.085)
CBSA controls	Yes	Yes	Yes	Yes	Yes	Yes
Unit controls	No	Yes	Yes	No	Yes	Yes
Tenant controls	No	No	Yes	No	No	Yes
Observations	6,614	6,614	6,614	6,614	6,614	6,614
R-squared	0.006	0.010	0.013	0.006	0.010	0.013

Notes: AHS 2019-2021. $\Delta Rent_{i,21}$ measures the unit-specific change in (log) rent between 2019 and 2021; FTHB measures the change in the share of FTHB between 2019 and 2021 at the CBSA level; $ShareC_{m,19-21}$ measures the share of constrained home buyers in a given CBSA (average between 2021 and 2019). CBSA level controls average house price growth (2019-2021); population growth (2019-2021); change in average annual income (2019-2021) as well the share of voucher recipients, the share of rent-controlled units and (log) average income and (log)population size in 2021. Unit-level controls include dummies for unit size, n.bedrooms, n.bathrooms, building age in years a dummy for whether the unit is an apartment or a house. Tenant controls include age of the household head, household income decile (relative to the city/year income distribution) and number of people living in the unit. Heteroskedasticity-robust standard errors are clustered at the city-size level.

Table A6: *Placebo: Different MTI thresholds*

VARIABLES	(1) $\Delta Rent_{i,23}$	(2) $\Delta Rent_{i,23}$	(3) $\Delta Rent_{i,23}$	(4) $\Delta Rent_{i,23}$	(5) $\Delta Rent_{i,23}$	(6) $\Delta Rent_{i,23}$
Placebo ShareC25 $_{m,19-21}$	0.082	0.068	0.036			
	(0.055)	(0.052)	(0.046)			
Placebo ShareC50 $_{m,19-21}$				0.171	0.168	0.276
				(0.201)	(0.202)	(0.177)
CBSA controls	Yes	Yes	Yes	Yes	Yes	Yes
Unit controls	No	Yes	Yes	No	Yes	Yes
Tenant controls	No	No	Yes	No	No	Yes
Observations	5,911	5,911	5,911	5,911	5,911	5,911
R-squared	0.008	0.013	0.020	0.008	0.013	0.020

Notes: AHS 2019-2021. $\Delta Rent_{i,23}$ measures the unit-specific change in (log) rent between 2021 and 2023; $PlaceboShareC25_{m,19-21}$ measures the share of home buyers in a given CBSA with MTI below 25% and counterfactual MTI above; $PlaceboShareC50_{m,19-21}$ measures the share of home buyers in a given CBSA with MTI below 50% and counterfactual MTI above. Both measures are constructed as CBSA-level averages between 2021 and 2019. CBSA level controls average house price growth (2021-2023); population growth (2021-2023); change in average annual income (2021-2023) as well the share of voucher recipients, the share of rent-controlled units and (log) average income and (log)population size in 2023. Unit-level controls include dummies for unit size, n.bedrooms, n.bathrooms, building age in years a dummy for whether the unit is an apartment or a house. Tenant controls include age of the household head, household income decile (relative to the city/year income distribution) and number of people living in the unit. Heteroskedasticity-robust standard errors are clustered at the city-size level.

Table A7: *Rents: Including controls for housing supply elasticity*

VARIABLES	(1) $\Delta Rent_{i,23}$	(2) $\Delta Rent_{i,23}$	(3) $\Delta Rent_{i,23}$
$\text{ShareC}_{m,19-21}$	0.216***	0.248***	0.214***
	(0.058)	(0.076)	(0.057)
$\Delta Multifamilypermits_{m,21-23}$	0.003		
	(0.012)		
Share Multifamily permits $_{m,21}$		-0.025	
		(0.041)	
Supply Elasticity $(\text{Saiz})_m$			-0.008
			(0.008)
CBSA by Year FE	Yes	Yes	Yes
HH and Unit controls	Yes	Yes	Yes
Observations	5,911	5,911	5,911
R-squared	0.021	0.021	0.021

Notes: AHS 2019-2023. $\Delta Rent_{i,23}$ measures the unit-specific change in (log) rent between 2021 and 2023; $ShareC_{m,19-21}$ measures the share of constrained home buyers in a given CBSA (average between 2021 and 2019). Multifamily permits are derived from Census data, as the number of bulding permits issued (2 or more units) in any given year. CBSA-level supply elasticity is taken from Saiz (2010). CBSA level controls average house price growth (2019-2021); population growth (2019-2021); change in average annual income (2019-2021) as well the share of voucher recipients, the share of rent-controlled units and (log) average income and (log)population size in 2021. Unit-level controls include dummies for unit size, n.bedrooms, n.bathrooms, building age in years a dummy for whether the unit is an apartment or a house. Tenant controls include age of the household head, household income decile (relative to the city/year income distribution) and number of people living in the unit. Heteroskedasticity-robust standard errors are clustered at the city-size level.

Table A8: *Rental supply and share of constrained buyers*

VARIABLES	(1) Converted Units	(2) New Units	(3) Rental Vacancies
$\text{ShareC}_{m,19-21}$	0.040	0.073**	-0.048***
	(0.035)	(0.035)	(0.016)
CBSA Controls	Yes	Yes	Yes
Unit controls	Yes	Yes	Yes
Tenant controls	Yes	Yes	Yes
Observations	15,096	8,901	11,778
R-squared	0.016	0.047	0.010

Notes: AHS 2021-2023. Converted units is a dummy taking value 1 if a housing unit was owner-occupied in 2021 and is renter-occupied (or vacant for rent) in 2023, 0 if it is owner-occupied. New units is a dummy taking value 1 if a (occupied) rental unit was built in the survey year or the year prior, 0 otherwise. Rental vacancies is a dummy taking value 1 if a unit is vacant for rent, 0 if it is rented. $ShareC_{m,19-21}$ measures the share of constrained home buyers in a given CBSA (average between 2021 and 2019). CBSA level controls average house price growth (2021-2023); population growth (2021-2023); change in average annual income (2021-2023) as well as (log) average income and (log) population size in 2023. Unit-level controls include size, n.bedrooms, n.bathrooms, a dummy for whether the unit is an apartment or a house and whether there is a new lease in place. Bootstrapped SEs in parentheses are robust to heteroskedasticity.

Table A9: *Rental prices, vacancies and share of constrained renters*

VARIABLES	(1) $\Delta Rent_{i,23}$	(2) Converted Units	(3) New Units	(4) Rental Vacancies
$\text{ShareCRent}_{m,23}$	0.162**	0.087**	0.051*	-0.078***
	(0.068)	(0.040)	(0.031)	(0.016)
CBSA Controls	Yes	Yes	Yes	Yes
Unit controls	Yes	Yes	Yes	Yes
Tenant controls	No	No	No	No
Observations	5,911	15,096	8,901	11,778
R-squared	0.013	0.016	0.047	0.011

Notes: AHS 2021-2023. Converted units is a dummy taking value 1 if a housing unit was owner-occupied in 2021 and is renter-occupied (or vacant for rent) in 2023, 0 if it is owner-occupied. New units is a dummy taking value 1 if a (occupied) rental unit was built in the survey year or the year prior, 0 otherwise. Rental vacancies is a dummy taking value 1 if a unit is vacant for rent, 0 if it is rented. $ShareCRent_{m,23}$ measures the share of renters in a given CBSA in 2023 with imputed MTIs above 31 and counterfactual MTIs below if imputed using 2021 average mortgage rates. CBSA level controls average house price growth (2021-2023); population growth (2021-2023); change in average annual income (2021-2023) as well as (log) average income and (log) population size in 2023. Unit-level controls include size, n.bedrooms, n.bathrooms, a dummy for whether the unit is an apartment or a house and whether there is a new lease in place. Bootstrapped SEs in parentheses are robust to heteroskedasticity.

Table A10: *Rent increase and constrained home-buyers: overall DTI*

VARIABLES	(1) $\Delta Rent_{i,23}$	(2) $\Delta Rent_{i,23}$	(3) $\Delta Rent_{i,23}$	(4) $\Delta Rent_{i,23}$	(5) $\Delta Rent_{i,23}$	(6) $\Delta Rent_{i,23}$
CDTI: $\text{FTHB}_{m,19-21}$	0.272***	0.257***	0.255***			
	(0.075)	(0.073)	(0.075)			
CDTI: $\text{RB}_{m,19-21}$				-0.123	-0.093	-0.157
				(0.163)	(0.158)	(0.155)
$\Delta HP_{m,23}$	0.017	0.003	0.016	0.460***	0.406***	0.423***
	(0.079)	(0.076)	(0.076)	(0.084)	(0.076)	(0.073)
$\Delta Income_{m,23}$	0.432	0.411	0.440	0.057	0.045	0.016
	(0.332)	(0.326)	(0.322)	(0.242)	(0.234)	(0.226)
$\text{Population}_{m,23}$	0.022	0.027	0.028	-0.013	-0.010	-0.012
	(0.023)	(0.022)	(0.022)	(0.026)	(0.024)	(0.024)
CBSA controls	Yes	Yes	Yes	Yes	Yes	Yes
Unit controls	No	Yes	Yes	No	Yes	Yes
Tenant controls	No	No	Yes	No	No	Yes
Observations	5,228	5,228	5,228	5,236	5,236	5,236
R-squared	0.006	0.011	0.016	0.010	0.017	0.024

Notes: Freddie Mac Single Family Loan Level Dataset and AHS 2019-2023. $\Delta Rent_{i,23}$ measures the unit-specific change in (log) rent between 2021 and 2023; $CDTI : FTHB_{m,19-21}$ measures the share of constrained first-time home buyers in a given CBSA; $CDTI : FTHB_{m,19-21}$ measures the share of constrained repeat-buyers in a given CBSA. Constrained buyers (first-time and repeat) are defined as Freddie Mac buyers in either 2019 or 2021 who had overall DTI ratios below 50, but would have counterfactual DTI ratios above 50 under 2023 average mortgage rates. CBSA level controls average house price growth (2021-2023); population growth (2021-2023); change in average annual income (2021-2023) as well the share of voucher recipients, the share of rent-controlled units and (log) average income and (log)population size in 2023. Unit-level controls include dummies for unit size, n.bedrooms, n.bathrooms, building age in years a dummy for whether the unit is an apartment or a house. Tenant controls include age of the household head, household income decile (relative to the city/year income distribution) and number of people living in the unit. Heteroskedasticity-robust standard errors are clustered at the city-size level.

Table A11: *Rental supply and constrained buyers: overall DTI*

VARIABLES	(1) Converted Units	(2) New Units	(3) Rental Vacancies	(4) Converted Units	(5) New Units	(6) Rental Vacancies
CDTI: $\text{FTHB}_{m,19-21}$	0.120**	-0.011	-0.061***			
	(0.049)	(0.034)	(0.022)			
CDTI: $\text{RB}_{m,19-21}$				0.183**	-0.047	-0.054
				(0.074)	(0.071)	(0.036)
CBSA Controls	Yes	Yes	Yes	Yes	Yes	Yes
Unit controls	Yes	Yes	Yes	Yes	Yes	Yes
Tenant controls	No	No	No	No	No	No
Observations	13,098	7,840	10,136	14,251	7,966	10,702
R-squared	0.018	0.044	0.011	0.016	0.048	0.010

Notes: Freddie Mac Single Family Loan Level Dataset and AHS 2019-2023. Converted units is a dummy taking value 1 if a housing unit was owner-occupied in 2021 and is renter-occupied (or vacant for rent) in 2023, 0 if it is owner-occupied. New units is a dummy taking value 1 if a (occupied) rental unit was built in the survey year or the year prior, 0 otherwise. Rental vacancies is a dummy taking value 1 if a unit is vacant for rent, 0 if it is rented. $CDTI : FTHB_{m,19-21}$ measures the share of constrained first-time home buyers in a given CBSA; $CDTI : FTHB_{m,19-21}$ measures the share of constrained repeat-buyers in a given CBSA. Constrained buyers (first-time and repeat) are defined as Freddie Mac buyers in either 2019 or 2021 who had overall DTI ratios below 50, but would have counterfactual DTI ratios above 50 under 2023 average mortgage rates. CBSA level controls average house price growth (2021-2023); population growth (2021-2023); change in average annual income (2021-2023) as well as (log) average income and (log) population size in 2023. Unit-level controls include size, n.bedrooms, n.bathrooms, a dummy for whether the unit is an apartment or a house and whether there is a new lease in place. Bootstrapped SEs in parentheses are robust to heteroskedasticity.

Table A12: *Rents: lock-in effects*

VARIABLES	(1) $\Delta Rent_{i,23}$	(2) $\Delta Rent_{i,23}$	(3) $\Delta Rent_{i,23}$
Lock-in share$_{m,23}$	-0.076	0.015	0.036
	(0.051)	(0.058)	(0.051)
ShareC$_{m,19-21}$	0.272***		
	(0.067)		
CDTI: FTHB$_{m,19-21}$		0.239***	
		(0.074)	
CDTI: RB$_{m,19-21}$			-0.127
			(0.160)
CBSA by Year FE	Yes	Yes	Yes
HH and Unit controls	Yes	Yes	Yes
Observations	5,911	5,911	5,911
R-squared	0.021	0.017	0.026

Notes: Freddie Mac Single Family Loan Level Dataset and AHS 2019-2023. $\Delta Rent_{i,23}$ measures the unit-specific change in (log) rent between 2021 and 2023; $Lock-inshare_{m,21}$ measures the share of homeowners in a given CBSA with oustanding mortgages and interest rates below average current mortgage rates (i.e. 7.1 percent), based on AHS data. $ShareC_{m,19-21}$ measures the share of constrained home buyers in a given CBSA (average between 2021 and 2019). $CDTI: FTHB_{m,19-21}$ measures the share of constrained first-time home buyers in a given CBSA; $CDTI: FTHB_{m,19-21}$ measures the share of constrained repeat-buyers in a given CBSA. CBSA level controls average house price growth (2019-2021); population growth (2019-2021); change in average annual income (2019-2021) as well the share of voucher recipients, the share of rent-controlled units and (log) average income and (log)population size in 2021. Unit-level controls include dummies for unit size, n.bedrooms, n.bathrooms, building age in years a dummy for whether the unit is an apartment or a house. Tenant controls include age of the household head, household income decile (relative to the city/year income distribution) and number of people living in the unit. Heteroskedasticity-robust standard errors are clustered at the city-size level.

Table A13: *Heterogeneity: income deciles*

VARIABLES	(1) $\Delta Rent_{i,23}$	(2) $\Delta Rent_{i,23}$ No Voucher	(3) $\Delta Rent_{i,23}$ No Rent Control	(4) $\Delta Rent_{i,23}$ No new leases	(5) $\Delta Rent_{i,23}$ No recent lease
$\text{ShareC}_{m,19-21}$	0.369***	0.363***	0.404***	0.352***	0.452***
	(0.064)	(0.082)	(0.064)	(0.074)	(0.109)
Decile 4-6	0.100***	0.081**	0.099***	0.105***	0.114***
	(0.028)	(0.036)	(0.028)	(0.029)	(0.033)
Decile 7-10	0.151***	0.125***	0.158***	0.122***	0.136**
	(0.030)	(0.033)	(0.029)	(0.032)	(0.056)
Decile 4-6*$\text{ShareC}_{m,19-21}$	-0.251*	-0.257*	-0.246*	-0.254*	-0.427**
	(0.129)	(0.155)	(0.126)	(0.136)	(0.171)
Decile 7-10* $\text{ShareC}_{m,19-21}$	-0.584***	-0.515***	-0.646***	-0.421***	-0.645***
	(0.133)	(0.141)	(0.130)	(0.139)	(0.239)
CBSA Controls	Yes	Yes	Yes	Yes	Yes
Unit controls	Yes	Yes	Yes	Yes	Yes
Tenant controls	Yes	Yes	Yes	Yes	Yes
Observations	5,911	4,760	5,613	5,386	3,778
R-squared	0.021	0.026	0.022	0.021	0.021

Notes: AHS 2021-2023. $\Delta Rent_{i,23}$ measures the unit-specific change in (log) rent between 2019 and 2021; FTHB measures the change in the share of FTHB between 2019 and 2021 at the CBSA level; $ShareC_{m,19-21}$ measures the share of constrained home buyers in a given CBSA (average between 2021 and 2019). Column 2 excludes voucher recipients; column 3 excludes units subject to rent control; column 4 excludes leases signed during the survey year or the previous year; column 5 excludes tenancies lasting less than three years. CBSA level controls average house price growth (2019-2021); population growth (2019-2021); change in average annual income (2019-2021) as well the share of voucher recipients, the share of rent-controlled units and (log) average income and (log)population size in 2021. Unit-level controls include dummies for unit size, n.bedrooms, n.bathrooms, building age in years a dummy for whether the unit is an apartment or a house. Tenant controls include age of the household head, household income decile (relative to the city/year income distribution) and number of people living in the unit. Heteroskedasticity-robust standard errors are clustered at the city and size level.

Table A14: *Heterogeneity: income deciles pre-trends*

VARIABLES	(1) $\Delta Rent_{i,21}$	(2) $\Delta Rent_{i,21}$ No Voucher	(3) $\Delta Rent_{i,21}$ No Rent Control	(4) $\Delta Rent_{i,21}$ No new leases	(5) $\Delta Rent_{i,21}$ No recent lease
$\text{ShareC}_{m,19-21}$	-0.017	0.095	-0.024	0.065	0.149
	(0.106)	(0.101)	(0.106)	(0.109)	(0.114)
Decile 4-6	0.019	0.032	0.018	0.012	0.008
	(0.026)	(0.026)	(0.026)	(0.031)	(0.034)
Decile 7-10	0.063*	0.081**	0.053	0.040	0.042
	(0.038)	(0.040)	(0.038)	(0.045)	(0.052)
Decile 4-6*$\text{ShareC}_{m,19-21}$	-0.023	-0.168*	-0.024	-0.085	-0.057
	(0.105)	(0.097)	(0.105)	(0.126)	(0.121)
Decile 7-10* $\text{ShareC}_{m,19-21}$	-0.264*	-0.426***	-0.233	-0.218	-0.362*
	(0.141)	(0.145)	(0.144)	(0.173)	(0.218)
CBSA Controls	Yes	Yes	Yes	Yes	Yes
Unit controls	Yes	Yes	Yes	Yes	Yes
Tenant controls	Yes	Yes	Yes	Yes	Yes
Observations	5,911	4,760	5,613	5,386	3,778
R-squared	0.021	0.026	0.022	0.021	0.021

Notes: AHS 2021-2023. $\Delta Rent_{i,23}$ measures the unit-specific change in (log) rent between 2019 and 2021; FTHB measures the change in the share of FTHB between 2019 and 2021 at the CBSA level; $ShareC_{m,19-21}$ measures the share of constrained home buyers in a given CBSA (average between 2021 and 2019). Column 2 excludes voucher recipients; column 3 excludes units subject to rent control; column 4 excludes leases signed during the survey year or the previous year; column 5 excludes tenancies lasting less than three years. CBSA level controls average house price growth (2019-2021); population growth (2019-2021); change in average annual income (2019-2021) as well the share of voucher recipients, the share of rent-controlled units and (log) average income and (log)population size in 2021. Unit-level controls include dummies for unit size, n.bedrooms, n.bathrooms, building age in years a dummy for whether the unit is an apartment or a house. Tenant controls include age of the household head, household income decile (relative to the city/year income distribution) and number of people living in the unit. Heteroskedasticity-robust standard errors are clustered at the city and size level.

Table A15: *Heterogeneity: market segment*

VARIABLES	(1) $\Delta Rent_{i,23}$	(2) $\Delta Rent_{i,23}$	(3) $\Delta Rent_{i,23}$	(4) $\Delta Rent_{i,23}$	(5) $\Delta Rent_{i,23}$
ShareC$_{m,19-21}$	0.336***	0.242***	0.203***	0.370***	0.418***
	(0.069)	(0.076)	(0.064)	(0.118)	(0.127)
Median size*ShareC$_{m,19-21}$	-0.142**				
	(0.066)				
Large size*ShareC$_{m,19-21}$	-0.168*				
	(0.098)				
House		-0.006			
		(0.030)			
House*ShareC$_{m,19-21}$		-0.055			
		(0.157)			
Recent			-0.065		
			(0.044)		
Recent *ShareC$_{m,19-21}$			0.206		
			(0.223)		
Vacancy Rate 21				0.032	0.007
				(0.024)	(0.026)
Vacancy Rate 21*ShareC$_{m,19-21}$				-0.272**	-0.099
				(0.133)	(0.152)
Decile 4-6*ShareC$_{m,19-21}$					-0.091
					(0.186)
Decile 7-10*ShareC$_{m,19-21}$					-0.240
					(0.295)
Decile 4-6*ShareC$_{m,19-21} * Vacancyrate21$					-0.291
					(0.288)
Decile 7-10*ShareC$_{m,19-21} * Vacancyrate21$					-0.694*
					(0.370)
Observations	5,911	5,911	5,911	5,911	5,911
R-squared	0.020	0.020	0.020	0.020	0.022

Notes: AHS 2021-2023. $\Delta Rent_{i,23}$ measures the unit-specific change in (log) rent between 2019 and 2021; FTHB measures the change in the share of FTHB between 2019 and 2021 at the CBSA level; $ShareC_{m,19-21}$ measures the share of constrained home buyers in a given CBSA (average between 2021 and 2019). Column 1 interacts these shares by a dummy, taking values from 1 to 3 corresponding to different buckets of unit size (0-750; 750-999; more than 999 sqft); in column 2 the dummy taking value 1 if the rental is a house, 0 if an apartment; in column 3 the dummy takes value 1 if the building has been developed in the previous 20 years, 0 otherwise. Columns 4 and 5 use vacancy rates, defined as the share of vacant rental units by size bucket (small, medium large) in any given city, in 2021. CBSA level controls average house price growth (2019-2021); population growth (2019-2021); change in average annual income (2019-2021) as well the share of voucher recipients, the share of rent-controlled units and (log) average income and (log)population size in 2021. Unit-level controls include dummies for unit size, n.bedrooms, n.bathrooms, building age in years a dummy for whether the unit is an apartment or a house. Tenant controls include age of the household head, household income decile dummies (relative to the city/year income distribution) and number of people living in the unit. Heteroskedasticity-robust standard errors are clustered at the city and size level.

B. Appendix: Imputing Renter's MTI

To impute renters' mortgage-to-income (MTI) ratios, I follow an approach analogous to the method used by the Bureau of Labor Statistics to estimate Owner-Equivalent Rents for the shelter component of the CPI.

I begin by imputing the current market value of each renter-occupied property i, in CBSA m and year t, based on the values of similar owner-occupied properties in the same market and year. I estimate the following hedonic regression using the owner-occupied sample:

$$\widehat{HousePrice}_{imt} = \alpha + \gamma_n^N X_{imt} + \theta_n^N(\lambda_t * X_{imt}) + \phi_{mt} + \varepsilon_{imt}$$

Where X_{imt} is a vector of unit-specific characteristics: building type (apartment or house), unit age and its square, size in square feet, fixed effects for the number of bedrooms and bathrooms, and an indicator for reported neighborhood crime. Each characteristic is interacted with year fixed effects to allow the valuation of housing attributes to evolve over time (e.g., changing preferences for size or location). ϕ denotes CBSA-by-year fixed effects capturing local macroeconomic or policy factors affecting prices. The estimated coefficients $\gamma_n; \theta_n; \phi$, are then used to predict the market value of renter-occupied units with comparable attributes in the same city and year.

Next, I estimate the mortgage amount each renter would need to finance the purchase of their unit. I regress the observed mortgage amounts of first-time buyers on their house values and unit characteristics:

$$\widehat{Mortgage}_{imt} = \alpha + \beta_1 \widehat{HousePrice}_{imt} + \gamma_n^N X_{imt} + \theta_n^N(\lambda_t * X_{imt}) + \phi_{mt} + \varepsilon_{imt}$$

This specification mirrors the hedonic approach above but includes the house value as a control. The resulting coefficients are used to predict mortgage amounts for renters with similar demographic and property characteristics (include predicted property value) in the same CBSA and year.

Finally, I estimate the mortgage interest rate a renter would likely face if they purchased their unit. Using observed data for first-time buyers, I estimate:

$$\widehat{Rate}_{imt} = \alpha + \beta_1 \widehat{HousePrice}_{imt} + \beta_2 \widehat{Mortgage}_{imt} + \gamma_n^N X_{imt} + \theta_n^N(\lambda_t * X_{imt}) + \phi_{mt} + \varepsilon_{imt}$$

This regression predicts the borrower-specific interest rate conditional on property value, loan size, and other characteristics, with fixed effects capturing local lending conditions. The coefficients are then used to predict each renters' estimate interest rate.

For each renter, I use the imputed property value, loan amount, and mortgage rate to calculate the annual mortgage payment under a 30-year fixed-rate amortization schedule.[30]

$\widehat{Payment}_{imt} = [\widehat{Mortgage}_{imt}/30] + [\widehat{Mortgage_{rimt}} * Rate_{imt}]$

Dividing this by the household's reported annual income yields the imputed mortgage-to-income ratio:

$\widehat{MTI_{Rimt}} = \widehat{Payment}_{imt} / AnnualIncome_{Rimt}$

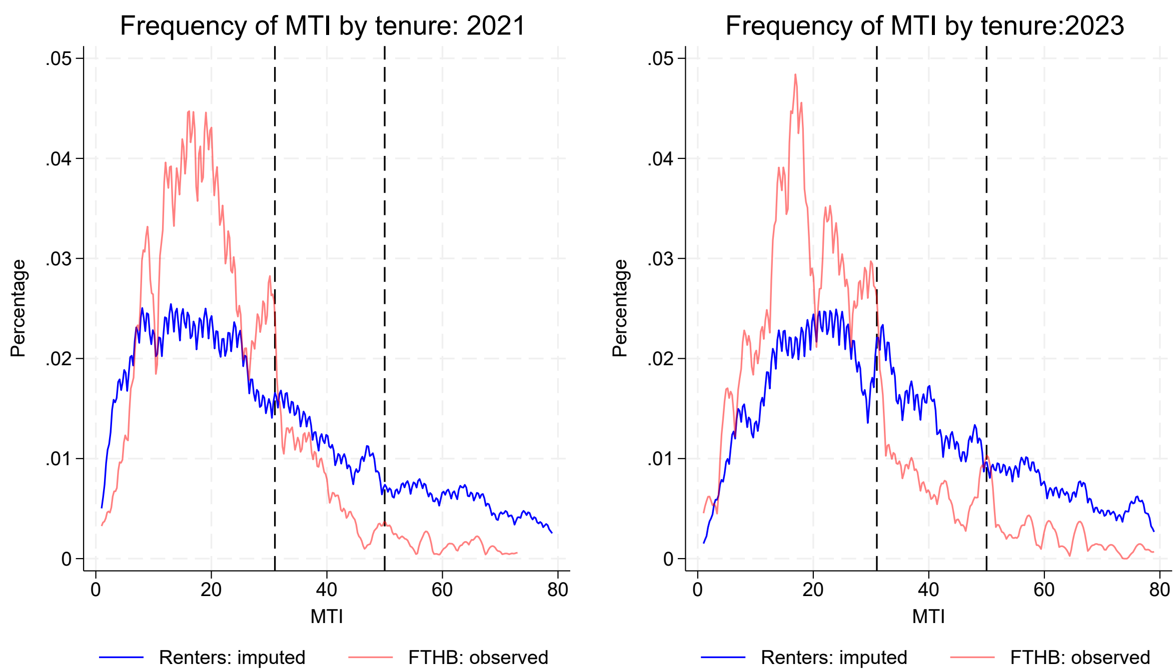
This variable represents the payment burden the household would face if purchasing their current rental unit. It is used throughout the main analysis to compare renters and first-time buyers around underwriting thresholds and to identify constrained potential buyers.

Figure B1 plots the distributions of owner (observed) and renters'(imputed) MTIs for 2021 and 2023. Renters' MTIs are higher than first-time buyers', as renter households tend to be poorer, on average. Renter's imputed MTI distribution shift decisively to the right in 2023, consistently with higher interest rates and rising house prices. There is also a visible spike in the proportion of renters with imputed MTI at or just above the front-end threshold, suggesting that a number of potential home-buyers may indeed have been pushed above underwriting limits by the change in interest rates between the two waves.

This methodology also offers some insights on the relative cost of buying VS renting across US cities. Figure B2 shows that, in 2021, a renter living in DC or Miami would generally have benefited from the acquisition of the same property they lived in, as this would have reduced their monthly housing costs. However, the same renter in San Francisco would have typically faced a higher housing cost if they chose to buy, due to higher average property valuations relative to rent prices. In 2023, the sharp increase in mortgage rates combined with rising or stable property prices increased the cost of buying in many US cities, often aligning these average costs with the cost of renting a similar unit.

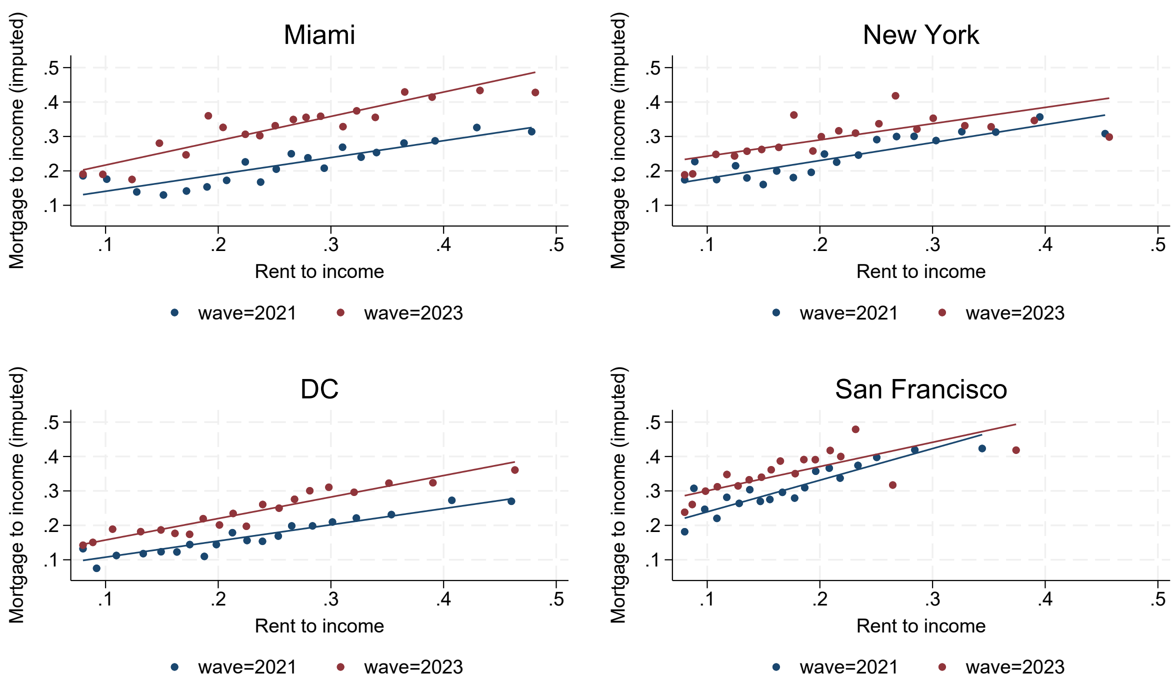
[30] I also assume a constant amortization schedule. This is a simplification, as a typical fixed-rate mortgage amortizes less at the beginning and more towards the end. Given that most mortgages in the US are issued with fixed nominal payments at least for the first year of the loan (true ARMs are rare), this simplification is irrelevant towards the calculations of MTIs in the first year.

Figure B1: *Renters' and first-time buyers MTIs by year*



Sources: American Housing Survey, 2021-2023. The figures plot the kernel densities of owners' MTIs and renters' imputed MTIs by year. Observations are weighted by frequency weights.

Figure B2: *Cost of renting VS buying by city*



Sources: American Housing Survey, 2021-2023. The figures plots the imputed MTI ratios for renters assuming they wanted to finance the acquisition of the same property they live in, using a 30 year FRM at prevailing market rates with 20 percent down-payment. Observations are weighted by frequency weights.

C. Appendix: Counterfactual DTIs in Freddie Mac's Loan Level Dataset

To complement the AHS-based analysis and address its lack of back-end ratio data, I use loan-level information from Freddie Mac's Single-Family Loan-Level Dataset (SFLLD) to estimate counterfactual debt-to-income (DTI) ratios for first-time and repeat home buyers. Unlike HMDA or other public mortgage datasets, the SFLLD includes borrower DTI ratios at origination and explicitly identifies first-time buyers, making it well-suited for this exercise.[31]

The analysis uses Freddie Mac purchase loans originated between 2019 and 2021—the period preceding the 2022–2023 tightening cycle. I restrict the sample to 30-year fixed-rate mortgages with complete information on loan amount, interest rate, and DTI. First-time buyers are identified using Freddie Mac's "First-Time Homebuyer Flag," while repeat buyers include all other purchase borrowers.

Because the SFLLD does not report borrower income directly, I rely on loan-level information from the Home Mortgage Disclosure Act (HMDA) dataset, which reports applicants' income at origination, to infer the shares of constrained buyers in SFLLD.

Using the same methodology as in Bosshardt et al. (2024) I construct counterfactual DTIs in HMDA assuming that 2019–2021 borrowers faced 2023 average interest rates on newly originated 30-year fixed-rate mortgages. I thus estimate the proportion of HMDA borrowers with DTI ratios below 50 percent in 2019 or 2021, but who would have had counterfactual DTIs above 50 percent if subject to 2023 mortgage rates.

This allows me to identify the DTI buckets in HMDA for which the vast majority (i.e. more than 95%) of borrowers would have crossed the 50 percent DTI threshold under the counterfactual analysis. For the 2019 and 2021 vintages of HMDA data, these thresholds correspond to observed DTI ratios of 46 and 45 percent, respectively.

I then apply these benchmarks to Freddie Mac's data, to define the portion of constrained home-buyers (both first-time and repeat) in each CBSA.

In other words, I assume that all Freddie Mac's home-buyers with observed DTIs equal to or above 46 percent in 2019 or 45 percent in 2021 would have been pushed above the 50 percent limit if subject to 2023 average mortgage rates. I define these borrowers as "constrained", discriminating between first-time and repeat home-buyers.

[31] Freddie Mac's share corresponds to about one third of overall US mortgage debt outstanding at the end of 2023 (UrbanInsitute, 2023).

This allows me to compute their relative prevalence as a share of the CBSA-level population of Freddie Mac's first-time and repeat buyers, respectively (for 2019 and 2021). These shares of constrained home-buyers are then used as a key regressor of interest in the analysis in Section 4.2.