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

Alessia De Stefani*

March 19, 2025
PRELIMINARY: DO NOT QUOTE

Abstract

Applying a regression discontinuity design and nonparametric methods to property-level data from the American housing survey, I show that that the sharp rise in mortgage rates between 2021 and 2023 pushed many renters above FHA payment-to-income thresholds, delaying their move into homeownership. As these households remain in the rental market, local demand pressures intensify contributing to rent price inflation in 2023. Cities with higher shares of constrained first-time buyers experienced steeper rent increases-controlling for unit, occupant, and city-level economic conditions. Rent price growth is more pronounced among poorer renters, underscoring the potential for second-round distributional effects of monetary policy.

JEL Classification: E31; E52; R21
Keywords: Monetary Policy; Rents; Inflation; Mortgage

*International Monetary Fund, Research Department. Alessia De Stefani: adestefani[at]imf[dot]org. I am grateful to Bruno Albuquerque, Marijn Bolhuis, Samuel Mann and Andrea Presbitero for helpful comments and suggestions. I did not receive any funding for this research and have no conflicts of interest to disclose. The views expressed herein are those of the author and should not be attributed to the IMF, its Executive Board, or its Management.

1. Introduction

The post-pandemic tightening cycle has rekindled fears that monetary policy could exacerbate home-buying inequality (Bosshardt et al., 2024; Ringo, 2024). With prospective buyers caught between historically high mortgage rates and soaring property prices, the rate at which US renters transition into home-ownership plummeted between 2021 and 2023 (Figure 1). Meanwhile, average rental prices surged (Figure A1), further intensifying affordability pressures. Yet, research on how monetary policy affects rental prices remains sparse, leaving its distributional impacts largely unexplored.

This paper addresses this gap in the literature. Using property-level data from the American Housing Survey, I find that between 2021 and 2023 renters' propensity to transition into home-ownership declined sharply. This decline is largely due to rising mortgage rates, which by pushing many tenants beyond Federal Housing Administration (FHA) mortgage-to-income thresholds reduced their move into home-ownership. As potential buyers remained renters for longer, demand pressure on local rental markets increased, unmet by an adequate increase in rental supply in the short run. This resulted in rent price inflation in 2023, particularly among lower-income renters– underscoring the potential for second-round distributional effects of monetary policy.

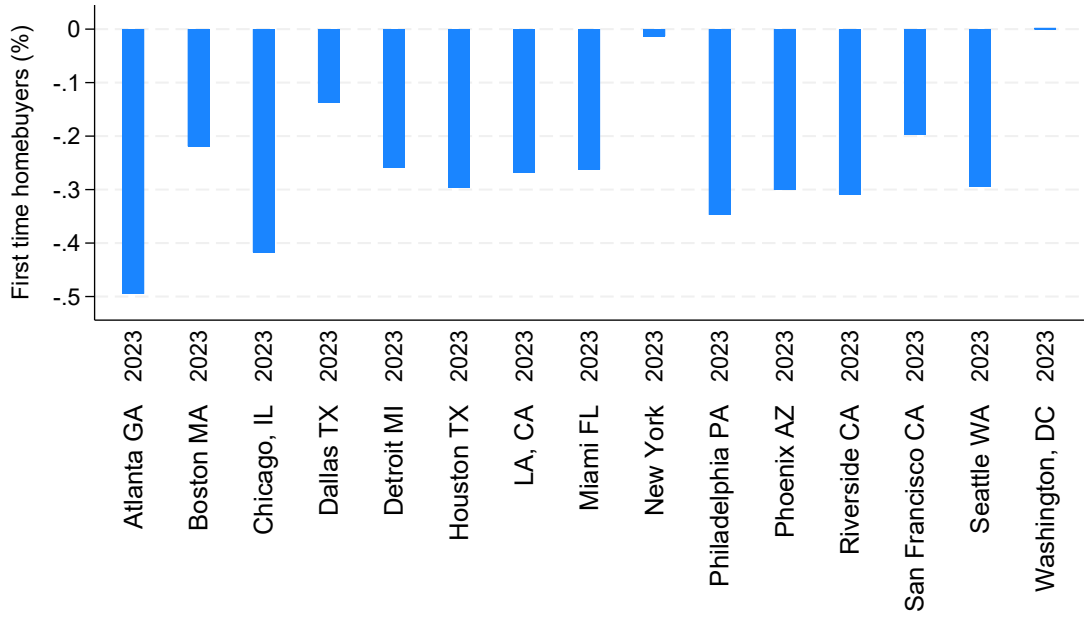
Methodologically, I proceed in three steps. First, I use information on on both renter and owner-occupied properties in the 2019-2023 waves of the American Housing Survey (AHS), a representative sample of US housing units. Exploiting the panel component of the survey, I identify first-time home-buyers (FTHB), or households moving from renting to owning between two periods. The data also contains detailed information on the characteristics of each individual property (e.g.location, size, age, etc.) and of its occupants (e.g. tenure status, income, house value, mortgage financing, family composition and demographics). With this information, I develop a household-specific mortgage-to-income (MTI) ratio for first-time buyers at the time of home purchase, obtaining time-varying MTI distributions over different waves of the survey. I also impute MTI ratios for renters, should they decide to purchase the same property they live in.[1]

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 buying around an MTI ratio of 31. This ratio corresponds to a key underwriting parameter for FHA loans, the ratio of housing expenses to income, also

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

called *front-end* ratio. Using a regression discontinuity design I show that the probability of switching from renting to buying is 4 percent lower just above an MTI ratio of 31 than just below, for household with similar demographic characteristics living in the same city and year. The effect is significantly larger in 2023, compared to previous years.

Figure 1: *Decline in share of first-time buyer by city, 2021-2023*



Sources: American Housing Survey, 2021-2023. The chart displays the percentage change in the share of renters who become home-buyers between 2021 and 2023. Frequency weights are assumed.

In a second step, I show that rising mortgage rates made the MTI underwriting threshold a binding constraint for many renter households, explaining the drop in the volume of first-time buyers between 2021 and 2023. To do so, I follow the methodology in 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 develop a counterfactual distribution, simulating how the MTI distribution for 2021 first-time buyers would have looked like if borrowers were subject to 2023 interest rates, holding loan demand and housing choices constant. Similarly to Bosshardt et al. (2024), I assume a uniform increase in interest rates across households, taking as reference the difference between the prevailing mortgage rate at the time of the 2021 interviews and the same time in 2023. The reduction in volumes of first-time buyers occurs exclusively above the MTI threshold of 31, corresponding to the FHA front-end

ratio underwriting limit, while volumes are stable or increasing below this threshold.[2] I do not find the same effect when applying the same methodology to AHS data from the late 1970s, a period which recorded an equivalent change in mortgage rates, but when payment-to-income limits were not as binding. This suggests that the drop in first-time buyers between 2021 and 2023 can be attributed to the increase in mortgage rates, which pushed a mass of renters above MTI underwriting thresholds, reducing their ability to step onto the housing ladder.

Finally, I exploit variation in the relative prevalence of constrained first-time buyers across cities to test how their presence affects local rental markets. I show that units with identical characteristics and occupied by renters with similar demographics exhibit significantly higher rent price growth the larger the share of ex-ante constrained home-buyers in the local area. This effect is robust to controlling for other simultaneous city-level time-varying developments which could drive both the share of constrained buyers and rents, such as growth in average income, GDP, population and house prices. Rent price inflation is particularly pronounced for low-income households, suggesting that monetary tightening may have additional distributional consequences via the rental market, beyond its role in determining tenure decisions.

This paper bridges two strands of literature. The first relates to the role played by monetary policy and debt-to-income limits in determining housing tenure decisions.[3] Mabille (2023) shows that, during the Great Recession, young home-ownership rates declined sharply, as tighter credit conditions led more borrowers to face binding DTI constraints.[4] Similarly, Bhutta and Ringo (2021) estimate that a surprise interest rate cut led to an immediate increase in home-buying during the same period, an effect driven by DTI-constrained borrowers. In a closely related paper, Ringo (2024) finds that, by interacting with DTI limits, monetary tightening significantly reduces the share of low-income households in the population of home-buyers and that these effects persist for at least one year after the shock. Bosshardt et al. (2024), show that virtually the entire loss in mortgage originations in 2022 and 2023 relative to previous years can be attributed to tightening debt-to-income constraints, as low-income borrowers were pushed above underwriting thresholds by the increase in mortgage rates.

Relative to this literature, I contribute by (i) focusing on the transition from tenancy

[2]This corroborates the evidence in Bosshardt et al. (2024) who find a similar result using overall DTI limits.

[3]For a theoretical background on the role of DTI constraints, see Greenwald (2018), who shows that DTI and LTV limits interact, amplifying the response of house prices to changes in interest rates.

[4]Acolin et al. (2016) estimate that in this phase, tighter borrowing constraints related to wealth, income or credit scores lowered the home-ownership rate by about 5.2 percentage points, relative to 2004–2007.

into first-time home-ownership and (ii) studying on how fluctuations in tenure decisions affects rental market equilibria, an area where evidence is still scarce. Gete and Reher (2018) are the first to show that tighter lending standards lowered home-ownership rates after the Great Recession and increased demand for rental housing, leading to higher aggregate rental prices. 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. In a follow-up paper, Dias and Duarte (2022) use a structural model to show that by affecting transitions into home-ownership, monetary policy drives up rents, generating a temporary increase in headline inflation. Similarly, Castellanos et al. (2024) model a housing market with endogenous landlord formation and show that restricting credit access to potential buyers increases rental prices and decreases the home-ownership rate, with particularly adverse consequences for younger and poorer households.

I provide micro-level evidence of these channels, particularly how monetary tightening interacts with mortgage underwriting limits in determining tenure choices and, as a consequence, rent prices. I also provide novel evidence on the heterogeneity of rent price developments across different housing segments. Poorer tenants tend to experience the steepest rent price increases in response to monetary tightening. This is likely to exacerbate the distributional consequences of monetary tightening, especially shelter makes up a larger share of the consumption basket among poorer consumers (Molloy, 2024).[5]

More broadly, this paper also relates to the ongoing debate on the drivers of sticky inflation in the post-pandemic tightening cycle, particularly to the literature highlighting the key role of rising housing rents as drivers of the overall persistence in inflation (Dias and Duarte, 2022; Bolhuis et al., 2022; Adams et al., 2024).

This 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, DTI constraints and tenure decisions. Section 4 examines the effects on rental markets and Section 5 briefly concludes.

[5]This paper also relates to a growing literature on the distributional effects of monetary policy on income, consumption and financial assets. See for example Coibion et al., 2017; Ampudia et al., 2018; and Andersen et al., 2023.

2. Data

The American Housing Survey (AHS) is the most comprehensive source of national data on housing in the United States. Administered by the U.S. Census Bureau, the AHS has been conducted since 1973. Originally an annual survey, it is now fielded in odd-numbered years.

The AHS employs 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, hence focusing on the core national sample. To ensure consistency between the waves, I also exclude units with missing city codes, implicitly excluding all non-urban housing units. I mostly focus on the three waves conducted between 2021 and 2023. For a specific robustness test, I include two waves conducted in 1977 and 1980 respectively.

The remaining sample is overall composed of 23,000-28,000 observations per wave, with about 62-64 percent of the units being owner-occupied. It reports information on 15 MSAs.[6] Beyond geographical location, the survey reports detailed information on the housing units, including physical characteristics (age, size, type, structural conditions, and quality of the housing unit); housing costs (including rent, mortgage, utilities, and maintenance expenses) and financing details (mortgage size, interest rate); Household and Demographic Data (composition, income, and tenure status); and neighborhood attributes: perceptions of local quality, safety, and access to amenities.

The longitudinal component of the survey is designed to track housing units rather than occupants, but collects information on recent movers, including occupants' previous tenure status. This allows me to identify first-time home buyers, defined as either (i) households who move and switch from renting to owning a property between two waves (ii) households who report being first-time home-buyers and having moved into

[6]Specifically: 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; Washington, DC.

the current unit between the current survey and the previous one.

Using information on the purchase value of the property, mortgage size, interest payments and household annual income, I calculate mortgage payment to income ratios (MTI) for first-time home buyers, defined as annual mortgage payments divided by annual household income.[7] Given its longitudinal component, the survey can be used to calculate unit-specific (hedonic) changes in rent prices 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 on unit characteristics and demographics for the 2021-2023 waves are summarized in Table 1. The share of first-time home buyers as a proportion of the sample remained stable between 2019 and 2021, but declined by one percentage point in 2023 (a 25% reduction from 2021 levels). Other characteristics of the sample remained broadly unchanged, except for a slight increase in average MTI for first-time buyers in 2023 and a significant increase in rent inflation compared to 2021 levels.

Table 1: *Descriptive statistics by survey year*

	(1)	(2)	(3)
	2019	2021	2023
First-time buyers (%)	0.036	0.037	0.027
Share renters	0.37	0.38	0.37
Annual Income (2019 USD)	107,043	107,942	109,507
Age head	51.6	51.8	52.4
MTI (FTHB)	23.3	22.2	25
Change in rent (yoy, %)	.	0.079	0.12
Observations	28,147	27,157	23,942

Notes: American Housing Survey, 2019-2023. Analytical weights are assumed. Household income is expressed in 2019 USD.

Using survey information, I can estimate the cost renters would face if they were to purchase the same property they live in. I do so in two steps. First, I predict the sale price of the rented property, based on the reported value of similar houses in the same city and year.[8] Second, I apply some uniform assumptions on how renters will finance the acquisition of their property, assuming that they will secure a 30 year con-

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

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

ventional fixed-rate mortgage, at the average mortgage rate prevailing at the time of the survey, with a 20 percent down-payment–corresponding to the average down-payment recorded among first-time buyers in the survey.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.[9] 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 studies how changes in mortgage rates interact with underwriting standards to determine the share of renters who can become home-owners. First, I establish that the share of mortgage payments to income, or front-end ratio, is a key parameter in determining the probability of becoming a first-time home-buyer, because it determines elibigibility for a mortgage. Second, I exploit a non-parametric approach to understand how underwriting limits, which remained unchanged after 2021, interacted with rising interest rates, excluding a significant portion potential buyers from the owner-occupied housing market, in 2023.

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

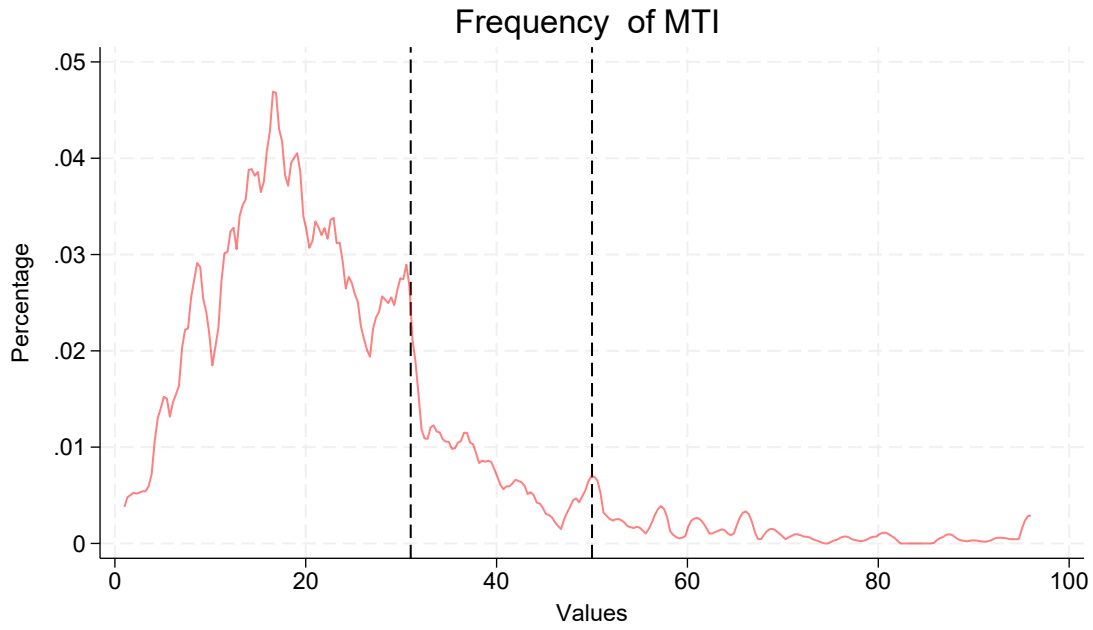
Loans issued under the umbrella of the Federal Housing Administration (FHA) need to comply with some key underwriting standards to ensure the solvency of the borrower. These include some parameters on overall DTI ratios, which are typically not to exceed 43-50 percent of the borrowers' monthly income (Bhutta and Ringo (2021)). However, another important underwriting parameter for many lenders is the so called *front-end* ratio, or the ratio of mortgage payments (including insurance, taxes and fees) to income, hereby MTI. For FHA loans, this threshold is not supposed to exceed 31 percent. While this is a soft threshold–indeed many first-time home buyers obtain loans with higher MTIs– FHA mortgages with front-end ratios exceeding this threshold require manual underwriting, potentially triggering the request for greater guarantees in the form of

[9]Further details on the imputation procedure are provided in Appendix B. The implicit assumption is that renters will always want trade up; i.e. to buy a housing unit of equivalent or better value than the one they live in. This is a reasonable assumption for first-time buyers, who tend to be younger than the average population. In this case, the imputed MTI corresponds to a lower bound.

income, collateral, or other assets.

A simple graphical analysis of MTIs distribution among first-time home-buyers across waves shows a significant discontinuity around this threshold (Figure 2) and significant bunching just below. Another discontinuity in the distribution can be observed around the FHA regulatory threshold for overall DTI ratios, which is set at 50 percent.

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. Observations are weighted by frequency weights.

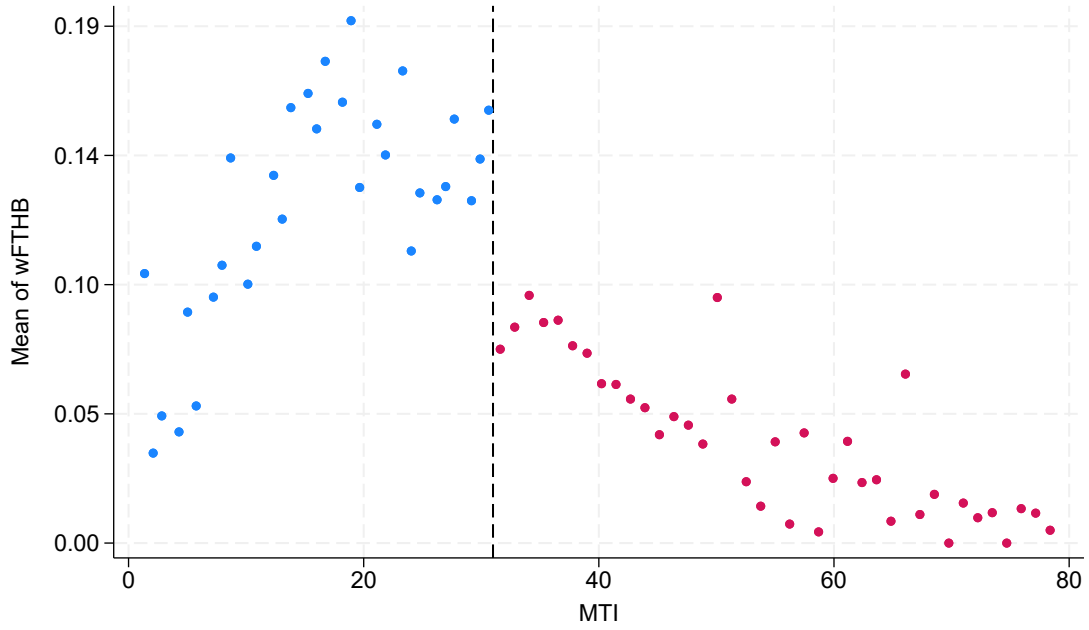
I exploit this discontinuity to study how much payment-to-income constraints matter for the relative probability of switching from renting to buying, in any given year. To do so, I impute MTI ratios which renters would face if they were to purchase the same home they currently live in.[10] By combining renter-imputed MTIs with observed MTIs for first-time buyers, I can estimate how the probability of switching from renting to buying changes in a close bandwidth around the front-end MTI threshold of 31, holding observable individual characteristics constant.

The probability of becoming a first-time buyer shows a clear discontinuity around the underwriting MTI threshold of 31, in this sample (Figure 3), while other relevant observed characteristics which could drive tenure choice remain continuous around the threshold (Appendix Figure A2). Placebo tests do not indicate any relevant disconti-

[10] See Section 2 and Appendix B.

nuities around other thresholds (Figure A3) and some key determinants of MTI ratios among first-time buyers, such as leverage ratios, remain constant around the threshold (Appendix figure A4).

Figure 3: *Probability of finding a first-time buyer vs renter 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, by MTI value. the vertical axis shows the percentage of observations within an MTI value which have value 1 if FTHB; 0 if renters. MTIs are observed for first-time buyers, imputed for renters; they are rounded to the closest decimal. Observations are weighted by frequency weights.

The regression-discontinuity design defined in Equation 1, aims at a more formal estimation of the change in probability of becoming a first-time buyer around the front-end MTI underwriting limit, conditional on observed household and unit characteristics:

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

Where $FTHB$ is a dummy taking value 1 if a given unit i in MSA 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 (this term is observed for first-time buyers and imputed for renters); X_{imt} is a vector of household and unit-specific controls.[11] θ_{mt} are MSA-by-year

[11]This includes income decile, family composition, educational attainment of the household head, their age and square of age; unit size, number of bedrooms and bathrooms and house value (observed for first-time buyers, imputed for renters).

fixed-effects, meant to capture all aggregate variation affecting equally all family units living in the same municipality during the same year. $beta_1$ is the coefficient of interest, measuring the effect of being just above VS just below threshold on the probability of being a first-time buyer, conditional on a wide set of controls. Table 2 presents the results of this equation, estimated over subsequently smaller windows around threshold.

Column 1 estimates the model on a large sample, including observations with MTI up to 80 percent and including a quadratic polynomial in MTI to control for non-linearities in the direct effect of MTI on the probability of becoming a home-owner. The estimates are large and statistically significant, suggesting that similar families living in similar units in the same city and year experience a probability of becoming first-time buyers which is 5 percent lower just above the threshold, compared to being just below.

Cols 2-4, present a local linear regression, by progressively narrowing the estimation window around the threshold, thus reducing the sample size significantly. The estimated differential effect becomes smaller, but remains negative and strongly significant. Column 4 reduces the sample to observations with MTIs between 26 and 36, or 5 points below and above the threshold, respectively. This rather conservative specification suggests that moving from just below to just above the front-end limit reduces the probability of finding a first-time home buyer in the sample by about 4 percent.

In Appendix Table A1 I augment this specification with an interaction term, capturing the differential effect for the year 2023 and show that the probability of becoming a home buyers around the threshold drops even more in 2023, relative to previous years.

This evidence suggests that the probability of becoming a home-buyer is determined by binding mortgage payment-to-income constraints, or whether potential home-buyers can qualify for mortgages under the prevailing underwriting rules and mortgage rates.

While suggestive, this evidence is subject to one key caveat, one a key assumption behind regression discontinuity is one of non-manipulation. For this setup to estimate the causal effects of the underwriting thresholds on the probability of becoming a first-time buyer, it is necessary to assume that people cannot voluntarily sort below the underwriting threshold. In reality, buyers may be able to adjust both their mortgage balances and their choice of property, effectively defining their placement in the MTI distribution. Indeed, the fact that Figure 2 exhibits excess mass, or bunching, just below the underwriting threshold is likely evidence of manipulation. The following section exploits this explicitly, by studying the missing and excess mass of home-buyers just above and just below the threshold, and studying how the relative densities are altered by changes in

Table 2: *Probability of becoming a first-time buyer as a function of MTI limits*

	(1)	(2)	(3)	(4)
VARIABLES	FTHB	FTHB	FTHB	FTHB
MTI	0-80	0-50	21-41	26-36
Threshold	-0.055***	-0.048***	-0.030**	-0.044**
	(0.008)	(0.009)	(0.014)	(0.019)
MTI	0.001	-0.001	0.007***	0.010***
	(0.001)	(0.001)	(0.001)	(0.003)
MTI2	-0.000***			
	(0.000)			
Observations	21,622	17,992	7,233	3,702
R-squared	0.182	0.194	0.197	0.209
MSA by Year FE	Yes	Yes	Yes	Yes
HH and Unit controls	Yes	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). MSA by year FE included. Heteroskedasticity-robust SEs in parentheses.

interest rates.

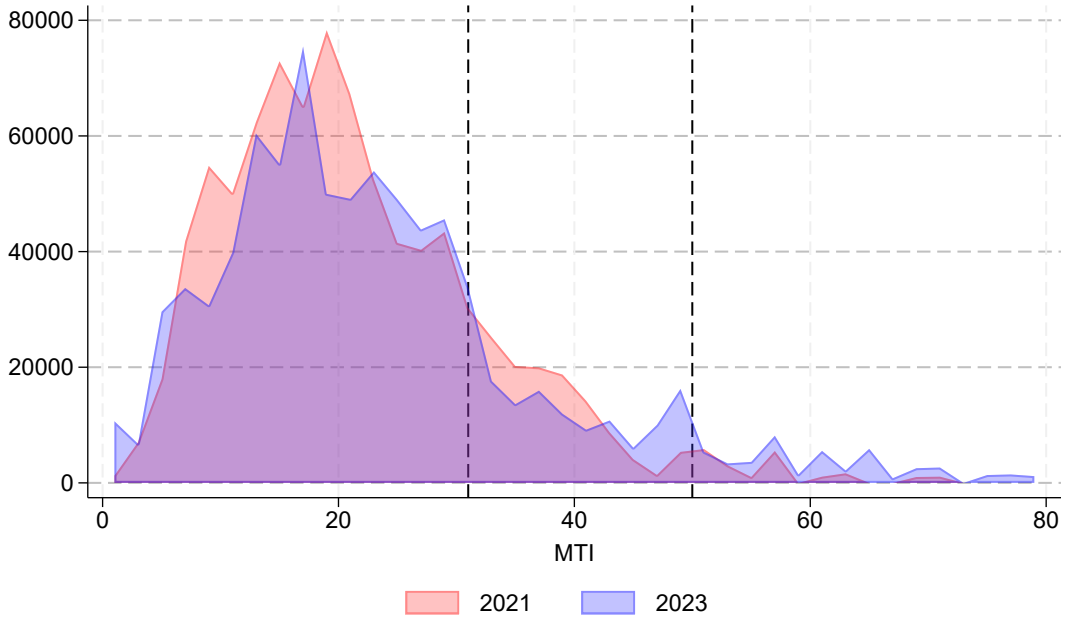
3.2. Measuring the effect of interest rates on purchasing behavior: counterfactual distributions

This section aims at assessing to what extent the decline in first-time buyers between 2021 and 2023 can be attributed to rising mortgage rates, which pushed a subset of potential home-buyers above binding MTI thresholds. I exclude renters and restrict the sample to first-time home-buyers observed over three waves: 2019 through 2023. Older waves are used to compare volumes of first-time buyers in a low-rate environment (2019-2021) to volumes in a high rate environment (2023) and to build a counterfactual distribution aimed at simulating what would have happened in absence of the rate increases, following Bhutta and Ringo (2021) and Bosshardt et al. (2024).

I proceed in two steps. First, I estimate the decline in volume of first-time home buyers as a proportion of the overall sample, between 2021 and 2023. Figure 4 shows that the number of first-time buyers declined significantly in the 2023 survey compared

to the 2021 survey. The frequency-weighted drop is 300,000 units, roughly corresponding to the 25% decline reported in Table 1. When considering the smaller set of first-time buyers for which it is possible to obtain a counterfactual distribution (i.e. data on interest payments, loan amounts is available), the decline is about 30,000 units or about 4% of 2021 levels. This decline is broadly uniform over the MTI distribution, with the only significant spike in volumes compared to 2021 concentrated at 50 percent, the upper bound of the underwriting comprehensive DTI limit.

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 to the closest decimal. Frequency weights are assumed.

Besides differences in volumes, the 2021 and 2023 distributions and demographic characteristics of first-time home buyers are very similar.[12] Hence in the second step, I follow Bosshardt et al. (2024) and use the 2021 distribution of first-time home buyers to develop a counterfactual distribution, simulating how 2021 volumes could have looked liked under the higher interest rate environment.

This counterfactual distribution is built by calculating individual MTIs of 2021 first-time buyers as if the same borrowers were subject to the average interest rates prevalent

[12]Appendix Table A2 shows that the common support assumption implied in this non-parametric approach is reasonable: on average, first time home-buyers are very similar in age, income, demographic composition. LTV ratios at purchase decline over the years, consistently with tightening credit standards.

in 2023. Similarly to Bosshardt et al. (2024), I assume a uniform increase in interest rates corresponding to the average change in rates on newly originated 30 years FRM between the first quarter of 2021 and the first quarter of 2023, or a 4.2 percentage points increase.[13]

I apply this average increase in mortgage rates to the borrower-specific mortgage rate, which is reported in the survey. I then recalculate MTI ratios for 2021 first-time home-buyers using this counterfactual interest rate, assuming all other parameters (house value, loan amount, amortization schedule) remain constant.[14] The resulting average increase in mortgage payments is about 1200$ per household/month while MTIs increase by 11 percentage points.

Figure 5 plots the observed 2023 distribution and the counterfactual 2021 distribution. Depending on where they fall on the MTI distribution, these difference can inform on the drivers of the decline in volumes of first-time buyers between the two waves of the survey. If the decline was driven by binding payment-to-income constraints, the drop should be concentrated on buyers on the right-hand side of the MTI distribution, and the switch in densities should occur around the key underwriting threshold. If, on the other hand, the changes in volumes were driven by shifts in preferences, or a decline in demand, changes should be more uniform across the MTI distribution.

Figure 5 shows that the missing mass of home-buyers emerges just above the MTI limit of 31, while below this threshold we observe a relative increase in loan volumes. When these gaps in the distributions are expressed in percentage points of 2021 volumes, the differences are even more striking. Figure A5 shows that differences in the distributions are broadly positive below the threshold but turn negative immediately above. Below the MTI limit of 31, the volume of first-time buyers increases by 23.4 percent, relative to 2021 levels. However above this threshold, the volume of buyers drops by 26.6 percent, overall, for an overall decline of 3.2 percent. The difference is concentrated between MTIs of 31 and 50, the FHA upper limit for overall DTI ratios. This decline in volumes corresponds broadly to the marginal decline in the propensity to become a first-time buyer around the FHA front-end threshold of 31 estimated in columns 3-4, Tables 2 and A1.

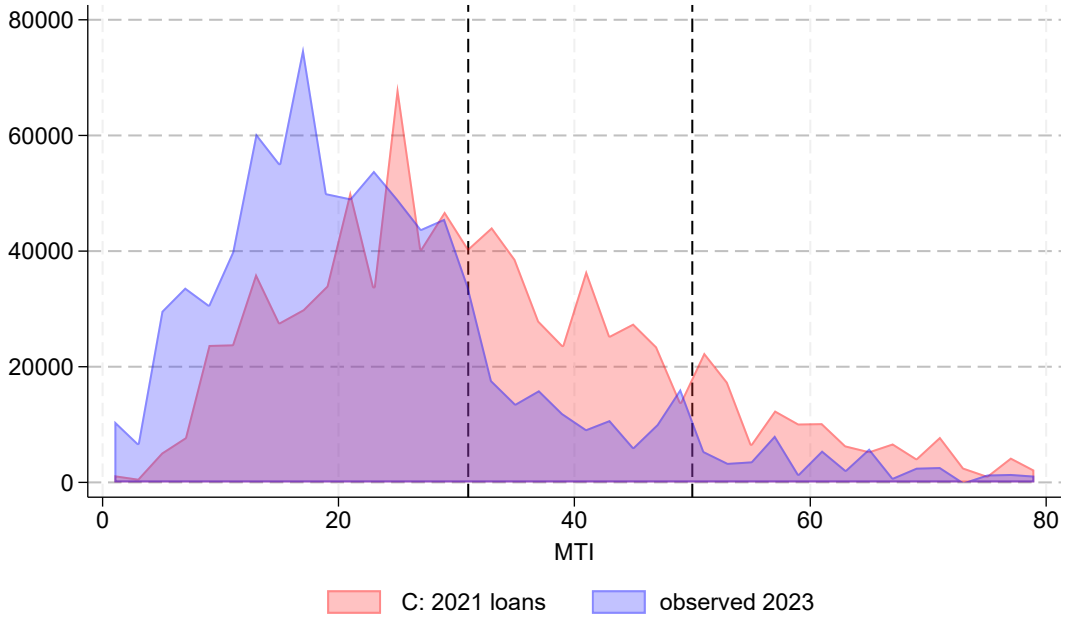
Since the MTI underwriting limits remain constant between 2021 and 2023, it is rea-

[13]The AHS does not provide mortgage origination dates, but all interviews are conducted in the first semester of any given year. Based on data underlying Figure A1, the average rate on newly originated 30 year 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.

[14]Despite applying an homogeneous counterfactual mortgage rate, individual mortgage interest rates in the counterfactual distribution retain significant cross-sectional heterogeneity, because 2021 buyers differ in the interest rates they paye on their mortgages.

sonable to assume that the decline in volumes above this threshold can be attributed to a tightening of payment-to-income constraints induced by the increase in mortgage rates. Specifically, a significant portion of potential home-buyers has been pushed above underwriting MTI limits, under the new interest rate regime.

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 to the closest decimal. Frequency weights are assumed.

3.3. Robustness: placebo tests and demand-adjusted counterfactual

To show that these results are not simply a mechanic result of the simulation and provide support to the notion that the decline in home-buyers is indeed a result of binding payment-to-income constraints, Figure 6 presents the results of a placebo test, running the same non-parametric analysis using data from the 1977 and 1980 waves of the American Housing Survey.

In an attempt to stave off inflation, the Fed entered a steep monetary tightening cycle in the late 1970s, which resulted in a dramatic increase in mortgage borrowing costs. However, unlike during the 2021-2023 monetary tightening cycle, borrowers were not facing the same systematic payment-to-income constraints, as manual underwriting was

predominant at the time and payment-to-income limits did not apply to all mortgages secularized by government agencies.[15]

The 1977 and 1980 waves of the AHS are the ideal laboratory to run a falsification exercise. Average mortgage rates increase from 8.75 percent in the first semester of 1977 to 14.05 percent in early 1980, the same 4.2 percentage point increase recorded between the 2021 and 2023 waves of the AHS. Consistently with rising mortgage costs, the total number of first-time home-buyers decline from about 3.6 percent of the sample to roughly 2.6 percent, a change that corresponds almost exactly to the decline observed between 2021 and 2023.

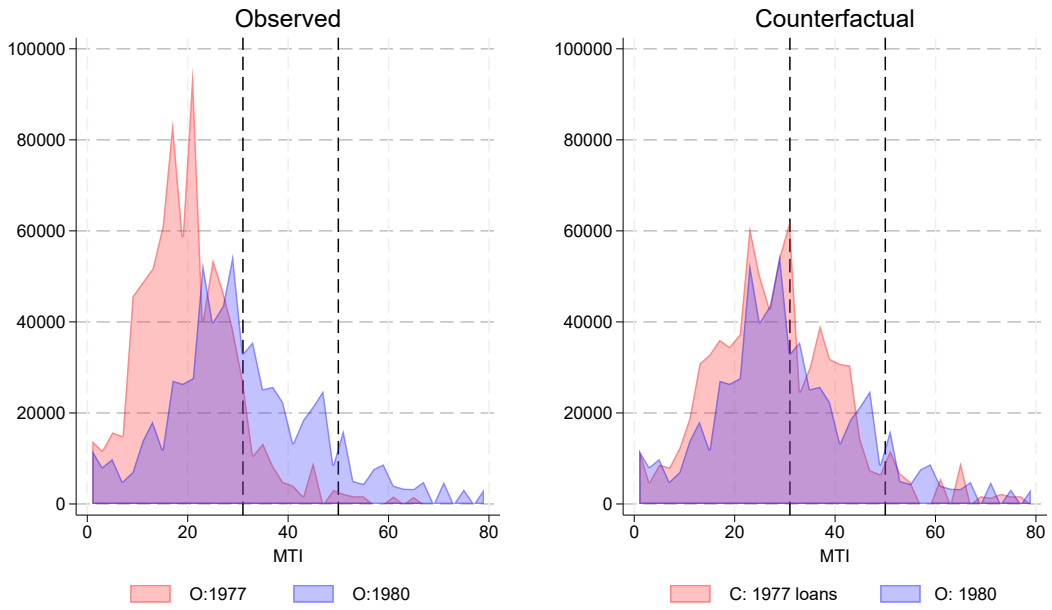
However, unlike in 2021-2023, the distribution of observed MTIs ratios for first time home-buyers is radically different between the two waves (left-hand panel of Figure 6). Consistently with a scenario where borrowers face higher borrowing costs but are unconstrained by strict payment-to-income underwriting limits, the distribution of MTIs for first-time buyers in 1980 shifts decisively to the right, compared to 1977. We do not observe this shift between 2021 and 2023, when MTI limits were strictly enforced (Figure 4) and the two distributions remain broadly similar.

The right-hand panel of Figure 6 applies the same methodology described in Section 3 to develop a counterfactual MTI distribution for 1977 first-time buyers, as if they were subject to mortgage rates prevalent in 1980. Albeit starting from different levels, the counterfactual 1977 distribution shifts to the right, closely resembling the observed 1980 distribution. The relative decline in loan volumes between the two waves is overall uniform across MTI thresholds, and no particular portion of the MTI distribution is affected, whether above or below the regulatory thresholds. This indicates the overall decline in loan volumes between the two waves is likely the product of factors other than payment-to-income limits, which were not binding at the time. Possibly, this is the result of a simple reduction in loan demand due to rising interest rates. The sharp contrast with the counterfactual distribution presented in Figure 5 indicates that the results presented in the latter are not a mechanical result of the simulation, but rather reflect the dominant role of payment-to-income constraints in driving the decline in home-purchasing activity

[15]FHA underwriting manuals, first published in 1936, imposed several parameters to insured lenders but did not set explicit payment to-income limits, leaving this parameter to the discretion of the underwriter (https://babel.hathitrust.org/cgi/pt?id=mdp.39015018409253view=1upseq=227). Similarly, Fannie Mae and Freddie Mac applied "knock out" rules to mortgages in their portfolio, including on DTI ratios, but underwriters retained a large margin of discretion in the application, as manual underwriting remained predominant until credit (FICO) scores were introduced in the 1990s. https://predatorylending.duke.edu/business-analysis/evolution-of-mortgage-lending/underwriting/$_ftn27$.

in 2023.

Figure 6: *Placebo tests: 1977-1980 first-time buyers*



Sources: American Housing Survey , 1977-1980. 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 1977 volumes, observed (LHS) and counterfactual (RHS). MTIs are rounded to the closest decimal. Frequency weights are assumed.

In Figure A6 I run an additional robustness test, by re-estimating the 2023 counterfactual adjusting loan demand to changes in interest rates, changes in house prices and average income levels, following the same approach used in the demand-adjusted counterfactual by Bosshardt et al. (2024). Results are robust to this alternative specification of the counterfactual and yield quantitatively similar estimates.

4. Regional heterogeneity and effects on rent price inflation

The decline in volume first-time home-buyers due to the increase in mortgage rates is not uniformly distributed across demographic characteristics of the population, or even cities. Table A3 shows that constrained home-buyers, with an observed MTI below 31 in 2021 and a counterfactual MTI above this threshold, have significantly lower income levels, are more likely to belong to racial minorities and less likely to have a graduate

degree, on average.[16]

Similarly, the relative prevalence of constrained home-buyers varies significantly across regions. Figure A7 shows that the proportion of constrained buyers, expressed as a share of 2021 first-time buyers, exhibits significant cross-sectional variation across US cities. The ex-ante shares of constrained home-buyers are correlated with ex-post city-level developments, such as the relative decline in the share of first-time buyers and the share of renters as a proportion of the total population (Figure A8).

In this section, I exploit regional variation in the shares of constrained buyers ex-ante to test the hypothesis that the missing mass of first-time buyers in 2023 increases local rental demand and, as a consequence, determines higher local rent inflation.

The intuition is that as credit conditions induce fewer households to step onto the home-ownership ladder, more people are likely to remain renters for longer. Housing supply in the rental segment is unlikely to adjust quickly enough to the relative increase in rental demand, and the demand pressure may generate a price increase for all tenants, including those who may not have wished to buy and those who would have been unable to buy even if interest rates were significantly lower.

To estimate the local ramifications of the credit-induced decline in first time buyers on rental prices I use the following cross-sectional regression specification, estimated for the year 2023:

$$\Delta Rent_{im} = \alpha + \beta_1 \widehat{\Delta FTHB}_m + \gamma_n^N X_{im} + \theta_n^N \Delta\lambda_m + \varepsilon_{im} \tag{2}$$

Where $\Delta Rent_{imt}$ is the percent change in rent between 2021 and 2023 for unit i, in city m. X_{im} is a vector capturing unit-specific characteristics, including size, number of rooms, age and neighborhood characteristics as well as demographic characteristics of its occupants. $\Delta\lambda_m$ is a vector of changes in city-level macroeconomic indicators between 2021 and 2023, such as growth in house prices (owner-occupied), population, and changes in average real incomes. β_1 is the coefficient of interest, capturing the relationship between the change in the city-level share in first-time home-buyers in 2021 and the growth in rental prices.

To account for endogeneity between the change in rent prices and changes in the city-level share of first-time buyers, I use the ex-ante share of constrained buyers $ShareC_{m,t-1}$ both as an instrument for the change in first-time home-buyers and in a reduced-form

[16]This definition of constrained home-buyers follows Bosshardt et al., 2024.

specification. The conditional exclusion restriction required to interpret these estimates causally is that, conditional on controlling for ex-ante demographic characteristics and ex-post city-level developments, the share of constrained buyers $ShareC_{m,t-1}$ affects rental prices only through its role in determining the change in first-time buyers, and not through other channels. The nuance of assuming a *conditional* exclusion restriction is key, as the share of constrained buyers ex-ante is correlated with demographic characteristics of the population which can predict growth in income, house prices or other developments related to rent price growth (Table A3). Similarly, the share of constrained home-buyers ex-ante could also be correlated with specific characteristics of the local housing stock, for example average square footage, the share of houses vs apartments and the share of rent-controlled units, all of which could predict ex-post developments in both owner-occupied and rental markets.

To ensure the conditional exclusion restriction is satisfied, the model includes a wide set of household and unit-specific characteristics, as well as aggregate developments in key macroeconomic aggregates measured at the city level (house prices, income, population growth). This approach is effectively akin to a difference-in-differences setup, comparing changes in rental prices between 2021 and 2023 for similar units occupied by similar renters across cities, holding other city-level macro-economic developments constant.

Table 3 presents the results of this estimation. Column 1 shows that the change in the share of first-time home-buyers is negatively correlated with hedonic rental price growth between 2021 and 2023, suggesting that cities which experienced a larger increase (or a smaller decline) in the share of first-time buyers between the two waves also experienced lower rent inflation.

Column 2 presents the reduced-form specification, showing that the share of constrained home-buyers ex-ante, defined as the share of first-time buyers with observed MTI below 31 and counterfactual MTI above, is positively and significantly correlated with rent inflation ex-post. This supports the intuition that cities where a larger proportion of the population has been excluded from home-ownership due to the rise in mortgage costs experienced significant demand pressures on their rental markets which translated in higher rent prices. Column 3 presents a 2SLS specification, where the change in first-time home-buyers between the two waves is instrumented with the share of constrained home-buyers ex-ante. The coefficients associated with $\Delta FTHB_{mt}$ is negative and statistically significant and it indicates that for each percentage point decline in the share of first time home-buyers relative to 2021 levels (8 percent of standard devia-

Table 3: *Rent increase and constrained home-buyers*

VARIABLES	(1) $\Delta Rent$	(2) $\Delta Rent$	(3) $\Delta Rent$ 2SLS
$\Delta FTHB_{mt}$	-0.082**		-0.469***
	(0.038)		(0.157)
$\text{ShareC}_{m,t-1}$		0.186***	
		(0.063)	
ΔHP_{mt}	0.163**	0.194**	0.225***
	(0.083)	(0.083)	(0.084)
Observations	5,911	5,911	5,911
R-squared	0.014	0.014	
MSA Controls	Yes	Yes	Yes
HH and Unit controls	Yes	Yes	Yes
First stage F stat			691

Notes: AHS 2021-2023. Rent measures the unit-specific change in rent between 2021 and 2023; FTHB measures the change in the share of FTHB between 2021 and 2023 at the MSA level; ShareC measures the share of constrained home buyers in a given MSA (average between 2021 and 2019). MSA level controls average house price growth (2021-2023); population growth (2021-2023); change in average annual income (2021-2023; HH and Unit 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). Bootstrapped SEs in parentheses are robust to heteroskedasticity.

Table 4: *Rental supply and share of constrained buyers*

VARIABLES	(1) Rental	(2) Converted Units	(3) Rental Vacancies
$\text{ShareC}_{m,t-1}$	0.122***	0.038	-0.055***
	(0.046)	(0.024)	(0.018)
ΔHP_{mt}	-0.171***	0.032	0.020
	(0.057)	(0.037)	(0.017)
ΔPop_{mt}	2.411***	-0.036	-0.276***
	(0.264)	(0.144)	(0.091)
$\Delta Income_{mt}$	0.051	-0.036	0.067
	(0.144)	(0.083)	(0.041)
Observations	23,942	15,096	11,778
R-squared	0.422	0.013	0.009
MSA Controls	Yes	Yes	Yes
HH and Unit controls	Yes	Yes	Yes

Notes: AHS 2023. Rental is a dummy taking value 1 if a unit is renter-occupied, 0 if owner-occupied. 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. Rental vacancies is a dummy taking value 1 if a unit is vacant for rent , 0 if it is rented. ShareC measures the share of constrained home buyers in a given MSA (average between 2021 and 2019). MSA level controls average house price growth (2021-2023); population growth (2021-2023); change in average annual income (2021-2023; HH and Unit 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). Bootstrapped SEs in parentheses are robust to heteroskedasticity.

tion), rent price growth increases by 0.46 percentage points, on average (12 percent of a standard deviation).

Table 4 shows that a key explanation for these price dynamics lies in the role of rental supply. The proportion of renters increases consistently with an increase in demand (column 1), but this is not met by an equivalent conversion of owner-occupied units into rental units (column 2). As building new rental units requires time, rental vacancies decline (column 3), likely contributing to price pressures beyond the role played by house price, income and population growth.

In Table A4 I check for pre-trends, testing whether the relationship between constrained buyers ex-ante and rent increases ex-post holds also between the 2019 and 2021 waves, before the interest rate hike. Finding an effect would be indicative of a systematic association between the share of constrained-home buyers ex-ante and rental price

developments ex-post, which would invalidate the parallel trends assumption. I find no evidence of this, as the coefficients are small and statistically insignificant.

The rental price increases associated with the decline in first-time buyers are heterogeneous across the renter population. Renters in the bottom four deciles of the city-year income distribution experience shaper rent increases as a result of the decline in first-time buyers (Table A5), while richer renters are relatively shielded from price increases.

5. Conclusions

This paper studies the joint effects of monetary policy and regulatory lending standards in shaping tenure choices and rental market dynamics. I derive two key takeaways. First, the large decline in first-time home-buyers between 2021 and 2023 can be largely attributed to rising mortgage rates during this period, which pushed many potential buyers above FHA mortgage-to-income underwriting thresholds.

Second, the reduction in first-time home-buyers increased pressure on some segments of the rental market, driving a steeper increase in average rent prices. Rent price inflation was more pronounced for units occupied by lower-income renters, highlighting the potential distributional consequences of the interaction between monetary policy and mortgage underwriting standards.

More broadly, this paper also contributes to the debate on role of rents as drivers of sticky inflation during the recent monetary tightening cycle (Bolhuis et al., 2022, Adams et al., 2024). Given that shelter expense accounts for 30% of the US Consumer Price Index (CPI) basket, the channels identified here likely contributed to the persistence of elevated headline inflation in the post-pandemic tightening phase.

References

Acolin, Arthur, Jesse Bricker, Paul Calem, and Susan Wachter (2016). "Borrowing Constraints and Homeownership". In: *American Economic Review* 106.5, pp. 625–629.

Adams, Brian, Lara Loewenstein, Hugh Montag, and Randal Verbrugge (2024). "Disentangling Rent Index Differences: Data, Methods, and Scope". In: *American Economic Review: Insights* 6.2, pp. 230–245.

Ampudia, Miguel, Dimitris Georgarakos, Jiri Slacalek, Oreste Tristani, Philip Vermeulen, and Giovanni Violante (2018). "Monetary Policy and Household Inequality". In: *SSRN Electronic Journal*.

Andersen, Asger Lau, Niels Johannesen, Mia Jørgensen, and José-Luis Peydró (2023). "Monetary Policy and Inequality". In: *The Journal of Finance* 78.5, pp. 2945–2989.

Bhutta, Neil and Daniel Ringo (2021). "The effect of interest rates on home buying: Evidence from a shock to mortgage insurance premiums". In: *Journal of Monetary Economics* 118, pp. 195–211.

Bolhuis, Marijn A, Judd N L Cramer, and Lawrence H Summers (2022). "The Coming Rise in Residential Inflation*". In: *Review of Finance* 26.5, pp. 1051–1072.

Bosshardt, Joshua, Marco Di Maggio, Ali Kakhbod, and Amir Kermani (2024). "The credit supply channel of monetary policy tightening and its distributional impacts". In: *Journal of Financial Economics* 160, p. 103914.

Castellanos, Juan, Andrew Hannon, and Gonzalo Paz-Pardo (2024). *The Aggregate and Distributional Implications of Credit Shocks on Housing and Rental Markets*. SSRN Scholarly Paper. Rochester, NY.

Coibion, Olivier, Yuriy Gorodnichenko, Lorenz Kueng, and John Silvia (2017). "Innocent Bystanders? Monetary policy and inequality". In: *Journal of Monetary Economics* 88, pp. 70–89.

Dias, Daniel and João B. Duarte (2019). "Monetary Policy, Housing Rents, and Inflation". In.

Dias, Daniel A. and João B. Duarte (2022). *Monetary Policy and Homeownership: Empirical Evidence,Theory, and Policy Implications*. SSRN Scholarly Paper. Rochester, NY.

Gete, Pedro and Michael Reher (2018). "Mortgage Supply and Housing Rents". In: *The Review of Financial Studies* 31.12, pp. 4884–4911.

Greenwald, Daniel (2018). *The Mortgage Credit Channel of Macroeconomic Transmission*. SSRN Scholarly Paper. Rochester, NY.

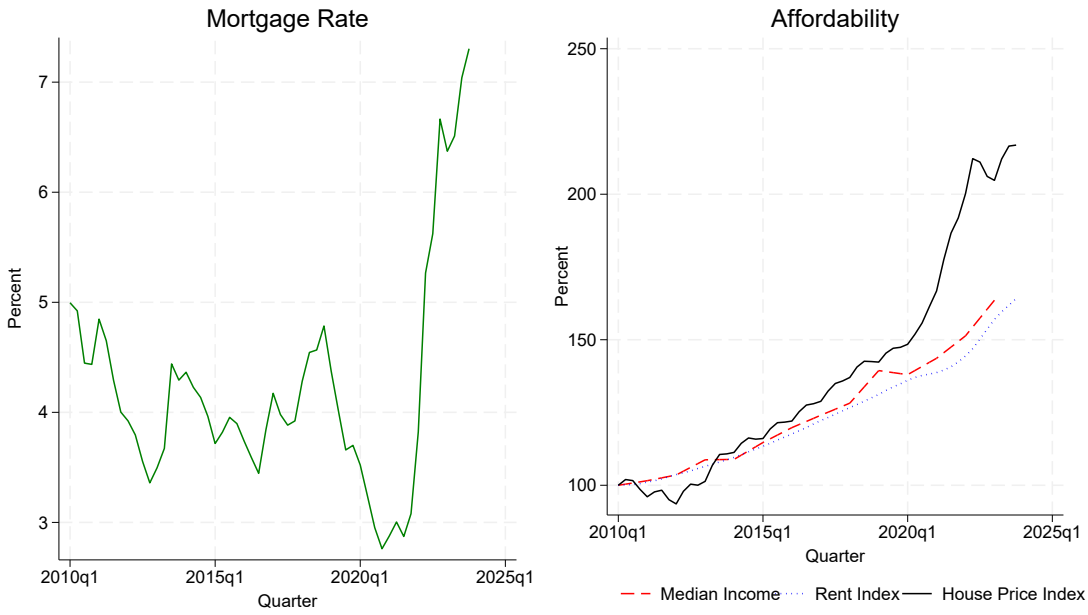
Mabille, Pierre (2023). "The Missing Homebuyers: Regional Heterogeneity and Credit Contractions". In: *The Review of Financial Studies* 36.7, pp. 2756–2796.

Molloy, Raven (2024). "JUE insight: Differences in rent growth by income from 1985 to 2021 and implications for inflation". In: *Journal of Urban Economics* 142, p. 103669.

Ringo, Daniel (2024). "Monetary Policy and Home Buying Inequality". In: *The Review of Economics and Statistics*, pp. 1–46.

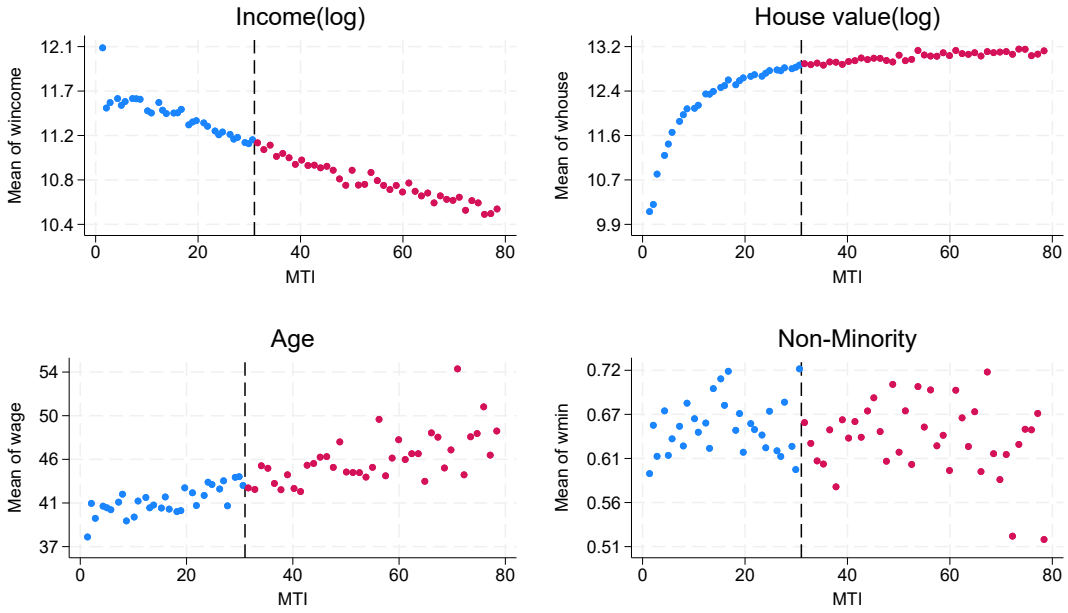
A. Appendix A: Figures

Figure A1: *Housing affordability over time*



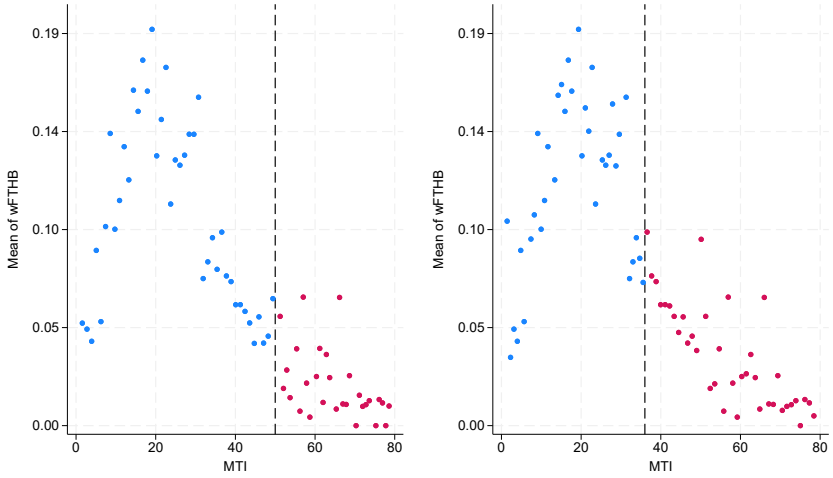
Sources: FRED. Mortgage rates are the average rates on newly originated 30-year FRMs. House Prices Index measures changes in value of the owner-occupied housing stock; Rental Index the change in rents of primary residences. Median household income (nominal) is interpolated to obtain quarterly frequencies.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

Figure A2: *Share of first-time home-buyers by MTI: placebo tests*



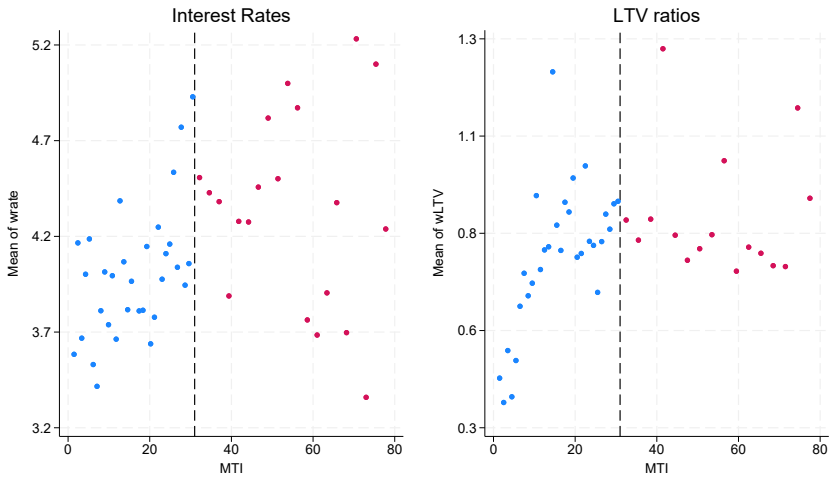
Sources: American Housing Survey, 2021-2023. The sample include first-time homebuyers and renters. The figure plots, clockwise: average income by MTI; average house value; share of non-minorities; age of household head. MTIs are rounded to the closest decimal. Frequency weights are assumed.

Figure A3: *Share of first-time home-buyers by MTI: placebo tests*



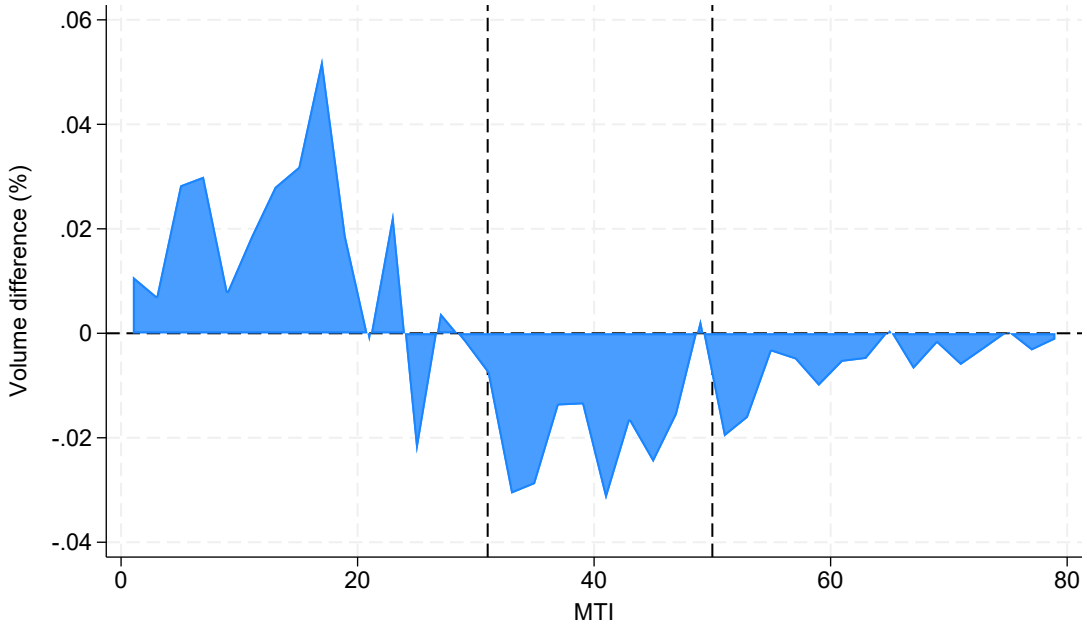
Sources: American Housing Survey, 2021-2023. The figure plots the share of FTHB by MTI; it splits the sample at MTI=36 and MTI=50, corresponding to FHA back-end ratio and overall DTI ratios. MTIs are rounded to the closest decimal. Frequency weights are assumed.

Figure A4: *Interest rates and LTVs for first-time buyers at different levels of MTI limits*



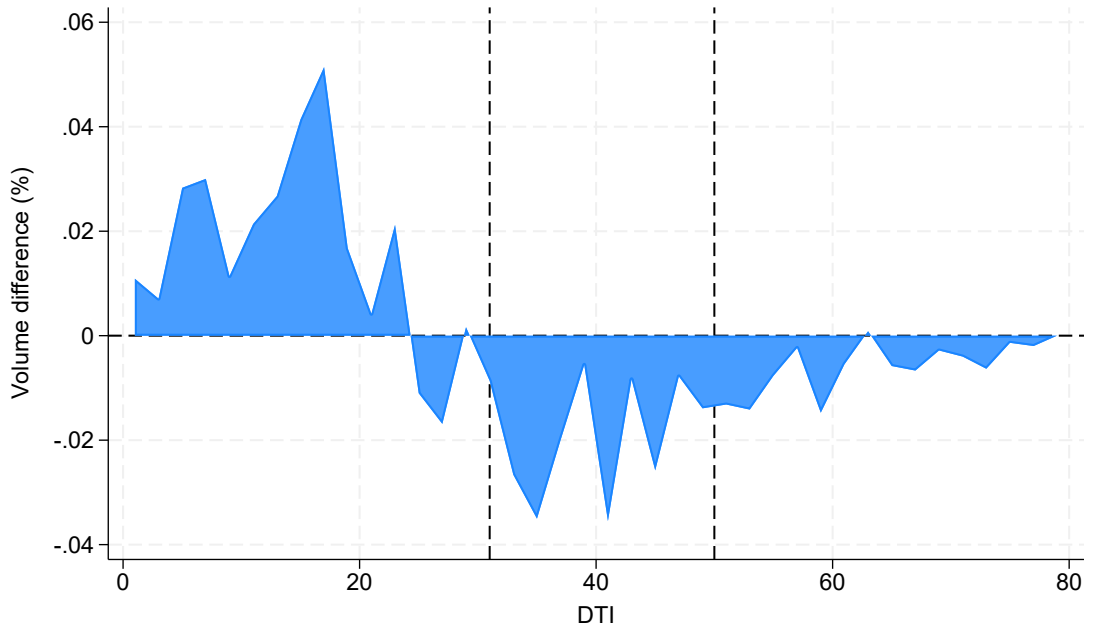
Sources: American Housing Survey, 2021-2023. The figure plots the average interest rate and average LTV ratio for first-time homebuyers at different points in the MTI distribution. MTIs are rounded to the closest decimal. Frequency weights are assumed.

Figure A5: *Difference between 2023 and counterfactual distribution: percent*



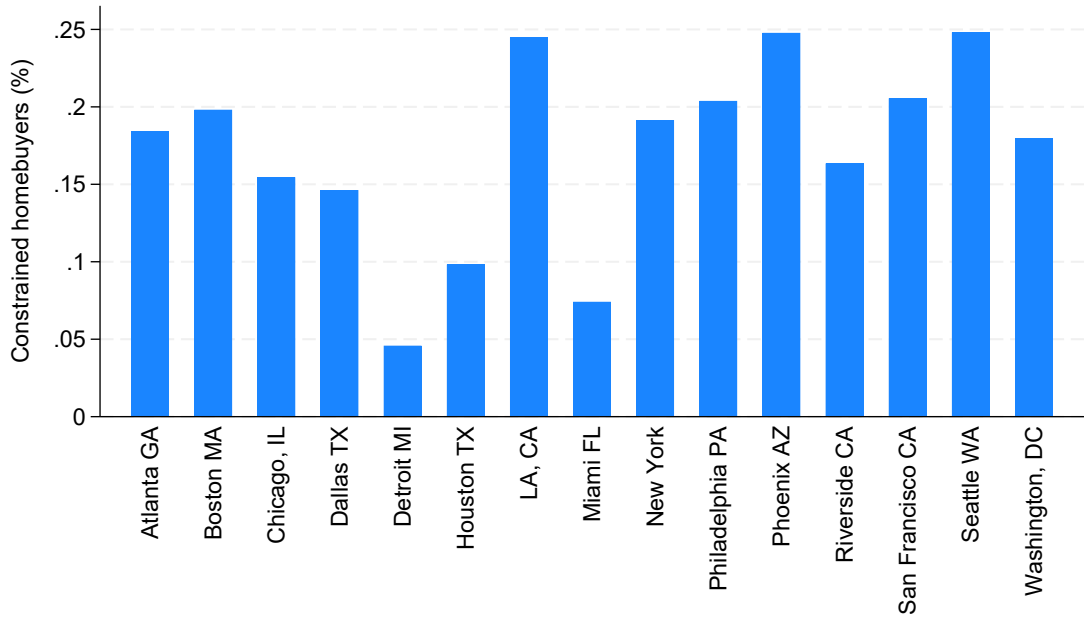
Sources: American Housing Survey , 2021-2023. The chart displays the difference between the observed 2023 distribution and the counterfactual distribution, built using 2021 data. Volumes are expressed in percentage points of 2021 volumes, by MTI value. MTIs are rounded to the closest decimal. Frequency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

Figure A6: *Difference between 2023 and 2021 distribution: demand-adjusted counterfactual*



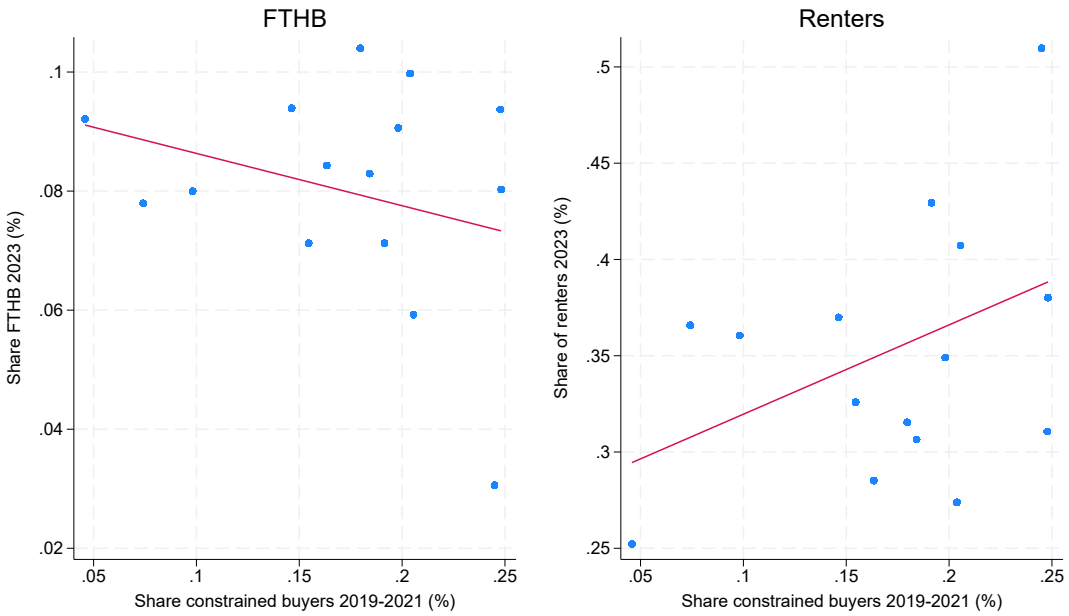
Sources: American Housing Survey , 2021-2023. The chart displays the difference in MTI distributions for first-time buyers in 2023 vs the demand-adjusted counterfactual relative to 2021 volumes. Following the methodology in Bosshardt et al. (2024), I adjust the extensive margin of loan demand in the 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 to the closest decimal. Frequency weights are assumed.

Figure A7: *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 MSAs. 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 to the closest decimal. Frequency weights are assumed.

Figure A8: *Share of constrained home-buyers ex-ante and city-level outcomes in 2023*



Sources: American Housing Survey , 2021-2023. The chart displays the correlation between the share of constrained home-buyers in 2021 across US MSAs and the ex-post share of FTHBs in 2023 (left-hand side) and the share of renters in 2023 (right-hand side) .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 to the closest decimal. Frequency weights are assumed.

Table A1: *Regression discontinuity: differential effects over time*

	(1)	(2)	(3)	(4)
VARIABLES	FTHB	FTHB	FTHB	FTHB
MTI	0-80	0-50	21-41	26-36
Threshold	-0.041***	-0.030***	-0.013	-0.031
	(0.008)	(0.009)	(0.014)	(0.020)
Threshold#2023	-0.056***	-0.069***	-0.067***	-0.048**
	(0.009)	(0.012)	(0.016)	(0.022)
Observations	21,966	18,423	7,253	3,984
MSA by Year FE	Yes	Yes	Yes	Yes
HH and Unit controls	Yes	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, based on 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). MSA by year FE included. Heteroskedasticity-robust SEs in parentheses.

Table A2: *Descriptive statistics for first-time buyers by survey year*

	(1)	(2)	(3)
	2019	2021	2023
HH income (2019 USD)	143,873	146,410	147,117
Age	38	38	39
Graduate degree	0.58	0.62	0.62
White	0.70	0.68	0.67
LTV	0.86	0.84	0.77
Observations	808	796	473

Notes: American Housing Survey, 2019-2023. Analytical weights are assumed. Household income is expressed in 2019 USD.

Table A3: *Demographic characteristics of constrained home-buyers*

Variable	Constrained	Not constrained
White	0.67	0.73
HH Gross Income (2019 USD)	105,328	163,304
Age head	38	38
Head graduate	0.56	0.65

Notes: American Housing Survey, 2021. Constrained buyers are defined as 2021 first-time homebuyers with MTI below 31 and counterfactual MTI above 31. Frequency weights are assumed. Household income is expressed in 2019 USD.

Table A4: *Pre-trends: change in rents between 2019 and 2021*

VARIABLES	(1) $\Delta Rent$	(2) $\Delta Rent$	(3) $\Delta Rent$ 2SLS
$\Delta FTHB_m$	-0.028		-0.119
	(0.031)		(0.708)
$\text{ShareC}_{m,t-1}$		0.023	
		(0.118)	
Observations	5,540	5,540	5,540
R-squared	0.007	0.007	0.006
MSA Controls	Yes	Yes	Yes
HH and Unit controls	Yes	Yes	Yes

Notes: AHS 2021-2023. Rent measures the unit-specific change in rent between 2019 and 2021; FTHB measures the change in the share of FTHB between 2021 and 2023 at the MSA level; ShareC measures the share of constrained homebuyers in a given MSA in 2019-2021. MSA level controls average house price growth (2021-2023); population growth (2021-2023); change in average annual income (2021-2023; HH and Unit 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). Bootstrapped SEs in parentheses are robust to heteroskedasticity.

Table A5: *Heterogeneity: income deciles*

VARIABLES	(1) $\Delta Rent$ 4	(2) $\Delta Rent$ 4 to 8	(3) $\Delta Rent$ ¿=8
$ShareC_{m,t-1}$	0.341***	0.092	-0.238
	(0.115)	(0.097)	(0.207)
Observations	3,645	2,155	753
R-squared	0.013	0.030	0.076
MSA Controls	Yes	Yes	Yes
HH and Unit controls	Yes	Yes	Yes

Notes: AHS 2021-2023. Column 1 reports results restricting the sample to the first 4 deciles of the city/year income distribution; coulmn 2 to the next four deciles; coulmn 3 to the top two deciles. $\Delta Rent$ measures the unit-specific change in rent between 2021 and 2023; $ShareC_{m,t-1}$ measures the share of constrained home buyers in a given MSA in 2019-2021. MSA-level controls average house price growth (2021-2023); population growth (2021-2023); change in average annual income (2021-2023; HH and Unit 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). Bootstrapped SEs in parentheses are robust to heteroskedasticity.

B. Appendix B: Imputing Renter's MTI

To impute renters' MTI, I mirror the approach used in the imputation of Owner Equivalent Rents, used by BLS to estimate the shelter component of CPI.

I start by imputing the current market value of renter property i, based on value of similar (owner-occupied) properties in the same MSA m in year t, based on an hedonic regression which includes a large set of unit-specific covariates:

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

Where X_{imt} is a large vector of unit-specific controls, specifically: type of building (apartment, or house); age of unit and square of age; size in square feet; fixed effects for the number of bedrooms and bathrooms; and whether the household is reporting significant crime in the neighborhood. Each characteristic X_{imt} is also interacted with year fixed-effects, to allow for the effect of these parameters to change over time (e.g. preferences shift in preferences regarding size or location in the post-pandemic phase). ϕ are MSA-by-year fixed-effects, capturing all time-varying MSA-specific variation which could affect property values. The coefficients $\gamma_n; \theta_n; \phi$, estimated on the owner-occupied sample, allow me to impute the current market value of equivalent renter-occupied units in the same MSA and year.

In a second step, I impute the cost of financing the acquisition of property i, for renter family R. To do so, I assume that all renter families will finance the purchase via a 30 year conventional fixed-rate mortgage with an LTV ratio of 80 percent (corresponding to the average for first-time buyers in this sample, see Figure A4) at the prevalent mortgage rates available at the time of the survey r_t.

Specifically impute the monthly cost of mortgage for renters' household R, living in unit i in city m and year t is:

$$\widehat{Payment}_{Rimt} = [[(0.8 * \widehat{HousePrice}_{imt})]/360] * r_t$$

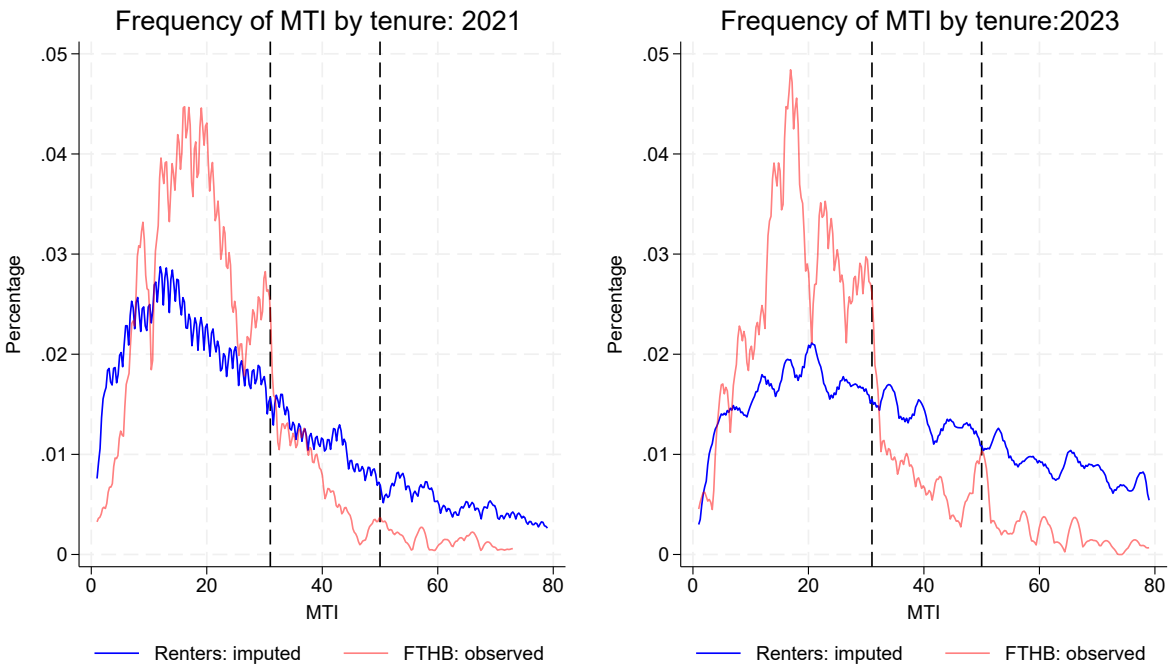
And the MTI for renter's family R living in unit i is:

$$\widehat{MTI}_{Rimt} = \widehat{Payment}_{Rimt} / AnnualIncome_{Rimt}$$

Figure B1 plots the distributions of owner (observed) and renters'(imputed) MTIs by survey year. Renters' MTIs are overall higher than FTHB's, which is reasonable considering that renter households tend to be younger and poorer. Renter's imputed MTI

distribution shift decisively to the right, in 2023, consistently with higher interest rates and rising house prices.

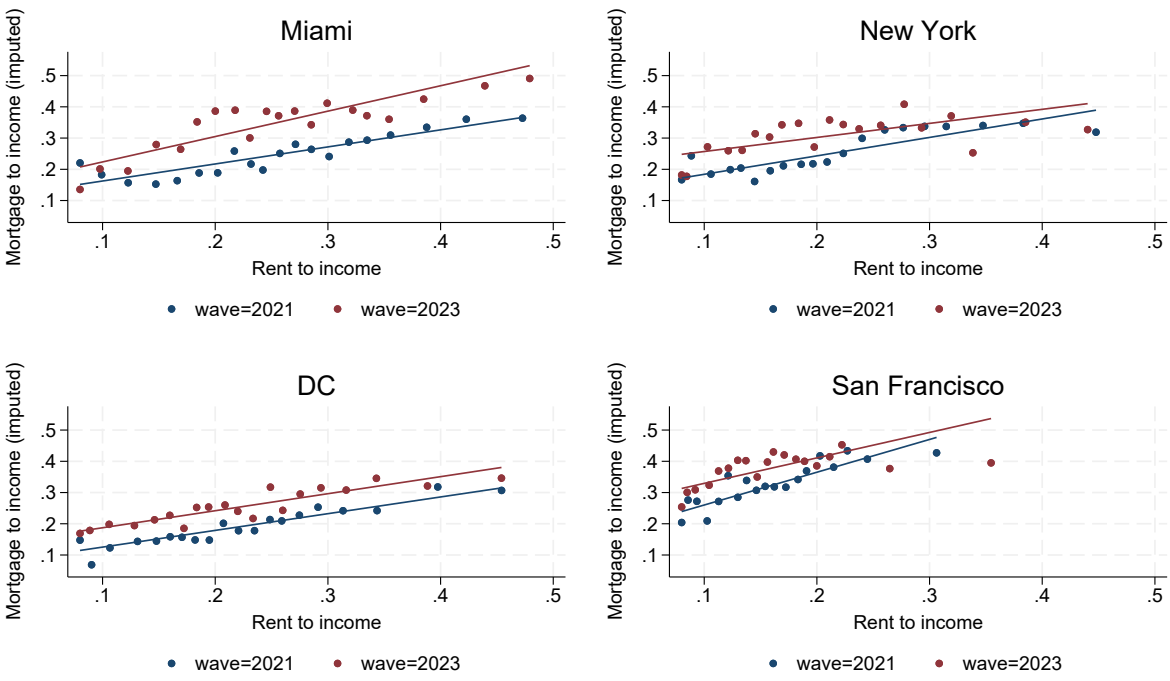
Figure B1: *Renters' and first-time buyers MTIs by year*



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

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 spending 30 percent of their income on rent could have benefited from the acquisition of the same property, as this would have reduced their monthly housing costs to about 20 percent of income. However, the same renter in San Francisco would have faced a housing cost closer to 40 percent of income if they chose to buy, due to higher average property valuations. In 2023, the sharp increase in mortgage rates combined with rising or stable property prices increased the cost of buying in virtually all US cities.

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. Frequency weights are assumed.